April 22, 2019

BY ELECTRONIC MAIL
AND U.S. CERTIFIED MAIL

Jared Polis
Colorado Governor
State Capitol Building
200 E. Colfax Ave., Rm. 136
Denver, CO 80203

Phil Weiser
Colorado Attorney General
Ralph L. Carr Judicial Building
1300 Broadway, 10th Floor
Denver, CO 80203

Jill Hunsaker Ryan
Executive Director
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246

Re: Request That You Take Action to Halt Illegal Construction of Oil and Gas Production Facilities in City and County of Broomfield

Dear Governor Polis, Attorney General Weiser, and Director Hunsaker Ryan:

We are writing to call your attention to ongoing and serious violations of Colorado clean air laws involving several oil and gas production facilities that are currently under construction in the City and County of Broomfield. **We urge you to take action to halt this illegal development and assure full protection of air quality and public health.**

BACKGROUND

Under the federally approved Colorado State Implementation Plan ("SIP") and the Clean Air Act, a major stationary source of air pollution cannot be constructed unless a permit is obtained under Air Quality Control Commission ("AQCC") Regulation No. 3, Part D. *See* Air Quality Control Commission ("AQCC") Regulation No. 3, Part D, Section I.A; *see also* 42 U.S.C. § 7503; 40 C.F.R. § 51.165. Within a nonattainment area, a major source must comply with nonattainment new source review ("NSR") permitting requirements set forth under AQCC

Regulation No. 3, Part D, Section V.

A major source in a nonattainment area includes any stationary source that has the potential to emit 100 tons per year or more of the regulated NSR pollutant for which the area is designated nonattainment." AQCC Regulation No. 3, Part D, Section V.II.A.24.b. Within areas designated nonattainment for ozone, the precursor emissions volatile organic compounds ("VOCs") and nitrogen oxides ("NOx") are considered regulated NSR pollutants for purposes of determining whether a source is major. AQCC Regulation No. 3, Part D, Section II.A.38.c.

The potential to emit of a stationary source of air pollution is defined in the Colorado SIP as "[t]he maximum capacity of a stationary source to emit a pollutant under its physical and operational design." AQCC Common Provisions Regulation, Section I.G. Although emission controls can be considered to be part of a source's "operational design," they can only be considered part of a source's design "if the limitation or the effect it would have on emissions is state enforceable ***and federally enforceable***." *Id*. (emphasis added).

The definition of "federally enforceable" under the Colorado SIP means "all limitations and conditions which are enforceable by the U.S. EPA Administrator[.]" AQCC Common Provisions Regulation, Section I.G (defining "Federally Enforceable"). Thus, limitations and conditions that are enforceable only by the State of Colorado, such as limitations and conditions in state regulations, are not "federally enforceable" pursuant to the Colorado SIP.

Within a nonattainment area, a major source cannot "begin actual construction" prior to obtaining a nonattainment NSR permit. AQCC Regulation No. 3, Part D, Section I.A.1. The term "begin actual construction" means the "[i]nitiation of physical on-site construction activities on an emissions unit that are of a permanent nature [and may] include, but are not limited to [] laying of underground pipe work." AQCC Regulation No. 3, Part D, Section II.A.7.

Nonattainment NSR is a stringent permitting process that ultimately assures the most rigorous oversight and control of pollution from major stationary sources in nonattainment areas. Among other things, the Colorado SIP requires that major stationary sources achieve "the lowest achievable emission rate," certify compliance at "all other existing major stationary sources owned, operated, or controlled by the applicant," achieve emission offsets, include an analysis of alternative sites, sizes, production processes, and environmental control techniques, and demonstrate that emissions will not adversely impact visibility in Class I areas. AQCC Regulation No. 3, Part D, Section V.A.

EXTRACTION'S OIL AND GAS FACILITIES

At issue is Extraction Oil and Gas, Inc.'s construction of four new oil and gas well pads in the City and County of Broomfield: the Livingston pad, Interchange A and B pad, Northwest A and B pad, and the United pad. A map of these pads is attached as Exhibit 1. Each pad will have multiple wells drilled and will ultimately support the production of large amounts of oil and gas. Extraction received approval from the Colorado Oil and Gas Conservation Commission ("COGCC") to construct all four pads. Below is a summary table of information related to Extraction's Broomfield well pads.

Well Pad Facility	Number of Wells	Number of Separators	Date Construction Approved	Date Construction Started or Will Start
Livingston	19	19	June 1, 2018	February 18, 2019
Interchange A and B	33	33	August 23, 2018	December 14, 2018
Northwest A and B	16	16	August 23, 2018	September 1, 2018 (est.)
United	16	16	October 2, 2018	May 1, 2019

The COGCC approved construction of the Livingston pad on June 1, 2018. *See* Exhibit 2, COGCC Form 2A Approval, Extraction Oil and Gas, Inc., Livingston Pad. According to a follow up COGCC filing, construction commenced on or around February 18, 2019. *See* Exhibit 3, COGCC Form 42 Notice of Construction of a New Location, Livingston Pad. Extraction's plans at the Livingston pad call for the construction of 19 oil and gas well, 19 separators, four natural gas compressors, and a number of other installations, including produced water surge drums, oil surge drums, piperack modules, and other equipment. *See* Exhibit 2 at 2. According to Extraction, construction of the Livingston facility will involve the laying of pipelines, including flowlines. *Id*. Information from the City and County of Broomfield indicates that construction of the well pad began on February 18, 2019 and that drilling is estimated to begin in June. *See* Exhibit 4, City and County of Broomfield, Oil and Gas Status Update (April 11, 2019) at 2.

The COGCC approved construction of the Interchange A and B pad on August 23, 2018. *See* Exhibit 5, COGCC Form 2A Approval, Extraction Oil and Gas, Inc., Interchange A & G Pad. According to a follow up COGCC filing, construction commenced on or around December 14, 2018. *See* Exhibit 6, COGCC Form 42 Notice of Construction of a New Location, Interchange A & B Pad. Extraction's plans at the Interchange A and B pad call for the construction of 33 oil and gas well, 33 separators, four natural gas compressors, and a number of other installations, including produced water surge drums, oil surge drums, piperack modules, and other equipment. *See* Exhibit 5 at 2. According to Extraction, construction of the Interchange A and B facility will involve the laying of pipelines, including flowlines. *Id*. Information from the City and County of Broomfield indicates that spudding of wells at the Interchange B portion of the pad began on March 25, 2019. *See* Exhibit 4 at 2. Extraction planned to begin actual drilling of the wells on April 15, 2019. *See id*. at 3. According to the City and County of Broomfield, a rig is currently on site to continue drilling of the spudded wells, where conductor and surface casing has already been set. *See* Exhibit 7, City and County of Broomfield, Public Notice, Continuation of Drilling, Interchange B Pad Site (April 18, 2019).

The COGCC approved construction of the Northwest A and B pad on August 23, 2018. *See* Exhibit 8, COGCC Form 2A Approval, Extraction Oil and Gas, Inc., Northwest A and B Pad. According to the COGCC, construction was expected to begin on September 1, 2018. *See id*. at 2. Extraction's plans at the Northwest A and B pad call for the construction of 16 oil and gas well, 16 separators, four natural gas compressors, and a number of other installations, including produced water surge drums, oil surge drums, piperack modules, and other equipment.

See id. at 2. According to Extraction, construction of the Northwest A and B facility will involve the laying of pipelines, including flowlines. *Id*. Information from the City and County of Broomfield indicates that if construction has not begun, it may begin in May 2019, with drilling expected to occur by December 2019. *See* Exhibit 9, City and County of Broomfield, Schedule of Extraction Oil and Gas Development (April 8, 2019).

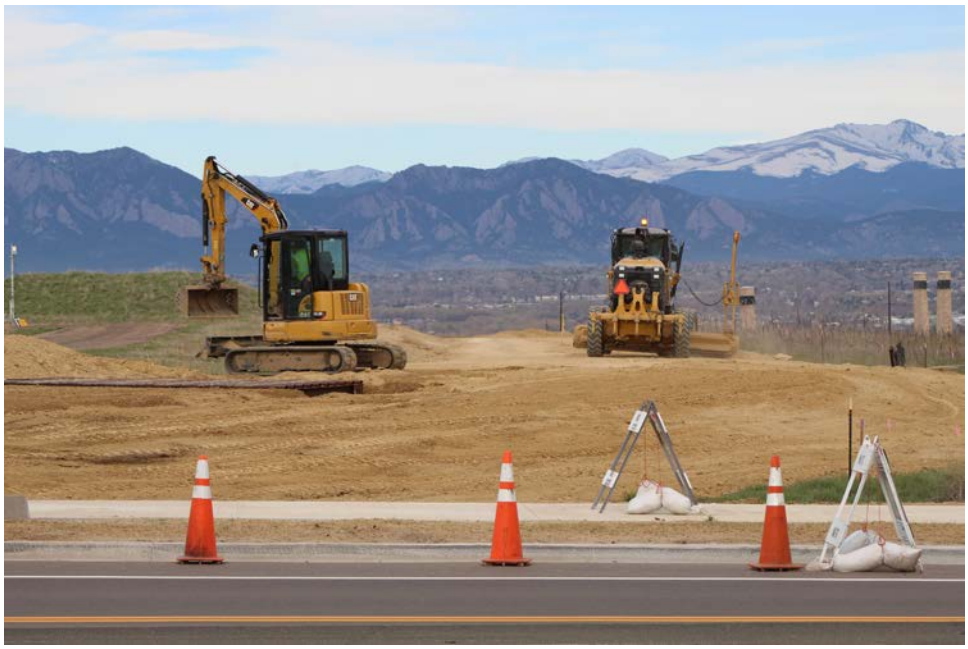
The COGCC approved construction of the United pad on October 2, 2018. *See* Exhibit 10, COGCC Form 2A Approval, Extraction Oil and Gas, Inc., United Pad. According to the COGCC, construction is expected to begin in May 2019. *See id*. at 2. Extraction's plans at the United pad call for the construction of 16 oil and gas well, 16 separators, three natural gas compressors, and a number of other installations, including produced water surge drums, oil surge drums, piperack modules, and other equipment. *See id*. at 2. According to Extraction, construction of the United facility will involve the laying of pipelines, including flowlines. *Id*. Information from the City and County of Broomfield indicates that if construction has not begun, it may begin in September 2019, with drilling expected to occur by February 2020. *See* Exhibit 9, City and County of Broomfield, Schedule of Extraction Oil and Gas Development (April 8, 2019).

Based on recent on-the-ground observations in Broomfield, it is clear that actual construction of the Interchange A and B and Livingston pads has begun. Extensive land clearing has occurred, a drilling rig has been installed at the Interchange A and B pad, and equipment is currently being constructed at both pads. *See e.g.* Pictures of Interchange A and B Pad and Livingston Pad below. What's more, Extraction has certainly begun to lay underground pipe work, including oil and gas well casing, at the Interchange A and B pad, indicating that construction of a permanent nature is occurring. Below are some images of the Interchange A and B and Livingston sites taken between April 17 and 20 by a WildEarth Guardians member who lives in Broomfield. While it is not clear whether actual construction has begun at the Northwest A and B and United pads, there is concern that given the COGCC's approvals, actual construction is occurring or is imminently likely to occur at these facilities.

Rig constructed on Interchange A and B Pad. Below, construction of rig at Pad. Photos by Laurie Anderson.

Rig at Interchange A and B Pad. Pad is adjacent to nearby homes. Photos by Laurie Anderson.

Land clearing and pipeline construction at the Livingston Pad.
Photos by Laurie Anderson.



Clearing and construction activities at Livingston Pad
Photos by Laurie Anderson.

EXTRACTION'S WELL PADS ARE MAJOR SOURCES OF AIR POLLUTION

By beginning construction of the Interchange A and B and Livingston pads, and possibly actual construction of the Northwest A and B and United pads, Extraction has begun actual construction of a permanent nature of major stationary sources of air pollution. Unfortunately,

the company has yet to even apply for, let alone obtain, major source permits pursuant to the Colorado SIP.

To begin with, it is important to point out that the well pads are located within the Denver Metro-North Front Range ozone nonattainment area. This region, which includes Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, and Jefferson Counties, as well as major portions of Larimer and Weld Counties, has been designated nonattainment due to violations of national ambient air quality standards for ground-level ozone. *See* 40 C.F.R. § 81.306. Because of ongoing violations of ambient air quality standards for ground-level ozone adopted in 2008, the region has been classified as a "moderate" nonattainment area, which has imposed more stringent permitting and planning requirements on the region. *See* 81 Fed. Reg. 26,697, 26,699 (May 4, 2016).

Because the well pads are located within the Denver Metro-North Front Range ozone nonattainment area, they would constitute major stationary sources of air pollution if they had the potential to emit 100 tons per year or more of VOCs or NOx. The best available information indicates the pads have the potential to emit more than 100 tons per year of VOCs, making them major stationary sources of air pollution.

To begin with, it is important to note that Extraction itself has analyzed emissions associated with its Broomfield well facilities and determined that its multi-well pads all have the potential to emit more than 100 tons per year of VOCs. In a report prepared in conjunction with developing the related Lowell and Sheridan well pads, the company reported both facilities had the potential to emit more than 100 tons per year of VOCs. *See* Exhibit 11, "Extraction Oil and Gas Broomfield Development Project, Emissions Inventory and Impact Analysis" (July 2017). The Lowell pad was reported to include 29 wells and the Sheridan pad was reported to include 19 wells, so both pads are comparable to the Livingston, Interchange A and B, Northwest A and B, and United pads. For both pads, completion emissions were reported to exceed 100 tons per year. *See* Table below.

Reported Emissions for Extraction's Lowell and Sheridan Well Pads in Broomfield

Phase of Development	Lowell VOC Emissions (tons/year)	Sheridan VOC Emissions (tons/year)
Drilling	0.22	0.14
Completion	212.2	139.0
Operation	2.032	1.332

Further, while Extraction estimated that drilling and operation emissions would be well below 100 tons per year at the Lowell and Sheridan pads, this estimate was based on the presumption that emission controls would be utilized. However, the report does not indicate that emission controls would be imposed by any federally enforceable limits, meaning the potential to emit for VOCs related to drilling and operations is much higher.

Regardless, we know for a fact that Extraction's multi-well facilities constructed nearby all have the potential to emit hundreds, if not thousands, of tons of VOCs annually. A review of

several Extraction Oil and Gas facilities near Broomfield, including in neighboring Weld County, indicates that without federally enforceable limits, VOC emissions often exceed 1,000 tons per year. These facilities are currently operating without air pollution permits required by the Colorado SIP. Given this, their potential to emit is based on their uncontrolled emissions. According to Extraction's permit applications (all of which are on file with the Colorado Air Pollution Control Division and are available electronically via the Division's WebDrawer website), based on uncontrolled emissions, they all have the potential to emit far more than 100 tons per year of VOCs. The bulk of these emissions result from natural gas venting at separators and venting at oil, condensate, and produced water tanks.

Potential to Emit for VOCs for Extraction Facilities in Vicinity of Broomfield Pads.[1]

Extraction Multi-well Facility	County	AIRS ID	Number of Wells	Potential to Emit for VOCs From Stationary Emission Points	Date Permit Application Submitted
Rinn Valley	Weld	123-A035	19	1,525.7	March 15, 2019
Milkshake	Weld	123-9CEB	17	1,234.7	October 11, 2018
McGirr-Northlight	Larimer	069-0565	12	1,477.0	June 12, 2018
Kennedy	Weld	123-9F5C	10	653.2	December 17, 2018
Downtown-Wake East	Weld	123-9D66	16	1,372.4	August 9, 2018
Coyote Trails	Weld	123-A00E	10	876.5	November 16, 2018
Enright	Weld	123-A021	16	1,355.6	January 23, 2019
Johnson's Corner	Weld	123-9FCC	13	3,461.5	May 23, 2018
Trott	Weld	123-A01C	24	1,256.3	December 21, 2018
C Street	Weld	123-9DD4	17	857.8	October 23, 2018
Walt	Weld	123-9FFC	13	3,276.6	September 28, 2018
Windsor LV2	Weld	123-9F9A	8	3,403.9	February 2, 2018

Extraction's multi-well pads in Broomfield are virtual mirror images of these other oil and gas production facilities, meaning potential emissions from the Livingston, Interchange A and B, Northwest A and B, and United pads will absolutely exceed major source thresholds.

[1] This data was all obtained from Extraction's air permit applications on file with the Air Pollution Control Division.

This is underscored by the fact that Extraction is moving to construct its well pads in Broomfield with no federally enforceable limits in place. Although the company has expressed that it intends to control emissions via pipelines and other practices, the reality is that pollution emitting activities at the Livingston, Interchange A and B, Northwest A and B, and United pads are currently not subject to any federally enforceable limits. There are no federally enforceable limits in place to require the use of pipelines or other practices to limits emissions and there is no documentation that pipelines or other emission control practices are a part of the physical and operational design of these facilities. Given this, these facilities are major sources under the Colorado SIP and the Clean Air Act. Accordingly, their construction is prohibited unless and until Extraction obtains major source permits.

We are particularly concerned given the lack of federally enforceable limits on emissions from separators. Extraction reports that at other similar multi-well facilities, uncontrolled separator emissions can be substantial. Below is a sampling of reported emissions from several of the company's multi-well facilities. With no federally enforceable limits in place to ensure that gas vented by the separators at the Livingston, Livingston, Interchange A and B, Northwest A and B, and United pads will be put into a pipeline or otherwise controlled, it is reasonable to presume the potential to emit for VOC emissions for these facilities will exceed the 100 ton per year major source threshold.

Low Pressure Separator Venting Potential to Emit at Extraction Multi-Well Facilities[2]

Extraction Multi-well Facility	Potential to Emit for VOCs From Separators
Rinn Valley	439.4
Milkshake	600.3
McGirr-Northlight	754.0
Kennedy	252.3
Downtown-Wake East	415.9
Coyote Trails	275.8
Enright	962.3
Johnson's Corner	2,570.0
Trott	809.4
C Street	478.1
Walt	121.8
Windsor LV2	2,526.2

We understand it may be argued the Colorado SIP allows Extraction to construct major sources of air pollution prior to obtaining permits. The Colorado SIP does allows new oil and gas production facilities to apply for general construction permits within 90 days after reporting first production. *See* AQCC Regulation No. 3, Part A, Section II.D.1.lll and Part B, Section II.D.7. However, this provision does not state that major sources are allowed to forego submitting

[2] This data was obtained from Extraction's air permit applications, which are currently pending before the Air Pollution Control Division.

applications prior to construction or to forego obtaining major source permits before beginning actual construction.

In fact, the Colorado SIP is clear that major sources must both obtain a permit pursuant to AQCC Regulation No. 3, Part B, as well as pursuant to AQCC Regulation No. 3, Part D. *See* AQCC Regulation No. 3, Part D, Section III.A. Thus, while a major source may be able to delay submitting an application for a Part B permit under the SIP, it is not allowed to forego submitting an application for Part D major source permit or to forego compliance with Part D's requirement that a permit be obtained prior to beginning actual construction. If the Livingston, Interchange A and B, Northwest A and B, and United pads were minor sources, there could be an argument that Extraction is operating in compliance with the SIP.[3] However, as major sources, they are not shielded from major source permitting requirements.

Furthermore, it may be argued that Extraction will operate with emission controls and/or practices in the process of operating the Livingston, Interchange A and B, Northwest A and B, and United pads. To the extent that any controls and/or practices will be utilized, they are not currently required under any federally enforceable requirements. We understand that industry often touts that it will meet Colorado regulations that may require some degree of emission limitations. However, Colorado law is clear that regulations adopted exclusively under state authority do not constitute federally enforceable provisions. *See* C.R.S. § 25-7-105.1(1). The law states that such state-only regulations are subject to enforcement "exclusively" under the laws of Colorado and the regulations of the AQCC. C.R.S. § 25-7-105.1(3).

REQUEST THAT YOU TAKE ACTION

The Air Pollution Control Division "shall enforce" violations of the Colorado SIP. *See* C.R.S. § 25-7-115(1)(a). The Division has authority to assess and seek penalties as a result of violations of the Colorado SIP. *See* C.R.S. § 25-7-1122. Further, the Colorado Attorney General has authority to "bring [] suit for an injunction" of violations of the Colorado SIP. C.R.S. § 25-7-121(1).

Pursuant to this authority, we request you take immediate action to halt Extraction's ongoing violations of the Colorado SIP and the company's illegal construction of major sources of VOCs in the City and County of Broomfield. We further request that you ensure Extraction applies for and obtains major source permits under the Colorado SIP before proceeding any further with construction. We note that it would now be inappropriate and contrary to the SIP to permit Extractions' facilities as minor sources. Given that the company began actual construction of the Livingston and Interchange A and B pads, and has likely began actual construction of the Northwest A and B and United pads, the company cannot now avoid major source permitting responsibilities.

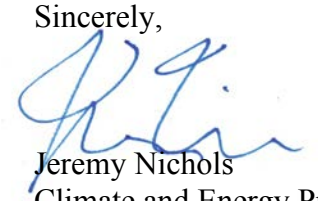
Please take any and all appropriate action to ensure full protection of our clean air and public health. Given that the Denver Metro-North Front Range region continues to struggle with

[3] We believe such an argument would be flawed given that the 90-day provision under AQCC Regulation No. 3, Parts A and B only relates to submitting emission notices and a permit application. The provision does not state that it provides a shield that allows facilities to operate indefinitely without legally required permits.

unhealthy levels of ozone pollution, it is simply not acceptable that Extraction is allowed to construct and ultimately pollute without legally required permits.

Thank you for your urgent attention to this matter. Please contact me with any questions or concerns.

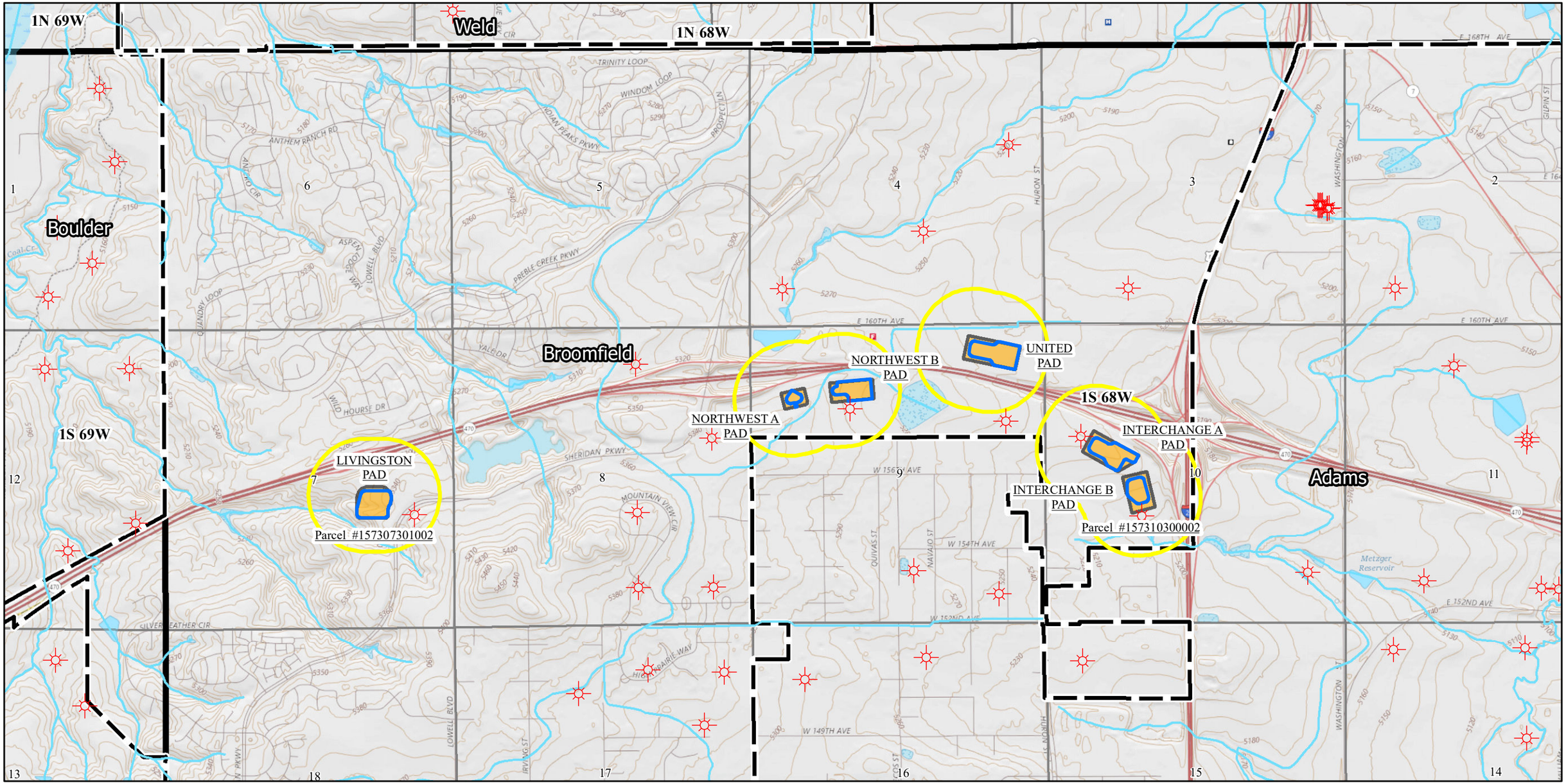
Sincerely,



Jeremy Nichols
Climate and Energy Program Director
WildEarth Guardians
2590 Walnut St.
Denver, CO 80205
(303) 437-7663
jnichols@wildearthguardians.org

cc: Garry Kaufman, Director, Colorado Air Pollution Control Division;
Colorado Air Quality Control Commission

Exhibit 1



EXTRACTION Oil & Gas

Broomfield Development
Oil & Gas Well Map

Scale:1:24,000	PRJ:NAD 83 State Plane CO N
Date: 12/14/2017	Author: CMB

N W E S

1 inch = 2,000 feet

0 0.25 0.5 1 Miles

Legend

- Oil & Gas Well
- 1000 Ft Buffer
- Production Disturbance Area
- Temporary Disturbance Area

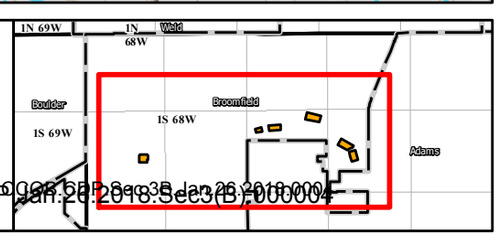


Exhibit 2

FORM 2A Rev 08/13

State of Colorado
Oil and Gas Conservation Commission

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

Oil and Gas Location Assessment

Document Number: 401477008

Date Received: 01/16/2018

☒ New Location ☐ Refile ☐ Amend Existing Location Location#: _____

This Oil and Gas Location Assessment is to be submitted to the COGCC for approval prior to any ground disturbance activity associated with oil and gas operations. Approval of this Oil and Gas Location Assessment will allow for the construction of the below specified Location; however, it does not supersede any land use rules applied by the local land use authority. Please see the COGCC website at http://cogcc.state.co.us/ for all accompanying information pertinent this Oil and Gas Location Assessment.

Location ID: **455317**

Expiration Date: **05/31/2021**

☒ This location assessment is included as part of a permit application.

CONSULTATION

☐ This location is included in a Comprehensive Drilling Plan. CDP # _____
☐ This location is in a sensitive wildlife habitat area.
☐ This location is in a wildlife restricted surface occupancy area.
☐ This location includes a Rule 306.d.(1)A.ii. variance request.

Operator

Operator Number: 10459
Name: EXTRACTION OIL & GAS INC
Address: 370 17TH STREET SUITE 5300
City: DENVER State: CO Zip: 80202

Contact Information

Name: Alyssa Andrews
Phone: (720) 481-2379
Fax: ( )
email: aandrews@extractionog.com

RECLAMATION FINANCIAL ASSURANCE

☒ Plugging and Abandonment Bond Surety ID: 20130028 ☐ Gas Facility Surety ID: _____
☐ Waste Management Surety ID: _____

LOCATION IDENTIFICATION

Name: Livingston Pad Number: _____
County: BROOMFIELD

QuarterQuarter: NWSE Section: 7 Township: 1S Range: 68W Meridian: 6 Ground Elevation: 5315

Define a single point as a location reference for the facility location. When the location is to be used as a well site then the point shall be a well location.

Footage at surface: 2332 feet FSL from North or South section line
1528 feet FEL from East or West section line

Latitude: 39.978564 Longitude: -105.040122

PDOP Reading: 1.2 Date of Measurement: 11/10/2017

Instrument Operator's Name: T. WINNICKI

RELATED REMOTE LOCATIONS

(Enter as many Related Locations as necessary. Enter the Form 2A document # only if there is no established COGCC Location ID#)

This proposed Oil and Gas Location is:	LOCATION ID #	FORM 2A DOC #
Well Site is served by Production Facilities		401606738
		401606721

FACILITIES

Indicate the number of each type of oil and gas facility planned on location

Wells	19	Oil Tanks*		Condensate Tanks*		Water Tanks*		Buried Produced Water Vaults*	
Drilling Pits		Production Pits*		Special Purpose Pits		Multi-Well Pits*		Modular Large Volume Tanks	
Pump Jacks		Separators*	19	Injection Pumps*		Cavity Pumps*		Gas Compressors*	4
Gas or Diesel Motors*		Electric Motors		Electric Generators*		Fuel Tanks*		LACT Unit*	
Dehydrator Units*		Vapor Recovery Unit*		VOC Combustor*		Flare*		Pigging Station*	

OTHER FACILITIES*

Other Facility Type	Number
Transformer	1
Maintenance Vessel	1
Emission Control Device	1
Produced Water Surge Drum	1
Gas Lift Metering Building	2
Piperack Modules	9
Compressor Drain Tank	1
Oil Surge Drum	1
Air Compressor	1
Fuel Gas Scrubber	1
Sales Gas Meter	1
Gas Lift Suction Scrubber	1
Electrical Switchrack	2

*Those facilities indicated by an asterisk (*) shall be used to determine the distance from the Production Facility to the nearest cultural feature on the Cultural Setbacks Tab.

Per Rule 303.b.(3)C, description of all oil, gas, and/or water pipelines:

Extraction will trench flowlines in one piping corridor that runs between the drill pad and the separator pad and be placed at 12” centers. These lines will most likely be 2” or 3” fusion bonded SCH160 steel pipe and have proper cathodic protection throughout the run. Extraction will then sweep up with a long radius that will tie off each line to the appropriate separator. All welds on these are 100% x-ray and hydro tested to the API and Manufactures specs for a class 1500 series flange. Also meets ASME code B31.4.

CONSTRUCTION

Date planned to commence construction: 06/01/2018 Size of disturbed area during construction in acres: 19.77

Estimated date that interim reclamation will begin: 09/01/2018 Size of location after interim reclamation in acres: 19.77

Estimated post-construction ground elevation: 5315

DRILLING PROGRAM

Will a closed loop system be used for drilling fluids: Yes

Is H_2S anticipated? No

Will salt sections be encountered during drilling: No

Will salt based mud (>15,000 ppm Cl) be used? No

Will oil based drilling fluids be used? Yes

DRILLING WASTE MANAGEMENT PROGRAM

Drilling Fluids Disposal: OFFSITE Drilling Fluids Disposal Method: Commercial Disposal

Cutting Disposal: OFFSITE Cuttings Disposal Method: Commercial Disposal

Other Disposal Description:

Beneficial reuse or land application plan submitted?

Reuse Facility ID: or Document Number:

Centralized E&P Waste Management Facility ID, if applicable:

SURFACE & MINERALS & RIGHT TO CONSTRUCT

Name: CITY&COUNTY OF BROOMFIELD Phone:

Address: ONE DESCOMBES DR Fax:

Address: Email:

City: BROOMFIELD State: CO Zip: 80020

Surface Owner: ☒ Fee ☐ State ☐ Federal ☐ Indian

Check all that apply. The Surface Owner: ☐ is the mineral owner

☐ is committed to an oil and Gas Lease

☐ has signed the Oil and Gas Lease

☐ is the applicant

The Mineral Owner beneath this Oil and Gas Location is: ☒ Fee ☐ State ☐ Federal ☐ Indian

The Minerals beneath this Oil and Gas Location will be developed from or produced to this Oil and Gas Location: Yes

The right to construct this Oil and Gas Location is granted by: Surface Use Agreement

Surface damage assurance if no agreement is in place: Surface Surety ID:

Date of Rule 306 surface owner consultation

CURRENT AND FUTURE LAND USE

Current Land Use (Check all that apply):

Crop Land: ☐ Irrigated ☒ Dry land ☐ Improved Pasture ☐ Hay Meadow ☐ CRP

Non-Crop Land: ☐ Rangeland ☐ Timber ☐ Recreational ☐ Other (describe):

Subdivided: ☐ Industrial ☐ Commercial ☐ Residential

Future Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	_____
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

CULTURAL DISTANCE INFORMATION

Provide the distance to the nearest cultural feature as measured from Wells or Production Facilities onsite.

	From WELL	From PRODUCTION FACILITY
Building:	824 Feet	1004 Feet
Building Unit:	1308 Feet	1486 Feet
High Occupancy Building Unit:	5280 Feet	5280 Feet
Designated Outside Activity Area:	5280 Feet	5280 Feet
Public Road:	447 Feet	205 Feet
Above Ground Utility:	1237 Feet	1426 Feet
Railroad:	5280 Feet	5280 Feet
Property Line:	282 Feet	172 Feet

INSTRUCTIONS:
- All measurements shall be provided from center of nearest Well or edge of nearest Production Facility to nearest of each cultural feature as described in Rule 303.b.(3)A.
- Enter 5280 for distance greater than 1 mile.
- Building - nearest building of any type. If nearest Building is a Building Unit, enter same distance for both.
- Building Unit, High Occupancy Building Unit, and Designated Outside Activity Area - as defined in 100-Series Rules.
-For measurement purposes only, Production Facilities should only include those items with an asterisk(*) on the Facilities Tab.

DESIGNATED SETBACK LOCATION INFORMATION

Check all that apply. This location is within a:

- ☐ Buffer Zone
- ☐ Exception Zone
- ☐ Urban Mitigation Area

- Buffer Zone - as described in Rule 604.a.(2), within 1,000' of a Building Unit.
- Exception Zone - as described in Rule 604.a.(1), within 500' of a Building Unit.
- Urban Mitigation Area - as defined in 100-Series Rules.
- Large UMA Facility – as defined in 100-Series Rules.

Pre-application Notifications (required if location is within 1,000 feet of a building unit):

Date of Rule 305.a.(1) Urban Mitigation Area Notification to Local Government: _____

Date of Rule 305.a.(2) Buffer Zone Notification to Building Unit Owners: _____

FOR MULTI-WELL PADS AND PRODUCTION FACILTIES WITHIN DESIGNATED SETBACK LOCATIONS ONLY:

☐ Check this box if this Oil and Gas Location has or will have Production Facilities that serve multiple wells (on or offsite) and the Production Facilities are proposed to be located less than 1,000 feet from a Building Unit. *(Pursuant to Rule 604.c.(2)E.i., the operator must evaluate alternative locations for the Production Facilities that are farther from the Building Unit, and determine whether those alternative locations were technically feasible and economically practicable for the same proposed development.)*

☐ By checking this box, I certify that no alternative placements for the Production Facilities, farther from the nearest Building Unit, were available based on the analysis conducted pursuant to Rule 604.c.(2)E.i.

In the space below, explain rationale for siting the multi-well Production Facility(ies) that supports your Rule 604.c.(2)E.i determination. Attach documentation that supports your determination to this Form 2A.

SOIL

List all soil map units that occur within the proposed location. attach the National Resource Conservation Service (NRCS) report showing the "Map Unit Description" report listing the soil typical vertical profile. This data is to used when segregating topsoil.

The required information can be obtained from the NRCS web site at http://soildatamart.nrcs.usda.org/ or from the COGCC web site GIS Online map page found at http://colorado.gov/cogcc. Instructions are provided within the COGCC web site help section.

NRCS Map Unit Name: ShF—Samsil-Shingle complex, 3 to 35 percent slopes

NRCS Map Unit Name: ReD—Renohill loam, 3 to 9 percent slopes

NRCS Map Unit Name: UlC—Ulm loam, 3 to 5 percent slopes

PLANT COMMUNITY:

Complete this section only if any portion of the disturbed area of the location's current land use is on non-crop land.

Are noxious weeds present: Yes ☐ No ☒

Plant species from: ☒ NRCS or, ☐ field observation Date of observation: _____

List individual species:

Check all plant communities that exist in the disturbed area.

- ☐ Disturbed Grassland (Cactus, Yucca, Cheatgrass, Rye)
- ☒ Native Grassland (Bluestem, Grama, Wheatgrass, Buffalograss, Fescue, Oatgrass, Brome)
- ☐ Shrub Land (Mahogany, Oak, Sage, Serviceberry, Chokecherry)
- ☐ Plains Riparian (Cottonwood, Willow, Aspen, Maple, Poplar, Russian Olive, Tamarisk)
- ☐ Mountain Riparian (Cottonwood, Willow, Blue Spruce)
- ☐ Forest Land (Spruce, Fir, Ponderosa Pine, Lodgepole Pine, Juniper, Pinyon, Aspen)
- ☐ Wetlands Aquatic (Bullrush, Sedge, Cattail, Arrowhead)
- ☐ Alpine (above timberline)
- ☐ Other (describe): _____

WATER RESOURCES

Is this a sensitive area: ☐ No ☒ Yes

Distance to nearest

downgradient surface water feature: 0 Feet

water well: 3450 Feet

Estimated depth to ground water at Oil and Gas Location 30 Feet

Basis for depth to groundwater and sensitive area determination:

Nearest surface water feature: Ditch 0' SW
Nearest water well: Permit 169501- -, 3450' NW, no depth to ground water provided
The depth to ground water is 30' as per water well permit 128950.

Is the location in a riparian area: ☒ No ☐ Yes

Was an Army Corps of Engineers Section 404 permit filed ☒ No ☐ Yes If yes attach permit.

Is the location within a Rule 317B Surface Water Supply Area buffer zone: No

If the location is within a Rule 317B Surface Water Supply Area buffer have all public water supply systems within 15 miles been notified:

Is the Location within a Floodplain? ☒ No ☐ Yes

Floodplain Data Sources Reviewed (check all that apply)

- ☐ Federal (FEMA)
- ☒ State
- ☐ County
- ☐ Local
- ☐ Other

GROUNDWATER BASELINE SAMPLING AND MONITORING AND WATER WELL SAMPLING

Water well sampling required per Rule 318A

WILDLIFE

- ☐ This location is included in a Wildlife Mitigation Plan
- ☐ This location was subject to a pre-consultation meeting with CPW held on

DESIGNATED SETBACK LOCATION EXCEPTIONS

Check all that apply:

- ☐ Rule 604.a.(1)A. Exception Zone (within 500' of a Building Unit) and is in an Urban Mitigation Area
- ☐ Rule 604.b.(1)A. Exception Location (existing or approved Oil & Gas Location now within a Designated Setback as a result of Rule 604.a.)
- ☐ Rule 604.b.(1)B. Exception Location (existing or approved Oil & Gas Location is within a Designated Setback due to Building Unit construction after Location approval)
- ☐ Rule 604.b.(2) Exception Location (SUA or site-specific development plan executed on or before August 1, 2013)
- ☐ Rule 604.b.(3) Exception Location (Building Units constructed after August 1, 2013 within setback per an SUA or site-specific development plan)

RULE 502.b VARIANCE REQUEST

- ☐ Rule 502.b. Variance Request from COGCC Rule or Spacing Order Number

ALL exceptions and variances require attached Request Letter(s). Refer to applicable rule for additional required attachments (e.g. waivers, certifications, SUAs).

OPERATOR COMMENTS AND SUBMITTAL

Comments	Single point location reference in the Location Identification section is the proposed Livingston S19-25-1N well. Notification Zone Drawing and UMA Check Exhibit both attached as "OTHER". This location is not in a buffer zone or UMA. The interim reclamation plan is not as extensive due in part to the large amount of grading and topography in this area. The objective was to minimize the removal of Broomfield Open Space material from this area and make it a balanced location.

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct and complete.
Signed: _____ Date: 01/16/2018 Email: aandrews@extractionog.com

Print Name: Alyssa Andrews Title: Regulatory Analyst

Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.

COGCC Approved: _____ **Director of COGCC** Date: 6/1/2018

Conditions Of Approval

All representations, stipulations and conditions of approval stated in this Form 2A for this location shall constitute representations, stipulations and conditions of approval for any and all subsequent operations on the location unless this Form 2A is modified by Sundry Notice, Form 4 or an Amended Form 2A.

COA Type	Description

Best Management Practices

No	BMP/COA Type	Description
1	Planning	Flammable Material. All ground within twenty-five (25) feet of any tank, or other structure containing flammable or combustible materials, shall be kept free of dry weeds, grass or rubbish, and shall conform to COGCC 600 Series Safety Regulations and the applicable Fire Code.
2	Planning	803. Permanent lighting will be installed around the facility to allow both the operator and haulers to conduct safe operations at night. All lights will be directed downward, inward and shielded so light pollution is minimized. During the Drilling and Completion Phases, consistent with applicable law, Operator will construct a 32 foot perimeter wall surrounding the well pads and operations area to reduce light escaping from the site.
3	Planning	This location is subject to a Comprehensive Development Plan (CDP), as set forth in the Operator Agreement between Extraction Oil and Gas, Inc. and the City and County of Broomfield, dated October 24, 2017. Operator is currently working through the CDP with the City and County of Broomfield staff.
4	Planning	Blowout Prevention Equipment ("BOPE"): A double ram and annular preventer will be used during drilling. Stabbing valves shall be installed in the event of reverse circulation and shall be prior tested with low and high pressure fluid.
5	Planning	Extraction maintains a Tactical Response Plan (TRP), also at times referred to as the Emergency Response Plan, which is designed to provide Extraction employees and designated Emergency Response Team (ERT) members with the information necessary to respond to incidents in a safe, rapid, effective, and efficient manner. The TRP is kept at Extraction's office and a copy is provided to the North Metro Fire Rescue District and the City of Broomfield. Extraction will place the TRP summary card in strategic places on the facilities during specific operations and copies of the summary card is provided to the North Metro Fire Rescue District to be kept in the responding fire engines.

6	Planning	Extraction will establish a live, 24-hour telephone hotline, as well as an email address, to receive feedback on our drilling and completion activities with the goal of having a tool for us to immediately investigate and address any complaints that arise. Prior to the initiation of 24-hour operations (drilling) Extraction will mail a post card (to include the email address and 24 hour manned phone number) to residents within 1/2 mile of the location.
7	Planning	This location is designed without permanent tanks. Oil, Gas, and produced water will be transported through a pipeline gathering to a Central Gathering Facility. Saleable gas will not be flared, it will be sent downline. For maintenance or upset conditions the use of a maintenance vessel and emission control devices will be utilized. Uncontrolled venting is prohibited other than where necessary for safety. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.
8	Planning	All loadlines shall be bull plugged or capped.
9	Traffic control	Access Roads: The access road will be constructed to accommodate local emergency vehicles. This road will be maintained for access at all times. Traffic will be routed to minimize local interruption. During construction and through the life of this location, Operator will utilize watering, via water trucks, to control fugitive dust. Additionally, the access road will be constructed with aggregate road base material and recycled asphalt and vehicle speeds will be limited to twenty five miles per hour to reduce dust. No untreated produced water or other process fluids shall be used for dust suppression.
10	Traffic control	A traffic plan is required by the City and County of Broomfield and shall be coordinated with the local jurisdiction prior to commencement of move in and rig up. Any subsequent modification to the traffic plan must be coordinated with the local jurisdiction.
11	General Housekeeping	Removal of Debris. All construction-related debris shall be removed from the site for proper disposal in a timely manner. The site shall be maintained free of debris and excess materials at all times during operation. Operator shall not burn or bury debris at any time on the Well Sites. Maintain appearance with garbage clean-up; a trash bin will be located on site to accumulate waste by the personnel drilling the wells. Site will have unused equipment, trash and junk removed immediately and legally disposed of as applicable.
12	General Housekeeping	Site security will be maintained at all times. Location will be adequately fenced to restrict access by unauthorized persons. The site will have gated access to keep unauthorized vehicles out and fencing will be placed around all production equipment.
13	Storm Water/Erosion Control	Implement and maintain BMPs to control stormwater runoff in a manner that minimizes erosion, transport of sediment offsite, and site degradation. Co-locate flowlines and/or gathering lines whenever feasible, and mitigate any erosion problems that arise due to the construction of any gathering lines. Location will be covered under Extraction Oil & Gas's field wide permit, permit number COR03M013. Typical stormwater BMPs installed include a diversion ditch and berm with sediment traps and installation of wattles where necessary. Please see the attached Stormwater BMP drawings.
14	Material Handling and Spill Prevention	Leak Detention Plan: Extraction will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads, tanks and fittings. Additionally annual SPCC inspections will be conducted and documented. Annual flowline testing will also occur according to COGCC rules 1101 and 1102. Inspection and record retention of flowline testing will be in accordance per COGCC regulation. All records will be made available to the COGCC upon request.
15	Material Handling and Spill Prevention	The location will be completely automated to monitor all production operations remotely. In the event that the facility is not operating under normal conditions, the automation system will immediately notify the operator. The automation system also has the ability to remotely perform an emergency shut down if necessary.

16	Material Handling and Spill Prevention	Automatic Safety Protective Systems and Surface Safety Valve. An automated safety system, governed by safety devices and a programmable logic computer, will be installed at the Well Sites. The automated safety system shall include the installation, monitoring and remote control of a Surface Safety Valve ("SSV") among many other engineered measures and devices that are implemented to greatly reduce or eliminate the potential for a well event. All New Wells will have a SSV installed prior to the commencement of the Production Phase connected to the production tubing at the surface. The SSV will be equipped to operate remotely via the automated safety protective system, which monitors multiple flowing pressures and rates which have predetermined maximum and/or minimum threshold values programmed and will remotely shut the well in should certain upset conditions be detected. Additionally, the automated safety system provides the ability to remotely shut-in wells on demand through operator remote intervention. The SSV will have documented quarterly testing to ensure functionality.
17	Dust control	805.c. Operator shall employ practices for control of fugitive dust caused by their operations. Such practices shall include but are not limited to the use of speed restrictions, regular road maintenance, restriction of construction activity during high-wind days, and silica dust controls when handling sand used in hydraulic fracturing operations. Additional management practices such as road surfacing, wind breaks and barriers may be used. No untreated produced water or other process fluids shall be used for dust suppression.
18	Construction	Containment Berms. The Operator shall utilize steel-rim berms around all separators at the Well Site with sufficient capacity to contain 1.5 times the maximum volume of all liquids that will be contained at a facility at any given time plus sufficient freeboard to prevent overflow. All berms and containment devices shall be inspected quarterly by the Operator and maintained in good condition. No potential ignition sources shall be installed inside the secondary containment area unless the containment area encloses a fired vessel or such sources are rated in accordance with industry codes and standards. Secondary containment such as duck ponds or lined earthen berms for temporary tanks shall also be used in addition to tankless and secondary containment around surface vessels. Permanent containment berms shall be constructed of steel rings, designed and installed to prevent leakage and resist degradation from erosion or routine operation. Secondary containment for separators shall be constructed with a synthetic or engineered liner that contains all primary containment vessels and is mechanically connected to the steel ring to prevent leakage. By request of the City and County of Broomfield, Extraction agrees to test pressure test flowlines according to the COGCC flowline rules bi-annually.
19	Construction	All new well equipment will be secured to the extent necessary to resist flotation collapse, lateral movement, or subsidence.
20	Construction	Base beams will be used and not guy line anchors.
21	Noise mitigation	Quiet Technology. The Operator agrees to use the Liberty Quiet Fleet or comparable technology from an alternative vendor on all Well Sites for completion activities.
22	Noise mitigation	To provide long term noise mitigation at this location, all production equipment will powered by electricity. If needed, sound mitigation panels will be installed around the compressors during production operations to shield sensitive areas.
23	Noise mitigation	Thirty-two foot sound walls will be used during drilling and completion operations. Sound walls will be installed on the edges impacting nearest neighbors. Sound walls will wrap the pad except for the southwest corner.

24	Noise mitigation	Baseline noise monitoring will be conducted prior to commencement of pad construction. Additional sound mitigation measures will be considered and implemented pursuant to third party recommendations. All noise survey data will be made available to the COGCC inspector upon request. The Operator shall continuously monitor noise and continuously collect and store noise readings with instruments placed between the Oil and Gas Location and residential Building Units. The Operator shall conduct the monitoring and data collection during construction, drilling, and completions operations. This data shall be available to COGCC on tables or graphs within 48 hours of being requested by COGCC. The Operator shall conduct a 72 hour baseline noise survey from a minimum of three points prior to the commencement of construction.
25	Noise mitigation	Electrified Drilling Rig - Extraction is working with United Power to supply sufficient electrical power for the drilling rig to drill the wells. Easements are being procured from the Landowners and the existing infrastructure is being upgraded in order to handle the larger electrical loads. While Extraction plans on drilling these wells on electrical power only, the rig will have diesel-powered generators in the event of an upset condition with the electrical supply from United Power. At that point, Extraction would use the diesel generators to power the rig until service from United Power was restored.
26	Emissions mitigation	Reduced Emission Completions (Commonly known as Green Completions). At Well Sites Operator shall employ reduced emission completions, also commonly known as green completions, which comply with federal and state requirements. In addition, Operator shall comply with the following: A. Gas gathering lines, separators, and sand traps capable of supporting green completions as described in COGCC Rule 805 shall be installed per the provisions of COGCC Rule 805. B. Operator shall comply with 40 CFR 60.5375(a)(1), (2) for green completions. C. Uncontrolled venting is prohibited other than where necessary for safety. D. Temporary flowback flaring and oxidizing equipment where allowed shall include the following: 1. Adequately sized equipment to handle 1.5 times the largest flowback volume of gas from a vertical/directional and/or horizontally completed well respectively as reported to the COGCC in a ten mile radius; 2. Valves and porting available to divert gas to flaring and oxidizing equipment; pursuant to the above Rules 40 CFR 60.5375 & COGCC Rule 805; 3. Auxiliary fueled with sufficient supply and heat to combust or oxidize non-combustible gases in order to control odors and hazardous gases. The flowback combustion device shall be equipped with a reliable continuous ignition source over the duration of flowback, except in conditions that may result in a fire hazard or explosion; and 4. The Operator has a general duty to safely maximize resource recovery and minimize releases to the atmosphere during flowback and subsequent recovery/operation.
27	Emissions mitigation	Exhaust. The exhaust from all engines, motors, coolers and other mechanized equipment shall be vented up or in a direction away from the nearest occupied building.
28	Emissions mitigation	Leak Detention Plan: Operator will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads and equipment. As part of Extraction's Leak Detection and Repair (LDAR) program, all equipment including above ground flowlines and piping will be inspected quarterly with an infra-red camera for the first 5 years of production.
29	Emissions mitigation	Operator will bring a new oil, gas, and water pipelines, to send produced volumes immediately down the pipeline. No production will flow to tanks on this location. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.

30	Odor mitigation	805. Oil & gas facilities and equipment shall be operated in such a manner that odors do not constitute a nuisance or hazard to public welfare. Extraction will use a mud cooling system to control the release of odors within the drilling and fracturing fluids. Odor preventing additives will be on site for use if and when needed. Extraction will use a base fluid that will decrease the measurable BTEX and aromatic properties by more than 50% of regular diesel. Operator is prohibited from masking odors from any oil and gas facility site by using masking fragrances.
31	Drilling/Completion Operations	Well Integrity. Operator must equip the bradenhead access to the annulus between the production and the surface casing, as well as any intermediate casing, with a fitting to allow safe and convenient determinations of pressure and fluid flow. Valves used for annular pressure monitoring shall remain exposed and not buried to allow for visual inspection. The Operator shall take bradenhead pressure readings as required by the COGCC.
32	Drilling/Completion Operations	Bradenhead Monitoring. Operator will conduct bradenhead monitoring on the New Wells as required on the relevant Applications for Permit to Drill - Form 2.
33	Drilling/Completion Operations	Backup stabbing valves will be required on well servicing operations during reverse circulation. Valves shall be pressure tested before each well servicing operation using both low-pressure air and high-pressure fluid.
34	Drilling/Completion Operations	All fresh water for completions shall be transported to the well site via temporary water lines.
35	Drilling/Completion Operations	BOPE testing for drilling operations. Upon initial rig-up and at least once every thirty (30) days during drilling operations thereafter, pressure testing of the casing string and each component of the blowout prevention equipment including flange connections shall be performed to seventy percent (70%) of working pressure or seventy percent (70%) of the internal yield of casing, whichever is less. Pressure testing shall be conducted and the documented results shall be retained by the operator for inspection by the Director for a period of one (1) year. Activation of the pipe rams for function testing shall be conducted on a daily basis when practicable.
36	Drilling/Completion Operations	Closed chamber drill stem tests shall be allowed. All other drill stem tests shall require approval by the Director. None planned for this well.
37	Drilling/Completion Operations	Closed-Loop Pitless Systems for the Containment and/or Recycling of Drilling Fluids. Wells shall be drilled, completed and operated using closed-loop pitless systems for containment and/or recycling of all drilling, completion, flowback and produced fluids. Operator shall recycle fluids to the maximum extent practicable.
38	Drilling/Completion Operations	Flowback Monitoring System: Autonomous 4 gas monitors will be placed around the location during the flowback phase.
39	Interim Reclamation	Operator shall be responsible for segregating the topsoil, backfilling, re-compacting, reseeding, and re-contouring the surface of any disturbed area so as not to interfere with Owner’s operations and shall reclaim such area to be returned to pre-existing conditions as best as possible with control of all noxious weeds.
40	Final Reclamation	Within 90 days subsequent to the time of plugging and abandonment of the entire site, superfluous debris and equipment shall be removed from the site. Identification of plugged and abandoned wells will be identified pursuant to 319.a.(5)The operator shall also inscribe or imbed the well number and date of plugging upon the permanent monument.
41	Final Reclamation	Reclamation. Operator must submit an oil and gas site reclamation plan and reclaim a Well Site not later than six (6) months after plugging and abandoning the last New Well at such Well Site, weather and planting season permitting.

Total: 41 comment(s)

Attachment Check List

Att Doc Num	Name
1009842	CORRESPONDENCE
1642219	CORRESPONDENCE
2316305	REFERENCE AREA PICTURES
2316326	EXHIBIT B
2316327	OTHER
2316329	CONST. LAYOUT DRAWINGS
2316334	OTHER
2478646	OPERATOR RESPONSE TO PUBLIC COMMENTS
401477008	FORM 2A SUBMITTED
401484674	ACCESS ROAD MAP
401484682	FACILITY LAYOUT DRAWING
401484685	HYDROLOGY MAP
401484699	LOCATION DRAWING
401484701	LOCATION PICTURES
401484702	MULTI-WELL PLAN
401484719	OTHER
401484728	REFERENCE AREA MAP
401484733	OTHER
401484738	WASTE MANAGEMENT PLAN
401484752	SURFACE AGRMT/SURETY
401484778	NRCS MAP UNIT DESC
401484780	NRCS MAP UNIT DESC
401484781	NRCS MAP UNIT DESC

Total Attach: 23 Files

General Comments

User Group	Comment	Comment Date
OGLA	COGCC Response to Broomfield LGD Form 2A Questions The Broomfield LGD submitted a comment document to COGCC for the proposed Extraction Livingston location on March 1 2018. The full LGD comment is on the Form 2A. COGCC is providing the following responses to the four questions on the LGD comment document: 1. The FACILITIES section indicates there are 2 gas compressors planned for the location. Extraction should provide information associated with the purpose of the compressors and how will they be fueled. COGCC Response: There are four gas compressors listed on the Facilities Section for the Livingston location. Gas compressors are common field equipment, in this case the compressors will be used to compress recovered flash gas to allow it to be sent down the gas sales line. The compressors will be powered by electricity. 2. The CONSTRUCTION section indicates that the size of the location after interim reclamation will be the same as the disturbed area during construction. Why will the location size remain the same after interim reclamation? COGCC Response: COGCC Rule 1003.b requires the operator to reclaim the land to its original condition and re-leveled as close to the original contours as practicable. Due the topography, the Livingston pad planned will be constructed by cutting into the terrain to the east and placing fill to the west. The 19.77 permitted location includes the pad and the cut and fill slopes. The operator will stabilize and seed the slopes but will not re-grade those disturbed areas. The working surface of the pad will be somewhat reduced and stabilized during production operations, but the overall outline of disturbed area will not change. 3. In the BEST MANAGEMENT PRACTICES section, Item 46 - Emissions mitigation 20. D. #4, #5 and #6 are not included COGCC Response: The emissions mitigation Best Management Practices on the Form 2A do not conflict with or prevent Extraction from complying the BMPs in Exhibit B of the Operator Agreement including BMP #20, which refers to all applicable rules and regulation promulgated by COGCC, CDPHE and US EPA. Extraction is reducing emissions on the pad through their use of pipelines for production, electric drill rig and production equipment, and other measures described in their BMPs. Additionally, Extraction has proposed additional leak detection and monitoring that will help reduce emissions. 4. The waste management plan only addresses E&P Waste. It does not discuss secondary containment and stormwater measures as required by Item 41 in the Best Management Practices of the Operator Agreement. COGCC Response: Waste management plans are required on a Form 2A if a proposed Oil and Gas Location is less than 1,000 feet from a Building Unit (Rule 303.b.(3)J.ii). Although the planned Livingston location will be greater than 1,000 feet to a Building Unit, Extraction provided a waste management plan that addresses management of E&P waste under COGCC's regulatory authority in accordance with COGCC 907a. Secondary and tertiary containment are provided for this Location and the operator has submitted detailed stormwater plan design documents.	06/01/2018
Permit	Final review complete.	06/01/2018
OGLA	Attached April 18, 2018 letter from Extraction to Broomfield LGD regarding the fire that occurred at an Extraction wellsite on December 22, 2017. Document ID#2316327	06/01/2018
OGLA	Operator provided an updated Response to Broomfield's Public Comments attachment.	06/01/2018

OGLA	COGCC staff met with Extraction personnel on 5/25/18. Discussed revision or addition of the following BMPs: fencing, anchoring equipment, flowline testing, air monitoring during flowback, and stormwater. Operator provided the BMP updates in a 5/31/18 email. Staff updated BMPs on 5/31/18	05/31/2018	
OGLA	Original Reference area photo to the west was not the reference area photo for this location. Operator corrected and sent revised photos. Date on photos for submission is 12/2017 and revised of 3/2018. Operator confimred pictures were taken in October 2017. Plants are not dormant and can identify vegetation to meet reference area photo requirements.	05/24/2018	
OGLA	Added stormwater drawing as other (doc no 2316334) and Operators response to public comments on the 2A as other (doc no 2316335). Email correspondence with Operator regarding clarification of changes on the 2A.	05/23/2018	
OGLA	OGLA review: No production for product, cultural distances to nearest above ground utility might be different, land use does not appear to be rangeland, water resources should be yes for sensitive area with surface water on the location and depth to water listed is nearest water well, not the most shallow groundwater. Most of the BMPs reference the City of Broomfield which is not enforceable by COGCC. First email sent to Operator on 2/26/18 – Operator responded on 3/6/18 and 3/21/18. Had a meeting with City of Broomfield 3/13/18 and 4/18 for BMPs. Met or spoke with Operator on 3/15/18 (in person), 4/9 (phone conversation), 4/11 (in person). Multiple email correspondence with Operator and City of Broomfield regarding BMPs.	05/22/2018	
Permit	Permitting review complete.	04/26/2018	
Permit	Permitting review complete pending review of 19 associated APDs.	04/20/2018	
Agency	Comment submitted by Tami Yellico, Broomfield LGD Extraction shall implement the following actions to its Emergency Plan for all Broomfield wellsites: a. Develop enhanced hotwork planning and setback procedures b. Expand training and enforcement of hotwork permit implementation and management, re-issued STEPS alert to employees and vendors for hazard recognition and proper PPE. c. Add additional field management levels for specific flowback activities d. Implement stationary LEL monitoring grid with alarms on all flowback operations e. Evaluate and retrofitting sound wall placements or technologies to enhance ventilation f. Develop and implementing automated tank gauging on flowback operations g. Revise prestart-up safety review (PSSR) of Green Completion flowback setups, including, but not limited to: i. Site layout ii. Grounding requirements iii. Vessel depressurizing procedures h. Hold meetings with vendors regarding all corrective actions listed above and have scheduled ongoing meetings to continually discuss the process. i.Extraction shall provide a third party report of any incident as requested by Broomfield	03/02/2018	
LGD	By way of an update to the COGCC, on October 24, 2017, Extraction and Broomfield entered into an Amended and Restated Operator Agreement (Agreement). Section 9 of the Agreement provides that Extraction must submit a	02/28/2018	

"Comprehensive Drilling Plan and Application" to Broomfield for such new wells or well sites (Plan). Per the Agreement, that Plan is subject to the review and approval by the City.

Broomfield has not approved the Plan as required by the Agreement. Broomfield has been working diligently with Extraction on the Plan, through weekly meetings and timely and reasonable communications with Extraction. The COGCC spacing orders for these spacing units, dated as of October 31, 2017, indicate that any Permits for the wells within these spacing units must "comport with" the Agreement.

As stated above, Section 9 of the Agreement provides that Extraction must submit a Comprehensive Drilling Plan for all of the well sites that is subject to Broomfield's approval. On December 15, 2017, Extraction submitted a draft Plan for the Livingston and Interchange B well pads. On January 22, 2018, Broomfield submitted 220 comments on that draft Plan, which included the comment that the Agreement requires the Plan to be for all of the well sites (Comments). On January 26, 2018, Extraction submitted a draft Plan for the Northwest A & B, United, and Interchange A & B Pads. On February 15, 2018, Extraction responded to Broomfield's comments, which relate to the Livingston and Interchange B portion of the Plan. Broomfield is in the process of reviewing Extraction's February 15th comments and providing comments on the second Plan submitted by Extraction on January 26, 2018.

In both citizens' and staff comments we have identified areas where Broomfield is requesting additional information and where we believe the Plan is not complete. Broomfield believes that Extraction has an obligation to correct or update any deficient statements in the Plan. The issues that remain outstanding in the Plan include the following:

[Liquid XAML Object]At meetings with Extraction on February 7, 2018, and February 14, 2018, Broomfield identified engineering issues that need to be resolved before permitting of the pipeline for all the well sites could go forward.

[Liquid XAML Object]At a meeting on February 16, 2018, Broomfield outlined deficiencies in Extraction's proposed Traffic Plan that need to be corrected.

[Liquid XAML Object]As of the date of these comments, Broomfield is still working with Extraction on required updates to its Emergency Response Plan and Risk Analysis Plan before those can be approved. Extraction has only provided a broad Risk Analysis Plan despite the requirement that risks and responses be identified.

[Liquid XAML Object]Extraction has not identified each type of hazard for each location and specific responses by phases, including referencing Broomfield's Emergency Response Plan and the COGCC Emergency Response Plan.

[Liquid XAML Object]It is Broomfield's understanding that Extraction has yet to talk with all Broomfield and Adams County residents to determine their desired mitigation measures for the well sites and truck roads to the north, even though Extraction committed to such individual communications.

[Liquid XAML Object]Extraction has not committed in writing to any necessary specific mitigation measures between residents and well sites to the north and east of residents in Adams County and Broomfield.

[Liquid XAML Object]Extraction has not yet committed in writing to necessary road improvements, stemming from increased truck traffic related to the Extraction operations.

[Liquid XAML Object]Extraction has yet to identify all traffic signage or committed to install such signage on its traffic plans.

[Liquid XAML Object]Extraction has yet to agree in the Plan that all class 7 and above vehicles are not allowed to operate on Public Roadways during the peak hours of 7-9 a.m. and 3-6 p.m. for Extraction activities

[Liquid XAML Object]Extraction has not submitted a final pavement design report for approval by the City and County Engineer.

[Liquid XAML Object]Extraction has yet to agree in the Plan to ensure the safety of emergency response teams, construction workers and the general public. Extraction has yet to agree in the Plan that Buffers shall be created as required on site to shield dust, noise, and light from residents

[Liquid XAML Object]Extraction has yet to provide a complete stormwater management plan.

[Liquid XAML Object]Extraction has failed to provide a more detailed GANTT chart on timing for all well sites.

[Liquid XAML Object]Extraction has not provided a long term reclamation plan.

[Liquid XAML Object]Extraction has not included practices it will use to address weeds at the sites.

[Liquid XAML Object]Extraction has not provided a complete explanation of its noise modeling approach.

[Liquid XAML Object]Extraction has not detailed the noise reduction levels it can achieve.

[Liquid XAML Object]Extraction has not provided written detail on the process of “Conduct Recovery Operations” including involvement of Broomfield’s Public Health Division.

[Liquid XAML Object]Despite the fact that many Broomfield and Adams County residents to the south of the well sites are on well water, Extraction has not included 12 additional requested requirements in its Water Quality Plan.

[Liquid XAML Object]Extraction has not complied with 2 requirements for the Wetlands Plan.

[Liquid XAML Object]Extraction has given only general responses to specific environmental site review requests.

[Liquid XAML Object]Extraction has not provided details of planning and installation of electrical infrastructure at the well sites as required for the Electrification Plan and Extraction has indicated that they will be updating the plan.

[Liquid XAML Object]Extraction has not provided a detailed visual mitigation plan for the well sites, service road, or pig launcher station.

[Liquid XAML Object]Broomfield is requesting that the phrase “The meteorological data that was used are "regional" and could be applied to a range of sites in the area. If the proposed development is similar and has the same or fewer wells, then the results could be extended to further characterizations” be added to the Plan concerning air modeling.

[Liquid XAML Object]Broomfield is requesting that the tank be removed from Figure 3 of the Plan since this tank will NOT be present. The diagram should correctly reflect what will be on site.

[Liquid XAML Object]Extraction has not provided a list of the hazardous materials that will be used on-site.

Other Comments concerning Form 2 and 2A include:

Livingston Form 2A Comments and Questions

[Liquid XAML Object]The FACILITIES section indicates there are 2 gas compressors planned for the location. Extraction should provide information

associated with the purpose of the compressors and how will they be fueled.

[Liquid XAML Object]The CONSTRUCTION section indicates that the size of the location after interim reclamation will be the same as the disturbed area during construction. Why will the location size remain the same after interim reclamation?

[Liquid XAML Object]In the BEST MANAGEMENT PRACTICES section, Item 46 - Emissions mitigation 20. D. #4, #5 and #6 are not included

[Liquid XAML Object]The waste management plan only addresses E&P Waste. It does not discuss secondary containment and stormwater measures as required by Item 41 in the Best Management Practices of the Operator Agreement.

Livingston Form 2 Comments

[Liquid XAML Object]Broomfield requests that the COGCC take a close look at the offset well evaluations provided by Extraction Oil and Gas to verify the estimates of offset distances of existing wells (including plugged and abandoned wells) from the new proposed horizontal wells. Broomfield was unable to confirm many of the distances indicated in the OPERATOR COMMENTS AND SUBMITTAL section of the Form 2s based on the OFFSET WELL EVALUATIONS spreadsheet or from the ANTI-COLLISION reports provided.

[Liquid XAML Object]According to the OFFSET WELL EVALUATIONS spreadsheet provided in the Form 2s, there are many plugged and abandoned wells and several producing wells that have horizontal offsets of less than 150 feet from the proposed new horizontal wells and it is indicated that No Remediation Is Required for these wells. Broomfield is very concerned about the short offset distance for some of these wells, for example new well Livingston S19-25-4N has an offset distance of only 19 feet from plugged and abandoned well McClintock MA 19-3J (API# 05-014-09137). Therefore, Broomfield requests that the COGCC take a close look to verify the proposed mitigation measures indicated by Extraction Oil and Gas are appropriate as defined by the DJ Basin Horizontal Offset Policy.

[Liquid XAML Object]For the Livingston S19-25-10N Form 2: In the SPACING AND UNIT INFORMATION section, the Distance from Completed Portion of Wellbore to Nearest Unit Boundary is blank.

Interchange Form 2 A Comments

[Liquid XAML Object]The FACILITIES section indicates there are 2 gas compressors planned for the location. Extraction should provide information associated with the purpose of the compressors and how will they be fueled.

[Liquid XAML Object]Do CDOT and the Northwest Parkway Authority need to be notified since portions of I-25 and the Northwest Parkway are within the notification zone?

[Liquid XAML Object]The waste management plan only addresses E&P Waste. It does not discuss secondary containment and stormwater measures as required by Item 41 in the Best Management Practices of the Operator Agreement.

Interchange Form 2 Comments

[Liquid XAML Object]Broomfield requests that COGCC take a close look at the offset well evaluations provided by Extraction Oil and Gas to verify the estimates of offset distances of existing wells (including plugged and abandoned wells) from the new proposed horizontal wells. Broomfield was unable to confirm many of the distances indicated in the OPERATOR COMMENTS AND SUBMITTAL section of the Form 2s based on the OFFSET WELL EVALUATIONS spreadsheet or from the ANTI-COLLISION reports provided.

[Liquid XAML Object]According to the OFFSET WELL EVALUATIONS spreadsheet provided in the Form 2s, there are many plugged and abandoned wells and several producing wells that have horizontal offsets of less than 150 feet from the proposed

	new horizontal wells and it is indicated that No Remediation Is Required for these wells. Broomfield is very concerned about the short offset distance for some of these wells; therefore, Broomfield requests that COGCC take a close look to verify the proposed mitigation measures indicated by Extraction Oil and Gas are appropriate as defined by the DJ Basin Horizontal Offset Policy. Broomfield asks that COGCC leave the comment period on the Permits open until all issues are resolved regarding the Plan. Broomfield will continue to work diligently with Extraction on the Plan.	
OGLA	In accordance with Rule 305.d.(3), the Director has extended the comment period by five days; therefore, the new deadline for public comment on this Oil and Gas Location Assessment Permit is THURSDAY, MARCH 1, 11:00am.	02/23/2018
OGLA	OGLA review: need more description on piping, interim reclamation is the same size as the construction area. Water resources sensitive with suface water within the disturbed area - distance to water well and depth to water needs to be corrected. BMPs from agreement with City of Broomfield being reviewed. Reference area photos are not during growing season.	02/21/2018
Permit	Per Rule 305.d.(1)A. , the comment period has been extended from 20 days to 30 days at the request of the Broomfield County LGD; the comment period will end February 24, 2018.	01/26/2018
Permit	Passed Completeness.	01/25/2018

Total: 16 comment(s)

Exhibit 3

FORM 42
Rev 03/15

State of Colorado
Oil and Gas Conservation Commission

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

OGCC RECEPTION

Receive Date: 02/11/2019

Document Number: 401935861

FIELD OPERATIONS NOTICE

The Form 42 shall be submitted as required by Rule, Notice to Operators, Policy, or Condition of Approval.
A Form 42 Update shall be submitted to revise the scheduled date or time on a previous Form 42 - Advance Notice of Field Operations.
A Form 42 Update must be for the same well, location, or facility and for the same Field Operation as a previous Form 42.
NOTE: Operator's Contact for Advance Notices of Field Operations should be available 24 hours a day, 7 days a week and should have the most current scheduling information for the operation. Operator's Contact for other notices should be able to respond to questions regarding the reported information.

Update of a previous Form 42 Notice: NO

Entity Information

OGCC Operator Number: 10459
Company Name: EXTRACTION OIL & GAS INC
Address: 370 17TH STREET SUITE 5300
City: DENVER State: CO Zip: 80202
Contact Person: Jeff Rickard
Phone: (720) 737-5144
Fax: ( )
Email: jrickard@extractionog.com

API #: 05 - - -
Facility ID:
Location ID: 455317
Facility Name: Livingston Pad
Submit By Other Operator
Sec: 7 Twp: 1S Range: 68W QtrQtr: NWSE
Lat: 39.978564 Long: -105.040122

NOTICE OF CONSTRUCTION OF A NEW LOCATION OR MAJOR CHANGE – 48-hour notice required

Start Date: 02/18/2019

I hereby certify all statements made in this form are, to the best of my knowledge, true, correct and complete.

Print Name: Jeff Rickard
Email: jrickard@extractionog.com
Signature:
Title: Regulatory Compliance Coo
Date: 02/11/2019

Exhibit 4

BROOMFIELD CITY COUNCIL

To: **Mayor and City Council**
From: **Charles Ozaki, City and County Manager**
Presented by: **Kevin Standbridge, Deputy City & County Manager**
Tami Yellico, Director of Strategic Initiatives

Status Update
Oil and Gas Update - April 11, 2019
Summary
● On October 9, 2018, City Council was updated on the Oil and Gas Communications Plan. The presentation, linked here, can be viewed online. ● At the March 19, 2019, meeting, Council was given the most recent presentation of an update on oil and gas activities. That update can be viewed here. ● This written memorandum is an update on elements of Broomfield's oil and gas program that have occurred since the March 19, 2019 City Council meeting update, including: ○ Extraction Oil and Gas activities: ■ Status of Sheridan Boulevard road repair; ■ Updated baseline air, noise, soil gas, and water testing; ■ Risk assessment process; and ■ Pipeline, access road, and pad construction. ○ Update on Crestone's proposed Goltl Pads in Broomfield ○ Update on Crestone's Acme Pad in Erie ○ Broomfield Municipal Code updates and implementation ○ COGCC Hearings (Goltl wells and DOAA) ○ Broomfield's Air Quality Monitoring and Testing Program ○ Broomfield's Oil and Gas complaint system ○ Risk Management Assessments ○ Broomfield contractor for continuous noise monitoring and consulting ○ Broomfield Oil and Gas Division Inspections ○ Webber MLVT (Modular Large Volume Tank) for fresh water storage ○ Other Meetings and Presentations
Prior Council Action
● August 24, 2017, City Council adopted the Oil and Gas Chapter to the Comprehensive Plan (Chapter). ● October 24, 2017, Resolution 2017-186, City Council approved Extraction Operator Agreement ● July 10, 2018, City Council approved the new Oil and Gas Regulations ● The Comprehensive Drilling Plan for Extraction, as called for in the Extraction Operator Agreement, was approved on August 20, 2018.
Financial Considerations
N/A
Alternatives
N/A
Proposed Actions/Recommendations
Discussion by the City Council regarding oil and gas issues by the City and County of Broomfield.

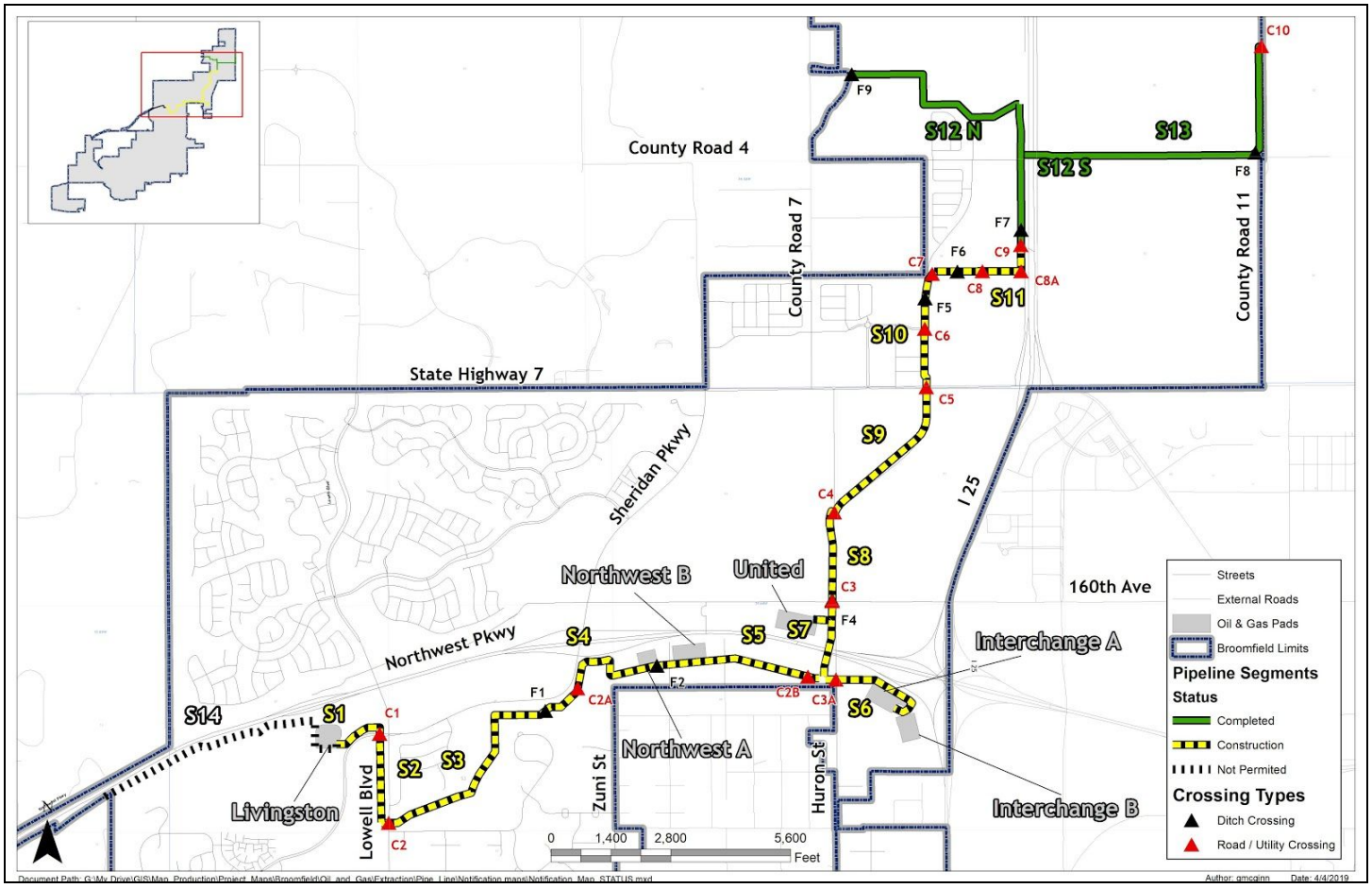
BACKGROUND

Broomfield continues to manage oil and gas issues using a variety of methods. Staff has taken City Council direction as it has been provided, on many of these oil and gas efforts, including the communications plan, oil and gas municipal code amendments, and State regulatory efforts. This memorandum is an update on all oil and gas efforts currently underway since the last Oil and Gas Update presented to Council at the March 19, 2019, meeting. (View that memo here.)

EXTRACTION OIL AND GAS ACTIVITIES

The most recent Timeline of Extraction activities is posted on the oil and gas web page under Oil and Gas Operators, Extraction. (View the updated timeline here.) As the new timeline indicates, drilling on the Interchange B pad, the first of Extraction's drilling sites in Broomfield, started on March 25th. Also, the construction of the Livingston Pad has been permitted, and the construction of the access road and well pad began February 18th and is ongoing. Drilling on the Livingston Pad is currently estimated to begin in June. Drilling each well will take approximately 6 days, however, this is weather dependent.

The oil, gas, and produced water pipelines that serve the six well pads must be in place prior to production on any of the six well pads planned for Broomfield. The map below indicates the segments of the pipeline that are completed, are being constructed, and are not yet permitted.



Construction on the Interchange A and B Pads

The installation of the sound walls for the Interchange A and B Pads are complete. Extraction provided the required letter of notice pursuant to Section 6 of Exhibit B to the Operators Agreement, providing at least 30 days prior notice of the intent to commence the drilling phase at the Interchange B Pad for 10 wells. Extraction began drilling the ten wells at the Interchange B Pad on March 25th. Spudding of the ten wells at Interchange B Pad is now complete and it is anticipated that the larger rig for drilling will move on the site within the next seven days, with drilling by the primary rig to start the week on April 15th.

The pipeline risk analysis is here. This was submitted by Extraction to Broomfield as was required by Section 3 of Exhibit B of the Operator Agreement, which reads as follows:

> If requested by the City, Operator will conduct a risk analysis to identify potential risks associated with pipelines and the measures implemented that are intended to mitigate such risks.

Extraction continues construction on the Northwest access road as depicted in this map. It is anticipated that this access road will be completed this week.

Broomfield Standards and Specification allow Saturday work permits. At this time it is anticipated that work on Extraction pipeline segments will be conducted, in addition to weekdays, on most Saturdays for the foreseeable future.

In boring underneath Sheridan Boulevard, west of the Lowell Boulevard intersection, Extracton's contractor caused a heaving issue with Sheridan Boulevard on their first bore. Staff has worked with Extraction to see that this issue is not repeated with future activities. Extraction is responsible for repairing the damage they created to Sheridan Boulevard. Geotechnical analysis of the heave has been conducted by a third party consultant and reviewed by Broomfield staff. Work on the heave will be subject to weather conditions and Council will be updated when the work is completed. The scope of work for the Sheridan heave is currently out to bid and the Engineering staff should have a schedule for the work to be done in the next two weeks.

Webber MLVT (Modular Large Volume Tank) For Fresh Water Storage

The MLVTs will be used to contain the fresh water that will be transported via pipeline to each of Extraction's new well pads in Broomfield for use during the completions phase of development. This water storage site was approved as part of the Amended and Restated Oil and Gas Operator Agreement between Extraction and Broomfield (see below):

> 11. Approved Water Storage Site. "Approved Water Storage Site" means the Weber H Unit 1 Well Pad, which was approved by the City on February 12, 2013 for a use by special review permit by Resolution No. 2013-22. Operator is permitted to use the Approved Water Storage Site for fresh water storage. Fresh water will be transported via pipeline from the Approved Water Storage Site to each of the Well Sites for use during hydraulic fracturing and completions operations. The City will grant underground and surface pipeline right-of-way or licenses as necessary for the transportation of water to and from the Approved Water Storage Site. At the completion of Operator's plan of development, Operator will remove the water tanks and plug and reclaim the existing well at the Approved Water Storage Site in accordance with state law and regulations and the Broomfield Municipal Code.

A Form 2A for the MLVTs on the Webber H, Unit 1 well pad (location shown in the blue square on the map below), was recently posted for comment by the Colorado Oil and Gas Conservation Commission (COGCC) and can be viewed here. The posting of this Form 2A initiates the comment period initially scheduled to end on

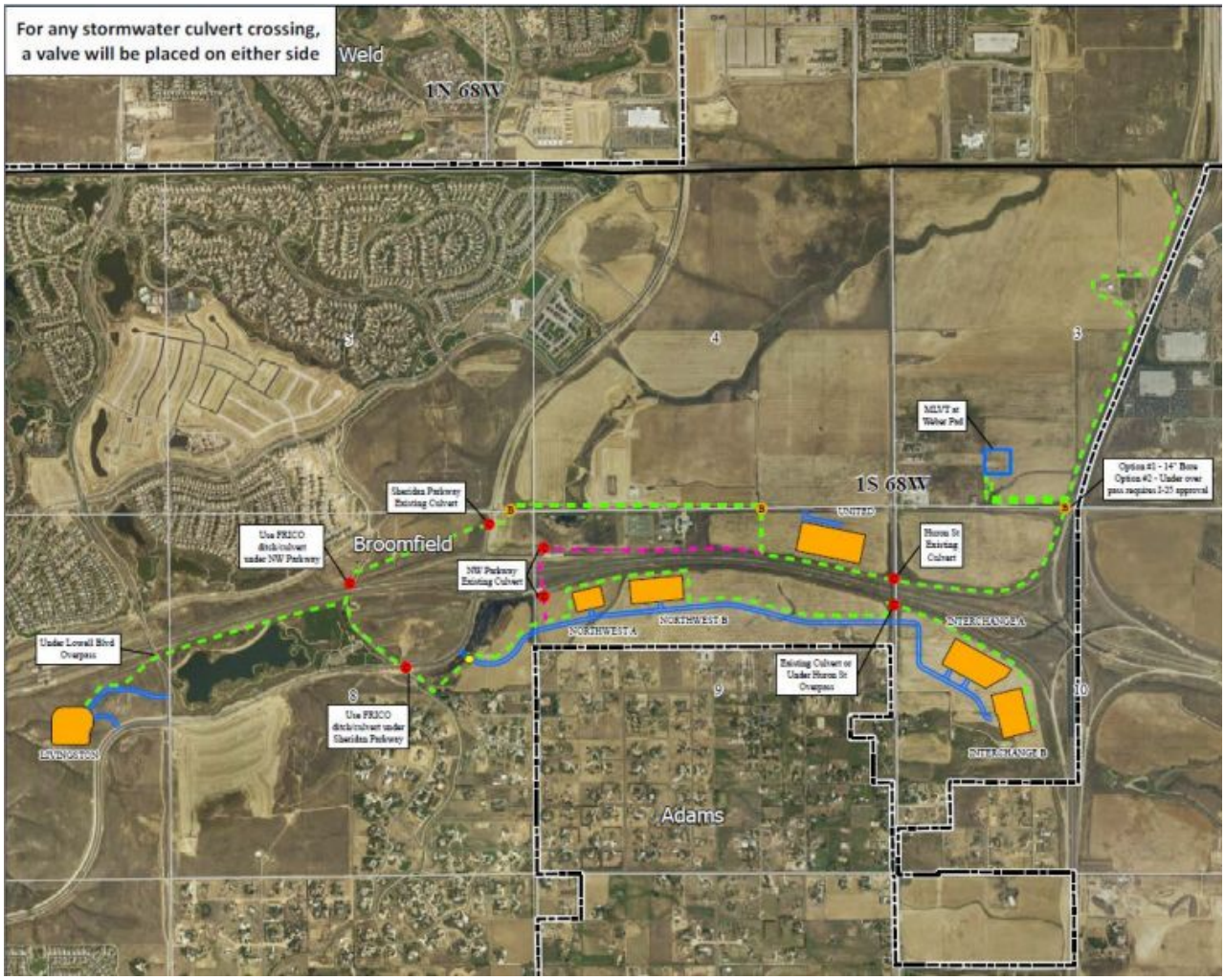
April 18, 2019. The comment period has been extended to April 28, 2019, by COGCC on Broomfield's request.

The water source for the MLVTs and the lay flat piping system is the Standley Ditch near Highway 7. Water delivery will be completed via lay flat pipe to the MLVT and from the MLVTs to Extraction's 6 well pads. This minimizes the need for the use of trucks to transport water to the individual oil and gas pads during the completion phase. The photograph below illustrates lay flat pipe.

Extraction will include several best management practices associated with the use of lay flat pipe. This includes:

- Actively monitoring the lay flat pipe system 24 hour per day/7 days per week by:
    - Staging a crew at pad locations
    - Staging a crew at pump station
- Walking the lay flat piping route every 6 hours
- Ability to shut-down and remove within ~ 30 minutes (e.g., a stormwater run-off event)
- Installing lay flat piping through culverts at road crossings or other natural features:
    - Clean out the culvert prior to installation to increase capacity
    - Install shut off valves on either side of the culvert

The lay flat pipe must be installed to each well pad prior to the start of the completion phase on that well pad. It is anticipated that completions will begin on the Interchange B Pad in July of 2019. In order to meet the completions start date, construction of the MLVT site and lay flat piping installation is tentatively planned to begin in June. A map of the proposed lay flat pipe route follows.



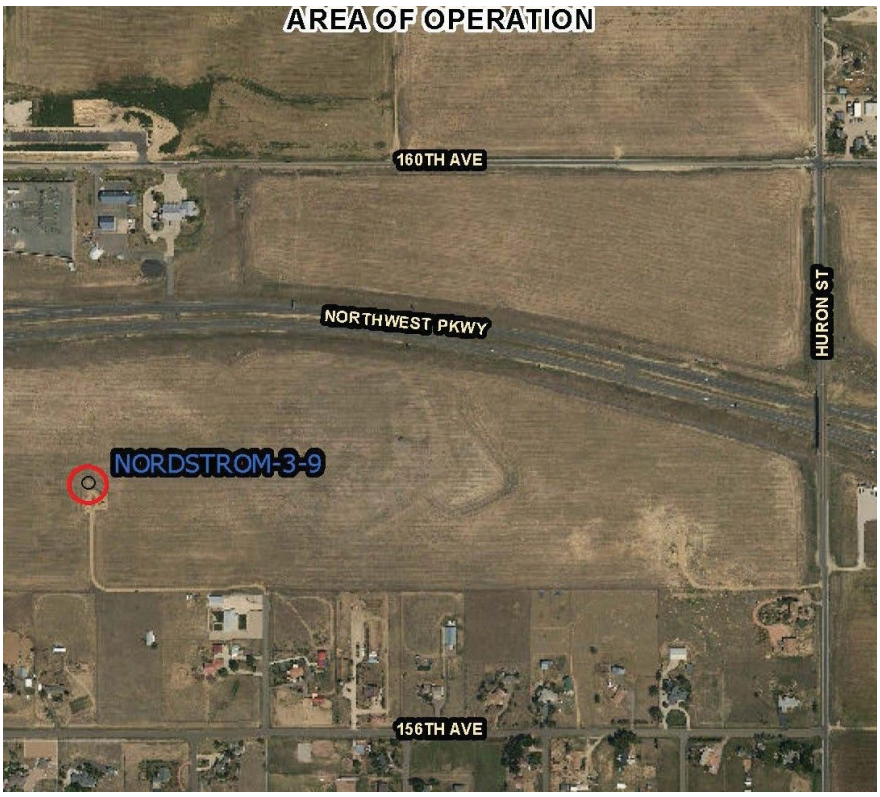
Plugging and Abandoning of Old Well Sites by Extraction

Extraction Oil and Gas is obligated under the Operator Agreement with Broomfield to plug and abandon 42 older wells, most of which are in Broomfield. Extraction will do this over the next two years. The names of the wells to be plugged and abandoned and the time frame for plugging and abandoning these wells in accordance with State law is linked here, and a map of those wells can be viewed here.

Legacy Contamination at Plugging and Abandoning Well Sites

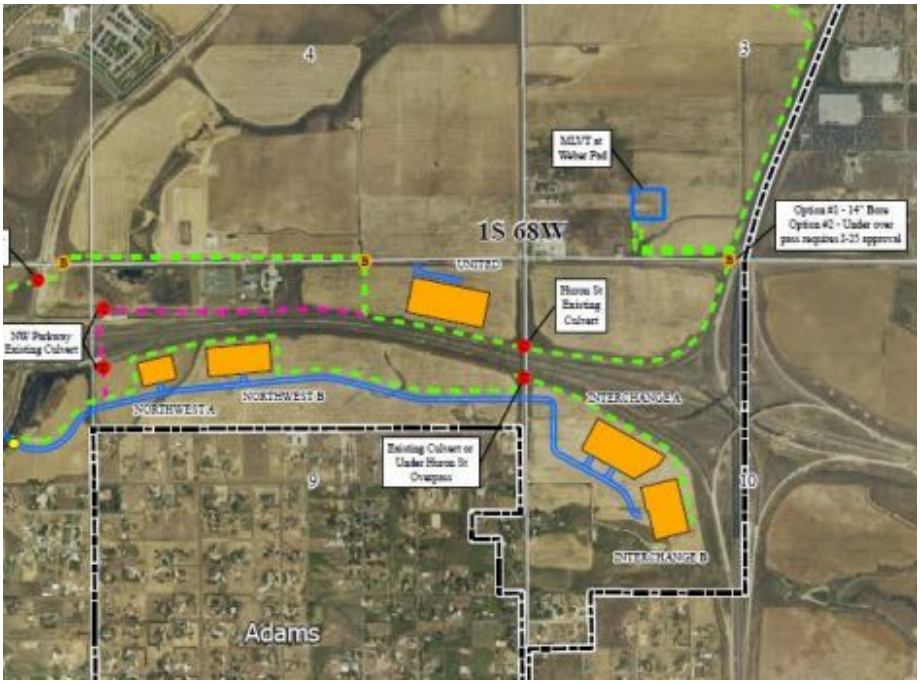
On April 10, 2019, Broomfield was notified by Extraction that historical contamination was identified at the Nordstrom 3-9 well site while removing the tanks. The Nordstrom 3-9 well was plugged in March 2019 and the tank removal is being conducted as part of the plugging and abandonment operations. The contamination appears to be from produced water. Extraction reported this finding upon discovery, as required, to Broomfield and the COGCC. A Broomfield inspector is in the process of acquiring additional information and will conduct a site investigation to further evaluate site conditions and review Extracton's plan for remediation.

The Nordstrom 3-9 location is identified in the red circle on the following map. This is a legacy well site in Broomfield that was drilled in 1990 and contained tanks and a separator. Extraction's redevelopment plan and Operator Agreement with Broomfield is allowing the opportunity to permanently remove legacy wells and tanks within Broomfield and its neighboring communities that have potentially leaked and caused contamination. The Nordstrom 3-9 well site is one of many more to be permanently removed and reclaimed over the next two to three years.



On April 9, 2019, the Broomfield was notified by Extraction that historical contamination was identified at the Webber "H", Unit #1 well site during plugging and abandonment operations. The contamination appears to be from produced water. Extraction reported this finding upon discovery, as required, to Broomfield and the COGCC. A Broomfield inspector is in the process of acquiring additional information and will conduct a site investigation to further evaluate site conditions and review Extracton's plan for remediation.

The Webber "H", Unit #1 well site is identified in the blue square in the map below. This is a legacy well site in Broomfield that contained tanks and a separator. The well site is currently the subject of a Form 2A location assessment permit, pending approval at the COGCC, for the future location of fresh water tanks to be used in the hydraulic fracturing process at the new Extraction well sites.



Currently, Extraction is awaiting testing results and preparing characterization and remediation plans for these locations. The remediation plans will have to be reviewed by COGCC and Broomfield, and there will be oversight of the clean up. As noted above, Extraction's redevelopment plan and Operator Agreement with Broomfield is allowing the opportunity to permanently remove legacy wells and tanks within Broomfield and its neighboring communities that have potentially leaked and caused contamination. These two well sites are two of many more to be permanently removed and reclaimed over the next two to three years.

Extraction's Pipeline Risk Assessment

Extraction has submitted its pipeline risk analysis here. This was submitted by Extraction to Broomfield as was required by the last sentence of Section 3 of Exhibit B of the Operator Agreement, which reads as follows:

> "If requested by the City, Operator will conduct a risk analysis to identify potential risks associated with pipelines and the measures implemented that are intended to mitigate such risks."

CRESTONE'S GOLTL PAD SITES

On February 23, 2018, Crestone Peak filed an application for a Use by Special Review (USR) for a proposed oil and gas development in Broomfield. The application includes 13 wells located on the east side of the proposed separators and associated equipment (Goltl East wells) and 13 wells located on the west side of the separators and associated equipment (Goltl West wells). The wells are located east of I-25, approximately one mile north of East 168th Avenue, and one quarter mile west of County Road 11. Public hearings have not been scheduled regarding the USR. Comments and questions regarding the application should be directed to the Broomfield Planning Division at oilandgasapplication@broomfield.org. A map of the Goltl Pad Site is linked here.

An updated USR application was submitted by Crestone on January 25, 2019. The application is in review by Broomfield staff and the application materials can be viewed here.

On December 7, 2018, the COGCC approved all 26 Form 2 applications and the Form 2A application for the Goltl Pads in Broomfield. The chart below shows the approved Form 2 applications. The Approved Form 2A Permit lists the Best Management Practices that the COGCC made conditions of the Form 2A Location Permit.

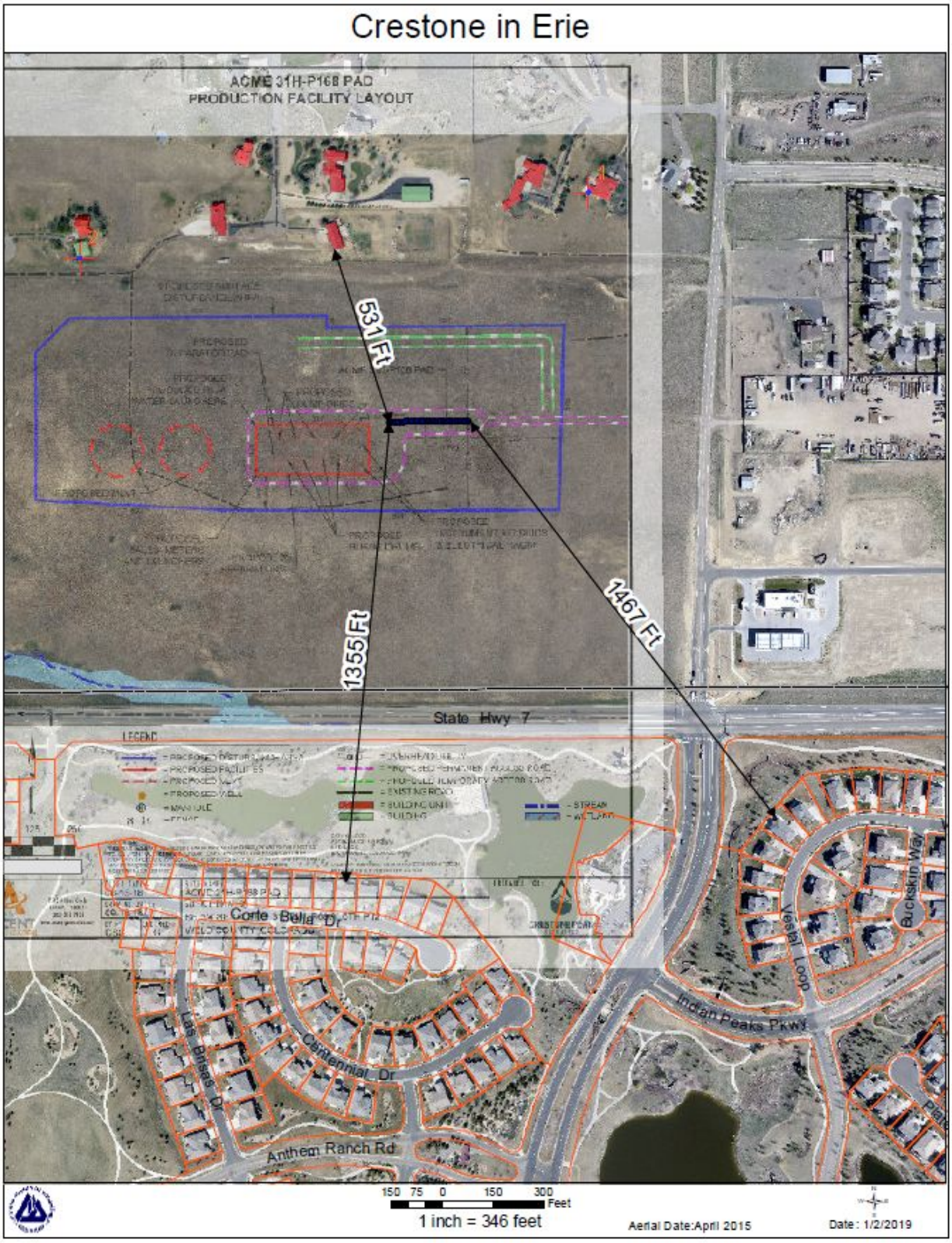
At Council's direction staff has requested a hearing before the COGCC on the approved GOLTL Pad Form 2 and 2A permits. That hearing was scheduled for April 29 and 30, at the COGCC. The COGCC has suspended the Form 2 and Form 2A approvals in response to the hearing request in accordance with Rule 305.e.(2). Due to the changes to the COGCC, created by Senate Bill 181, the April COGCC hearings have been postponed.

CRESTONE'S ACME PAD

Crestone is drilling up to 30 wells on at the Acme Well Pad in Erie, located north of State Highway 7 and west of Bonanza Drive. A map showing the Acme Pad layout is below. Erie has entered into an Operator Agreement with Crestone that includes best management practices (BMPs). A comparison of the Erie Operator Agreement BMPs with Broomfield's BMPs from the Extraction Agreement can be viewed here. The overall Extraction agreement includes more BMPs than are included in the Crestone agreement, and in most cases, the Extraction BMPs are stronger. The only caveat is that apparently the ACME pad has already been subject to the Town of Erie approval process, and pursuant to that process, other BMPs may have been required. So, it may be that in some instances where the chart says "no BMP required" for the ACME pad, the Town has required something already but that requirement is not contained in the BMP appendix.

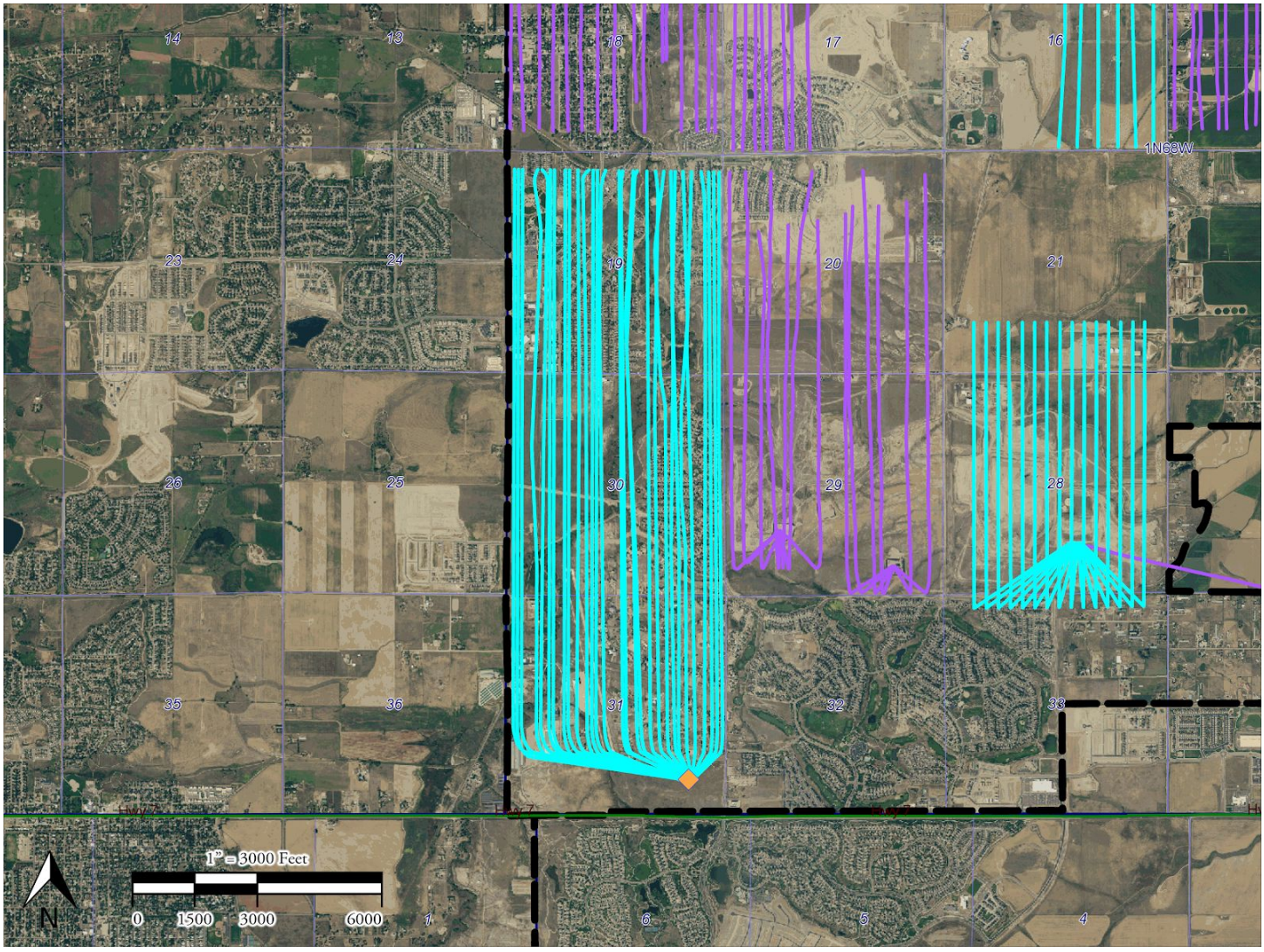
As reported to Council in an email on November 20, 2018, 29 Form 2 Well Applications for the Acme Pad have been posted to COGCC's website, which initiated the 20-day comment period. The comment period is now closed. Crestone has also filed one Form 2A Location Assessment Application for this location. The COGCC map of the Acme Pad indicating the direction of the well bores is included below. Broomfield filed the comments linked here with the COGCC with regard to the Acme Pad, as directed by Council on November 27, 2018. Broomfield's comments focus on issues potentially impacting Broomfield citizens associated with the Acme Pad, including traffic, air quality, emergency response, and spill prevention.

The map below shows the distances to existing residential areas in Broomfield and Erie.



The map below shows the direction and location of the underground boring for the Acme well pad.

Acme Well Bore - Directional Map



PROPOSED AMENDMENTS TO BROOMFIELD OIL AND GAS REGULATIONS

At the August 14, 2018, City Council meeting, City Council adopted a resolution requiring staff to bring forward to City Council all new spacing applications and all new Form 2 and 2A permit applications to receive direction from City Council with regard to requesting hearings before the Colorado Oil and Gas Conservation Commission (COGCC) on such applications. Staff has also brought forward to City Council two proposed amendments to Broomfield's oil and gas regulations with regard to the following two issues for review:

- A procedure for residents to report nuisance complaints and be assured they will be addressed fully. As currently proposed, after first contacting the appropriate staff, if the resident is not satisfied, the complaint will be referred to the relevant department head or hearing officer for a hearing; and
- Requirement that all new surface development shall be no closer than 1,320 feet to an existing oil and gas well, unless there is written notice and informed consent from the initial surface property purchaser.

The updated regulations were discussed by the City Council at the January 15, 2019, Study Session. Staff received direction from Council on potential revisions including a request to clarify the definition of affected

parties and to clarify that hearings may also be based on violations of Broomfield Municipal Code. On January 22, 2019, Ordinance No. 2075 regarding the hearing process was postponed to a future Study Session. Ordinance No. 2076 regarding setbacks, was passed on second reading on March 12, 2019.

The Oil and Gas Bill, SB 19-181, was passed by the Senate on April 3, 2019, and will move to the Governor for signature. Here is the draft bill with all 34 amendments included. City Council has directed the City and County Attorney to propose additional local regulations that may be warranted as a result of this State legislation.

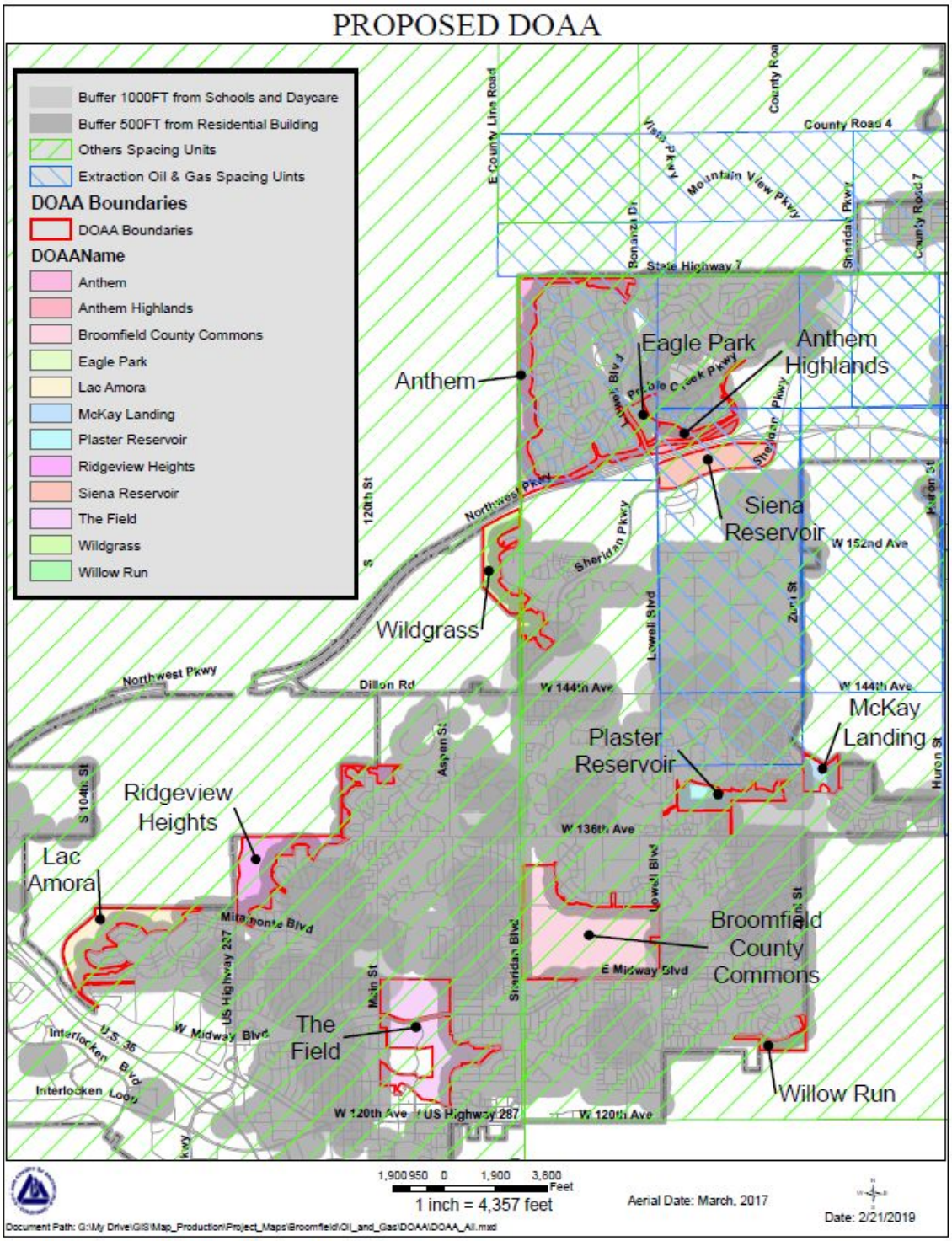
BROOMFIELD COUNTY COMMONS DESIGNATED OUTSIDE ACTIVITY AREA DESIGNATION

On March 11, 2019, the Colorado Oil and Gas Conservation Commission (COGCC) designated the Broomfield County Commons (BCC) as an Outdoor Activity Area under the COGCC rules. The significance of this designation is that no surface oil and gas development can occur on the BCC. The ruling by the COGCC was made after a hearing on Broomfield's application for the designation.

OTHER POTENTIAL DESIGNATED OUTSIDE ACTIVITY AREA DESIGNATION

The City Council, Open Space and Trails and City and County Manager's staff have discussed pursuing the DOAA designation for other open lands currently in use by the public in Broomfield. Each designation would prevent surface oil and gas development within the designated areas. Staff found the map below to be helpful in this process, as it indicates the currently eligible open areas in various colors and it shows which of those areas are already within an approved spacing unit with a designated surface location.

With the adoption of SB 19-181, staff will be reviewing the legislation to determine if other less expensive methods to accomplish the same outcome are available.



During the January 22, 2019, oil and gas update to City Council, there was a question with regard to whether or not the spacing units indicated on the DOAA map above expire. Legal review of the COGCC regulations on spacing units indicates spacing units do not expire. COGCC has confirmed this interpretation of the rules. Jim Rouse, COGCC Hearings Supervisor, confirmed that the older vertical spacing units do not expire and technically an operator could come back and drill vertical wells in these spacing units. An operator could also vacate these older spacing units with new spacing applications. Also, new horizontal spacing units for different geologic formations or zones can be superimposed on the older vertical spacing units. Applications for new horizontal spacing units to other formations in the green hatched area of the map above, could be made.

Staff recommends prioritizing the areas outside of approved spacing units that may be subject to future oil and gas development. Open Space and Trails staff has already completed the tally of public use that is necessary to request the designation for The Field. Here is the list of the open areas for which the DOAA designation could be pursued by staff in order of priority. Staff would appreciate Council review and comment on this list:

- The Field
- Ridgeview Heights
- Anthem Community Park (Sienna Reservoir)
- Metzger Open Space
- Loc Amora
- Great Western Reservoir
- McKay Landing
- Plaster Reservoir
- Markel Open Space

Staff is currently requesting cost proposals for the notices requirements for the Field and will work towards filing Broomfield's DOAA application for the Field by mid-year. Staff will be meeting with the Metzger Open Space Foundation in the near future, to discuss a possible DOAA application for the Metzger Farm Open Space with the Metzger Foundation and the City of Westminster. Staff's planned next steps for 2019 include:

1. Submit the Field DOAA application to COGCC; hire firm to do the notice
2. Ridgeview OS: Do the use analysis this spring, and move forward on notice once the use is scheduled so we don't have a big lag between the use data and notice information
3. Talk to the Broomfield-Westminster Open Space Foundation board about pursuing a DOAA for the Metzger Farm at its next meeting.
4. Investigate in more detail with contract petroleum engineer the level of risk for future development on other proposed DOAA.

BROOMFIELD'S AIR QUALITY MONITORING AND TESTING PROGRAM

Air quality is a main focus of the Oil and Gas Chapter of Broomfield's Comprehensive Plan as well as the Extraction Operator Agreement. These documents address specific action steps and Best Management Practices (BMPs) related to oil and gas development, operations, and concerns expressed by the public related to potential negative air quality impacts. Contracting for air quality monitoring supports several of the stated policies and associated action steps, as well as inform long-term strategies that may be adopted by Broomfield to address the concerns expressed by the public.

On August 28, 2018, City Council approved an air quality testing agreement with Ajax Analytics for an ongoing air quality monitoring and testing near the Extraction well sites and in nearby neighborhoods, as well as for the development of a webpage to report air quality monitoring results. The air quality program is a combined proposal of Colorado State University and Ajax Analytics. Data is being generated using the following sources:

- Using Colorado State University's Plume Tracker,
- Canister testing and analysis, and
- Ajax Analytics' monitoring stations

The generated data will be used to identify trends and monitor air quality impacts of operations at well sites and neighborhoods, to determine changes in volatile organic compounds, identify sources of emissions, and the age of emissions.

Ajax and CSU will validate data and correlate results with applicable air quality standards and health guidelines. Additionally, Broomfield will use this air quality data to provide:

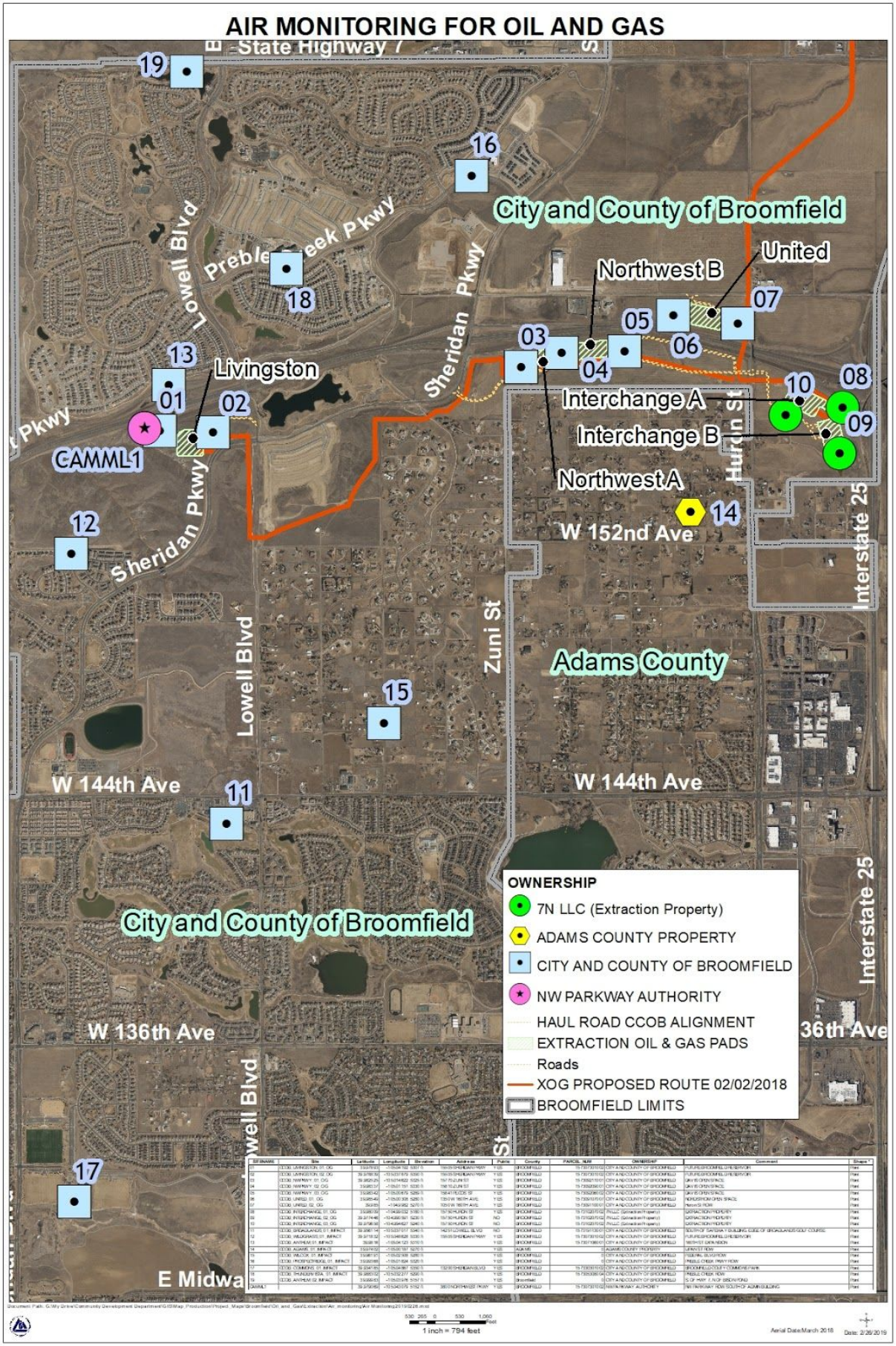
- Information supporting emergency response actions
- Follow-up information to respond to citizen complaints and concerns
- Information supporting inspections
- Data and trend analysis to support policy decisions and possible regulatory and statutory changes

The Ajax monitoring system is not intended to operate as an emergency notification system. However, it is important to note that the system does identify anomalies, such as spikes, that would be promptly reported to Broomfield and staff would follow up as necessary. This follow up may include onsite inspections with the infrared camera and/or contacting emergency responders, if appropriate.

A network of 19 monitoring stations, as indicated on the following map, throughout Broomfield has been fully deployed, with data being collected on an ongoing basis. All monitoring station data has been, and is currently, being captured in Ajax Analytics' environmental monitoring data platform. Baseline air quality data has been collected beginning in October of 2018 using Summa canisters. This data will be summarized and available in the April 2019 report and on the public portal.

Ajax Analytics and Colorado State University, released the public portal the last week of February. The public portal displays data and information related to air emissions and related health risks based on published health guidelines. The public portal is expected to expand with new features that help Broomfield and the public evaluate the monitoring data.

It is anticipated that Ajax and CSU will provide a presentation to Council on the air quality program in May. The first quarterly summary from Ajax Analytics and CSU is planned for delivery in April and will be shared with City Council, as soon as it is received, and posted on the oil and gas web page and the Broomfield Ajax website.

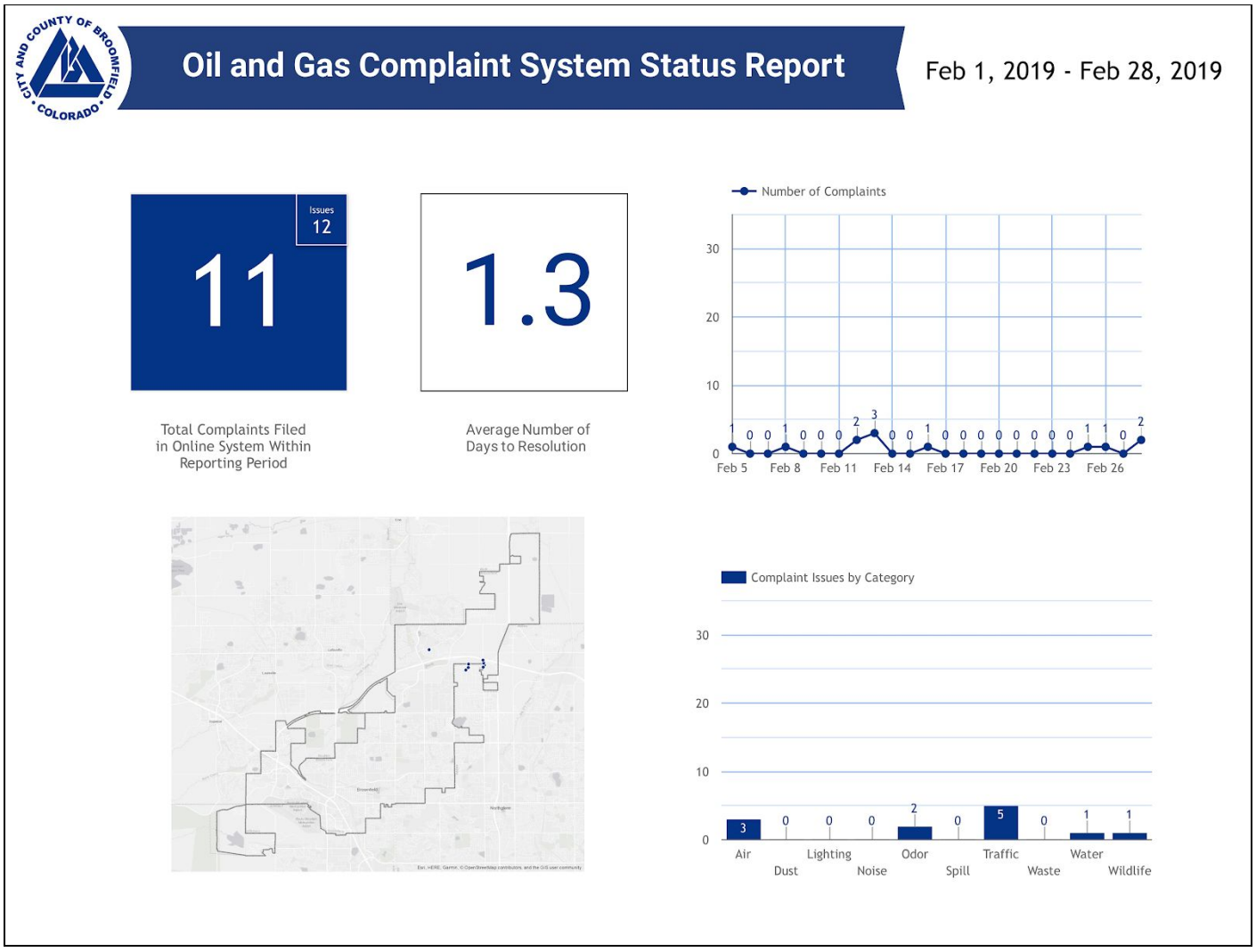

AIR MONITORING FOR OIL AND GAS
State Highway 7
19
16
City and County of Broomfield
United
Northwest B
07
05
06
03
04
18
Preble Creek Pkwy
Lowell Blvd
Sheridan Pkwy
13
Livingston
01
02
CAMML1
Interchange A
10
08
Interchange B
09
Hurlin St
Northwest A
14
W 152nd Ave
Interstate 25
12
Sheridan Pkwy
Zuni St
Adams County
15
Lowell Blvd
W 144th Ave
W 144th Ave
11
City and County of Broomfield
Interstate 25
W 136th Ave
36th Ave
Lowell Blvd
17
E Midway
OWNERSHIP
7N LLC (Extraction Property)
ADAMS COUNTY PROPERTY
CITY AND COUNTY OF BROOMFIELD
NW PARKWAY AUTHORITY
HAUL ROAD CCOB ALIGNMENT
EXTRACTION OIL & GAS PADS
Roads
XOG PROPOSED ROUTE 02/02/2018
BROOMFIELD LIMITS
1 inch = 794 feet
Aerial Date:March 2018
Date: 2/26/2019

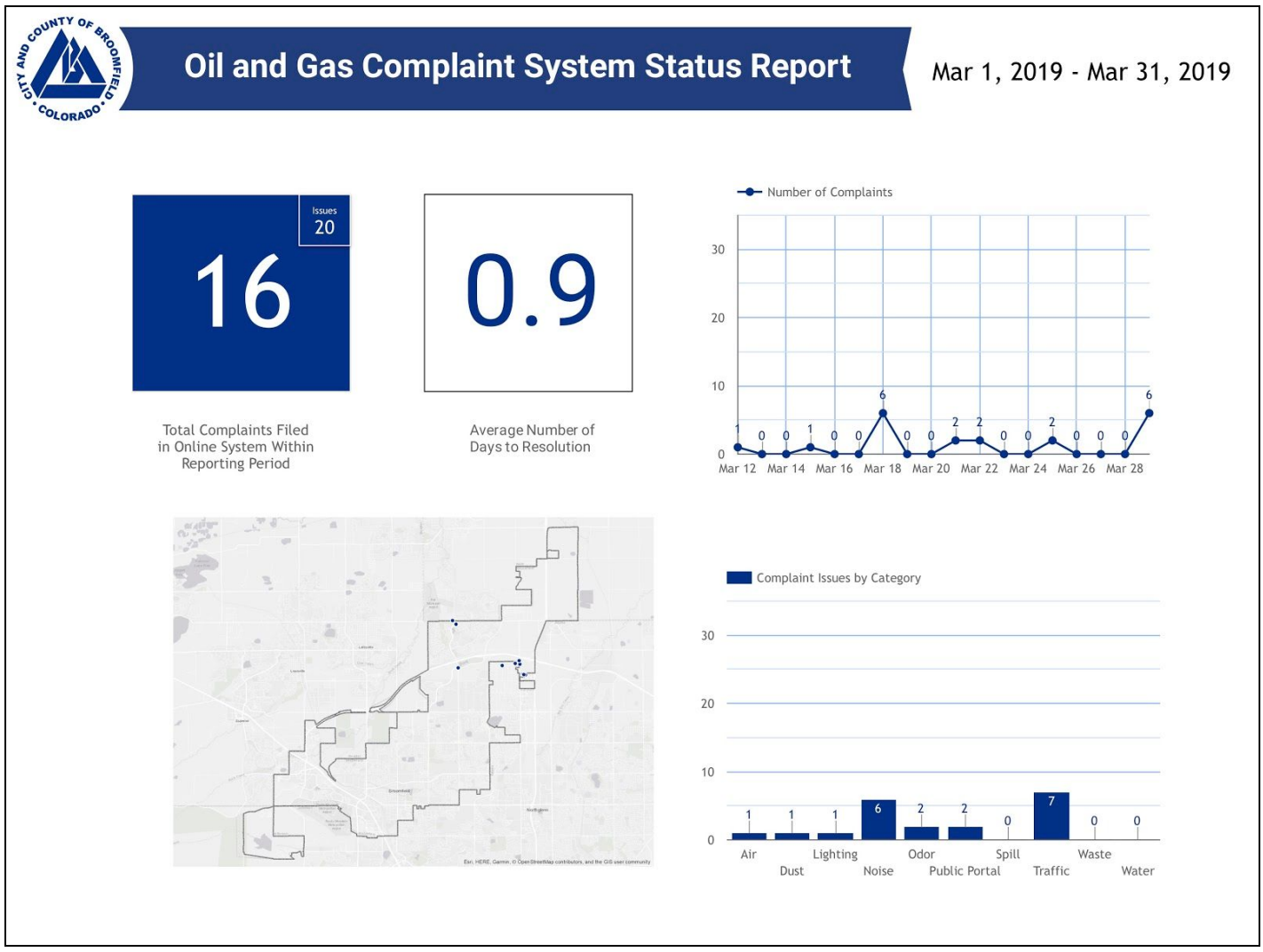
BROOMFIELD'S COMPLAINT SYSTEM

On September 30, 2018, Broomfield's online complaint system was launched. The complaint system was developed by staff from various departments, including Public Health, IT, Planning, Police, North Metro Fire Rescue District, Engineering, Traffic, Communications, and the City Manager's Office. It allows citizens to file a complaint regarding oil and gas issues online at: www.broomfield.org/oilandgas

A citizen filing a complaint will receive a response that their complaint has been received and is being investigated. Within five business days the citizen will receive a further follow up as to the status of the complaint. The total number of complaints that were filed in the complaint system and answered by staff from the inception of the complaint system to the date of this memo is 67. Past complaints can be viewed here.

Below are reports for February and March 2019, for Council review.





BROOMFIELD RISK ASSESSMENT

The City and County Manager signed an agreement with DNV-GL to conduct a risk assessment of Extraction's well sites for a total amount not to exceed $47,000. DNV-GL is a global quality assurance and risk management company. This Agreement with DNV-GL authorizes them to conduct a hazard identification (HAZID) process for the Extraction oil and gas well sites. In 2019, additional meetings were requested due to additional scope being added. A second agreement with DNV-GL was processed to include the new scope. The second agreement was for a total amount not to exceed $28,650.

The purpose of a HAZID is to identify all reasonably possible sources of hazards and threats to a system and to determine where further risk analysis is warranted. HAZIDs enable the identification of threats in numerous areas such as operations, projects and finance. The HAZID method is often used in conceptual design work, and the intent is to use a structured approach to identify concerns and issues associated with the concept or system being reviewed. In a HAZID study, hazard checklists are generated, and each section or node of the study (i.e. system boundary) is considered against the hazard checklist. Where it is agreed that a threat exists in a particular area, the risk presented by the threat is considered, usually with the aid of a Risk Matrix, and all possible means of either eliminating the hazard or controlling the risk and/or the necessity for further study are noted in HAZID worksheets. This process also validates risks and mitigations that have been previously identified.

Broomfield contracted with DNV-GL to conduct a risk assessment of Extraction's well sites:

- To identify risks and mitigation measures associated with those risks;
- To identify risks associated with recent oil and gas incidents in other parts of Colorado and any additional mitigation measures;
- To own a professional third party risk assessment associated with a new oil and gas development to use further in policy efforts; and
- To identify other mitigation measures that should be added to Broomfield's regulations.

DNV-GL staff, Broomfield staff and Extraction staff conducted a four day workshop to develop the risk assessment and several subsequent meetings. The DNV-GL report was finalized on February 16, 2019. A presentation of the risk assessment was made to Council by representatives of DNV-GL at the February 19, 2019, Study Session. A copy of the Study Session memo and report can be viewed here. The Study Session was broadcast on Channel 8 and live streamed. Following the Study Session, Council requested that a Community Forum be scheduled in late March or early April to discuss the assessment with the consultants and the community.

On March 22, 2019, from 5 to 6:30 p.m., City Council held a Community Meeting on Risk Assessment for Extraction Operations in Broomfield. The panel for the Community Meeting included Robin Pitblado, Cynthia Spitzenberger, and Marisa Pierce from DNV-GL, and Barbara Ganong, a petroleum engineer, who worked on Broomfield's behalf in the development of the risk assessment.

An additional study session with DNV-GL has been scheduled on May 14, 2019. The study session will be broadcast on Broomfield's Channel 8 and live streamed.

BROOMFIELD CONTRACTOR FOR CONTINUOUS NOISE MONITORING AND CONSULTING

On February 21, 2019 Broomfield signed a contract with Vibra-Tech Engineers, Inc. to provide continuous noise monitoring equipment at the Interchange B and Livingston Pads. In addition, they have been provided with the baseline noise reports prepared by Extraction's contractor ENRG for review and comment. Broomfield Oil and Gas Division staff met with Geoffrey Rigsby from Vibra-Tech to do a site preview and determine where noise monitoring equipment will be located. The noise monitoring station associated with the Interchange A and B Pads was installed on March 16, 2019. It is fully operational will remain throughout the drilling and completions phases, at a minimum.

BROOMFIELD OIL AND GAS DIVISION INSPECTIONS

All of the inspections on the existing oil and gas sites (approximately 35 sites) for the first quarter of 2019 have been completed. The results of these inspections will be available on the Oil and Gas webpage linked here.

For the new oil and gas sites, Broomfield has conducted the following inspections:

- The Construction Inspection Supervisor or his designee has been at the oil and gas sites that are under construction and at pipeline installation sites on a daily basis to inspect for compliance with CCOB issued permits.
- The Oil and Gas Division has completed the following:
    - Seven (7) construction phase inspections at the Interchange A and B sites;
    - Two (2) construction phase inspections at the Livingston site;
    - Four (4) drilling phase inspections at the Interchange B Pad;
- The Stormwater Administer or his designee conducts weekly perimeter inspections and has been performing onsite stormwater inspections on a monthly basis.

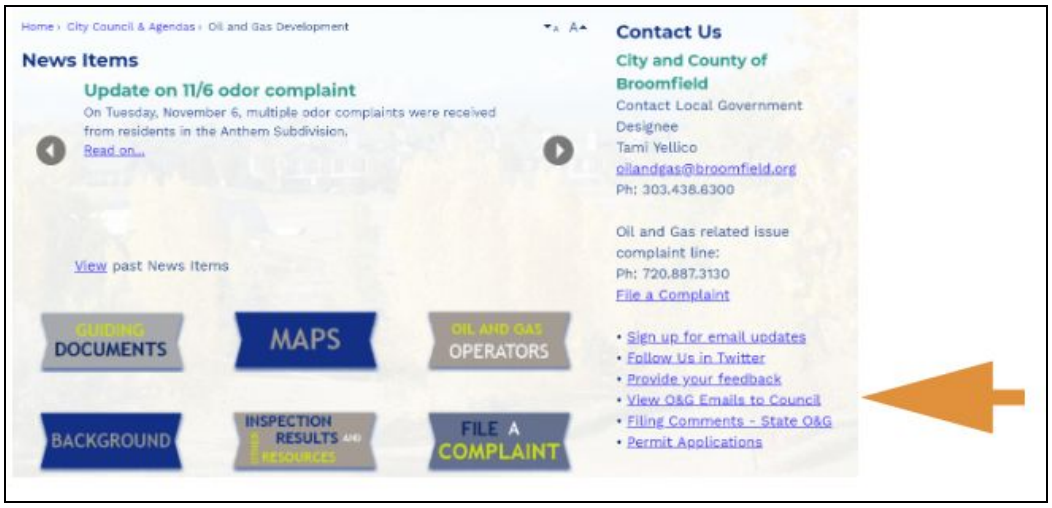
In addition to formal inspections, Oil and Gas Division staff are in the field and at these sites as well as at legacy sites where plugging and abandonment activities are occurring on a daily basis.

COGCC has also conducted inspections at the Livingston and Interchange A and B sites at least 11 times (approximately nine at Interchange and two at Livingston).

CORRESPONDENCE

Below are directions to view Oil and Gas emails received by City Council:

- Go to broomfield.org/1820/Oil-and-Gas-Development
- Click the link as shown below



ESTIMATED EXPENSES AND REVENUES REPORT

The Finance Department has estimated the oil and gas revenues and expenses from 2004 to 2040 and those spreadsheets can be viewed here.

BROOMFIELD SOIL GAS TESTING PROGRAM

The City and County of Broomfield (CCOB) has started soil gas testing on abandoned oil and gas wells in Broomfield. This program consists of a CCOB contractor, ERO, conducting soil gas screening around historically abandoned oil and gas wells in various parts of the City and, given the number of wells, is expected to last several months. As the program gets started, expect to receive a request for access should a well be on or near your property. The notice will provide the opportunity to permit ERO to access private property, typically yard areas, to conduct the screening in accordance with the protocols designed through consultation with the CCOB, ERO, Extraction Oil & Gas, and the Colorado Oil and Gas Conservation Commission to be able to provide consistent and comparable data. The request for access is entirely voluntary and should a response not be received, or access denied, the screening will occur without accessing the private property in question, using public rights-of-ways and publicly-owned lands. Access to private property will allow us to get readings closer to the abandoned well sites and give us more accurate information. The actual screening activities are weather dependent and will be conducted between April and June. The results will be provided to the appropriate regulatory agencies and the property owner. Two plugged and abandoned wells north of Highway 7 and east of 1-25 have been tested and those were negative for any emissions.

STRATEGIC INITIATIVES STAFF UPDATE

On March 25, 2019, the Colorado Senate approved Broomfield's Assistant Director of Strategic Initiatives, Laura Davis, to serve on the State's Solid and Hazardous Waste Commission for a 3 year term. The Commission drafts rules pertaining to solid and hazardous waste. The commission is comprised of nine members, appointed by the Governor: three members from industry; three members from the public at large; and three members from local government or academia. Laura has a Masters Degree in Environmental Policy and Management. She served for 5 terms and under 4 governors on the Colorado Board of Health. Before coming to Broomfield, Laura was the Director of Environmental, Health, and Safety and System Safety Engineering at Ball Aerospace for 24 years.

OTHER MEETINGS AND PRESENTATIONS

- An Oil and Gas Community Meeting with DNV-GL representatives on the Broomfield Risk Assessment of Extractions oil and gas operations in Broomfield was held on March 22, 2019, from 5-6:30 p.m. in the Broomfield City Council Chambers. The video of the meeting can be viewed here.
- Staff attended a meeting with the Anthem Ranch Board members to discuss emergency exits on March 21, 2019.
- On April 5, 2019, staff met with the Anthem Ranch Oil and Gas Committee to provide information on the air monitoring program.
- A Study Session has been scheduled on May 14, 2019, to discuss the risk assessment provided by DNV GL USA.
- Staff continues its conversations with other local governments on regulatory and legislative efforts for 2019.
- Staff plans to meet with the Metzger Open Space Foundation in the spring to discuss a potential DOAA application for the Metzger Farm Open Space.

Exhibit 5

FORM 2A Rev 08/13

State of Colorado
Oil and Gas Conservation Commission

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

Oil and Gas Location Assessment

Document Number: 401477000

Date Received: 01/16/2018

☒ New Location ☐ Refile ☐ Amend Existing Location Location#:

This Oil and Gas Location Assessment is to be submitted to the COGCC for approval prior to any ground disturbance activity associated with oil and gas operations. Approval of this Oil and Gas Location Assessment will allow for the construction of the below specified Location; however, it does not supersede any land use rules applied by the local land use authority. Please see the COGCC website at http://cogcc.state.co.us/ for all accompanying information pertinent this Oil and Gas Location Assessment.

Location ID: **456747**

Expiration Date: **08/22/2021**

☒ This location assessment is included as part of a permit application.

CONSULTATION

☐ This location is included in a Comprehensive Drilling Plan. CDP #

☐ This location is in a sensitive wildlife habitat area.

☐ This location is in a wildlife restricted surface occupancy area.

☐ This location includes a Rule 306.d.(1)A.ii. variance request.

Operator

Operator Number: 10459

Name: EXTRACTION OIL & GAS INC

Address: 370 17TH STREET SUITE 5300

City: DENVER State: CO Zip: 80202

Contact Information

Name: Alyssa Andrews

Phone: (720) 481-2379

Fax: ( )

email: aandrews@extractionog.com

RECLAMATION FINANCIAL ASSURANCE

☒ Plugging and Abandonment Bond Surety ID: 20130028 ☐ Gas Facility Surety ID:

☐ Waste Management Surety ID:

LOCATION IDENTIFICATION

Name: Interchange A & B Pad Number:

County: BROOMFIELD

QuarterQuarter: NESW Section: 10 Township: 1S Range: 68W Meridian: 6 Ground Elevation: 5213

Define a single point as a location reference for the facility location. When the location is to be used as a well site then the point shall be a well location.

Footage at surface: 2474 feet FSL from North or South section line

1550 feet FWL from East or West section line

Latitude: 39.978918 Longitude: -104.991656

PDOP Reading: 1.4 Date of Measurement: 09/28/2017

Instrument Operator's Name: T. WINNICKI

RELATED REMOTE LOCATIONS

(Enter as many Related Locations as necessary. Enter the Form 2A document # only if there is no established COGCC Location ID#)

This proposed Oil and Gas Location is:	LOCATION ID #	FORM 2A DOC #
Well Site is served by Production Facilities		401606721
		401606738

FACILITIES

Indicate the number of each type of oil and gas facility planned on location

Wells	33	Oil Tanks*		Condensate Tanks*		Water Tanks*		Buried Produced Water Vaults*	
Drilling Pits		Production Pits*		Special Purpose Pits		Multi-Well Pits*		Modular Large Volume Tanks	
Pump Jacks		Separators*	33	Injection Pumps*		Cavity Pumps*		Gas Compressors*	4
Gas or Diesel Motors*		Electric Motors		Electric Generators*		Fuel Tanks*		LACT Unit*	
Dehydrator Units*		Vapor Recovery Unit*		VOC Combustor*		Flare*		Pigging Station*	

OTHER FACILITIES*

Other Facility Type	Number
Maintenance Vessel	1
Piperack Modules	13
Compressor Drain Tank	1
Gas Lift Suction Scrubber	1
Fuel Gas Scrubber	1
Transformer	1
Emission Control Device	1
Electrical Switchrack	1
Gas Lift Metering Building	4
Produced Water Surge Drum	1
Oil Surge Drum	1
Air Compressor	1
Sales Gas Meter	1

*Those facilities indicated by an asterisk (*) shall be used to determine the distance from the Production Facility to the nearest cultural feature on the Cultural Setbacks Tab.

Per Rule 303.b.(3)C, description of all oil, gas, and/or water pipelines:

Extraction will trench flowlines in one piping corridor that runs between the drill pad and the separator pad and be placed at 12” centers. These lines will most likely be 2” or 3” fusion bonded SCH160 steel pipe and have proper cathodic protection throughout the run. Extraction will then sweep up with a long radius that will tie off each line to the appropriate separator. All welds on these are 100% x-ray and hydro tested to the API and Manufactures specs for a class 1500 series flange. Also meets ASME code B31.4.

CONSTRUCTION

Date planned to commence construction: 09/01/2018 Size of disturbed area during construction in acres: 21.94

Estimated date that interim reclamation will begin: 01/01/2019 Size of location after interim reclamation in acres: 8.90

Estimated post-construction ground elevation: 5213

DRILLING PROGRAM

Will a closed loop system be used for drilling fluids: Yes

Is H_2S anticipated? No

Will salt sections be encountered during drilling: No

Will salt based mud (>15,000 ppm Cl) be used? No

Will oil based drilling fluids be used? Yes

DRILLING WASTE MANAGEMENT PROGRAM

Drilling Fluids Disposal: OFFSITE Drilling Fluids Disposal Method: Commercial Disposal

Cutting Disposal: OFFSITE Cuttings Disposal Method: Commercial Disposal

Other Disposal Description:

The oil-based cuttings will be disposed of similarly and the water-based cuttings may be applied to the land application, facility ID 449314. Both disposal methods may be used for the water-based cuttings.

Beneficial reuse or land application plan submitted?

Reuse Facility ID: or Document Number:

Centralized E&P Waste Management Facility ID, if applicable:

SURFACE & MINERALS & RIGHT TO CONSTRUCT

Name: 7N LLC Phone:

Address: 370 17TH ST, SUITE 5300 Fax:

Address: Email:

City: DENVER State: CO Zip: 80202

Surface Owner: ☒ Fee ☐ State ☐ Federal ☐ Indian

Check all that apply. The Surface Owner: ☒ is the mineral owner

☒ is committed to an oil and Gas Lease

☒ has signed the Oil and Gas Lease

☒ is the applicant

The Mineral Owner beneath this Oil and Gas Location is: ☒ Fee ☐ State ☐ Federal ☐ Indian

The Minerals beneath this Oil and Gas Location will be developed from or produced to this Oil and Gas Location: Yes

The right to construct this Oil and Gas Location is granted by: applicant is owner

Surface damage assurance if no agreement is in place: Surface Surety ID:

Date of Rule 306 surface owner consultation

CURRENT AND FUTURE LAND USE

Current Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

Future Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	_____
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

CULTURAL DISTANCE INFORMATION

Provide the distance to the nearest cultural feature as measured from Wells or Production Facilities onsite.

	From WELL	From PRODUCTION FACILITY
Building:	808 Feet	780 Feet
Building Unit:	1002 Feet	1187 Feet
High Occupancy Building Unit:	4513 Feet	5116 Feet
Designated Outside Activity Area:	5280 Feet	5280 Feet
Public Road:	364 Feet	234 Feet
Above Ground Utility:	233 Feet	399 Feet
Railroad:	5280 Feet	5280 Feet
Property Line:	279 Feet	149 Feet

INSTRUCTIONS:
- All measurements shall be provided from center of nearest Well or edge of nearest Production Facility to nearest of each cultural feature as described in Rule 303.b.(3)A.
- Enter 5280 for distance greater than 1 mile.
- Building - nearest building of any type. If nearest Building is a Building Unit, enter same distance for both.
- Building Unit, High Occupancy Building Unit, and Designated Outside Activity Area - as defined in 100-Series Rules.
-For measurement purposes only, Production Facilities should only include those items with an asterisk(*) on the Facilities Tab.

DESIGNATED SETBACK LOCATION INFORMATION

Check all that apply. This location is within a:

- ☐ Buffer Zone
- ☐ Exception Zone
- ☐ Urban Mitigation Area

- Buffer Zone - as described in Rule 604.a.(2), within 1,000' of a Building Unit.
- Exception Zone - as described in Rule 604.a.(1), within 500' of a Building Unit.
- Urban Mitigation Area - as defined in 100-Series Rules.
- Large UMA Facility – as defined in 100-Series Rules.

Pre-application Notifications (required if location is within 1,000 feet of a building unit):

Date of Rule 305.a.(1) Urban Mitigation Area Notification to Local Government: _____

Date of Rule 305.a.(2) Buffer Zone Notification to Building Unit Owners: _____

FOR MULTI-WELL PADS AND PRODUCTION FACILTIES WITHIN DESIGNATED SETBACK LOCATIONS ONLY:

☐ Check this box if this Oil and Gas Location has or will have Production Facilities that serve multiple wells (on or offsite) and the Production Facilities are proposed to be located less than 1,000 feet from a Building Unit. *(Pursuant to Rule 604.c.(2)E.i., the operator must evaluate alternative locations for the Production Facilities that are farther from the Building Unit, and determine whether those alternative locations were technically feasible and economically practicable for the same proposed development.)*

☐ By checking this box, I certify that no alternative placements for the Production Facilities, farther from the nearest Building Unit, were available based on the analysis conducted pursuant to Rule 604.c.(2)E.i.

In the space below, explain rationale for siting the multi-well Production Facility(ies) that supports your Rule 604.c.(2)E.i determination. Attach documentation that supports your determination to this Form 2A.

SOIL

List all soil map units that occur within the proposed location. attach the National Resource Conservation Service (NRCS) report showing the "Map Unit Description" report listing the soil typical vertical profile. This data is to used when segregating topsoil.

The required information can be obtained from the NRCS web site at http://soildatamart.nrcs.usda.org/ or from the COGCC web site GIS Online map page found at http://colorado.gov/cogcc. Instructions are provided within the COGCC web site help section.

NRCS Map Unit Name: PIC - Planter loam 3 to 5 percent slopes

NRCS Map Unit Name: UlD—Ulm loam, 5 to 9 percent slopes

NRCS Map Unit Name: PlB—Platner loam, 0 to 3 percent slopes, PlC—Platner loam, 3 to 5 percent slopes

PLANT COMMUNITY:

Complete this section only if any portion of the disturbed area of the location's current land use is on non-crop land.

Are noxious weeds present: Yes ☐ No ☒

Plant species from: ☐ NRCS or, ☐ field observation Date of observation: _____ .

List individual species: _____

Check all plant communities that exist in the disturbed area.

- ☐ Disturbed Grassland (Cactus, Yucca, Cheatgrass, Rye)
- ☐ Native Grassland (Bluestem, Grama, Wheatgrass, Buffalograss, Fescue, Oatgrass, Brome)
- ☐ Shrub Land (Mahogany, Oak, Sage, Serviceberry, Chokecherry)
- ☐ Plains Riparian (Cottonwood, Willow, Aspen, Maple, Poplar, Russian Olive, Tamarisk)
- ☐ Mountain Riparian (Cottonwood, Willow, Blue Spruce)
- ☐ Forest Land (Spruce, Fir, Ponderosa Pine, Lodgepole Pine, Juniper, Pinyon, Aspen)
- ☐ Wetlands Aquatic (Bullrush, Sedge, Cattail, Arrowhead)
- ☐ Alpine (above timberline)
- ☐ Other (describe): _____

WATER RESOURCES

Is this a sensitive area: ☐ No ☒ Yes

Distance to nearest

downgradient surface water feature: 33 Feet

water well: 960 Feet

Estimated depth to ground water at Oil and Gas Location 36 Feet

Basis for depth to groundwater and sensitive area determination:

Nearest surface water feature: Ditch 33' NE
Nearest water well: Permit #261200- -, 960' SE, no depth to ground water provided
Depth to ground water: 36' from water well permit #93695 approximately 1500' SW of the pad

Is the location in a riparian area: ☒ No ☐ Yes

Was an Army Corps of Engineers Section 404 permit filed ☒ No ☐ Yes If yes attach permit.

Is the location within a Rule 317B Surface Water Supply Area buffer zone: No

If the location is within a Rule 317B Surface Water Supply Area buffer have all public water supply systems within 15 miles been notified:

Is the Location within a Floodplain? ☒ No ☐ Yes

Floodplain Data Sources Reviewed (check all that apply)

- ☐ Federal (FEMA)
- ☒ State
- ☐ County
- ☐ Local
- ☐ Other

GROUNDWATER BASELINE SAMPLING AND MONITORING AND WATER WELL SAMPLING

Water well sampling required per Rule 318A

WILDLIFE

- ☐ This location is included in a Wildlife Mitigation Plan
- ☐ This location was subject to a pre-consultation meeting with CPW held on

DESIGNATED SETBACK LOCATION EXCEPTIONS

Check all that apply:

- ☐ Rule 604.a.(1)A. Exception Zone (within 500' of a Building Unit) and is in an Urban Mitigation Area
- ☐ Rule 604.b.(1)A. Exception Location (existing or approved Oil & Gas Location now within a Designated Setback as a result of Rule 604.a.)
- ☐ Rule 604.b.(1)B. Exception Location (existing or approved Oil & Gas Location is within a Designated Setback due to Building Unit construction after Location approval)
- ☐ Rule 604.b.(2) Exception Location (SUA or site-specific development plan executed on or before August 1, 2013)
- ☐ Rule 604.b.(3) Exception Location (Building Units constructed after August 1, 2013 within setback per an SUA or site-specific development plan)

RULE 502.b VARIANCE REQUEST

- ☐ Rule 502.b. Variance Request from COGCC Rule or Spacing Order Number

ALL exceptions and variances require attached Request Letter(s). Refer to applicable rule for additional required attachments (e.g. waivers, certifications, SUAs).

OPERATOR COMMENTS AND SUBMITTAL

Comments

Single point location reference in the Location Identification section is the proposed Interchange B N35-20-1N well.

Notification Zone Drawing and UMA Check Exhibit both attached as "OTHER". This location is not in a buffer zone or UMA.

Well Sites. The Operator agrees that the maximum number of New Wells to be drilled at the Interchange A & B site to be as follows:
Interchange A Pad – 16 New Wells; and
Interchange B Pad – 17 New Wells.

NRCS Map Unit: UlC—Ulm loam, 3 to 5 percent slopes

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct and complete.
Signed: _____ Date: 01/16/2018 Email: aandrews@extractionog.com

Print Name: Alyssa Andrews Title: Regulatory Analyst

Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.

COGCC Approved: _____ **Director of COGCC** Date: 8/23/2018

Conditions Of Approval

All representations, stipulations and conditions of approval stated in this Form 2A for this location shall constitute representations, stipulations and conditions of approval for any and all subsequent operations on the location unless this Form 2A is modified by Sundry Notice, Form 4 or an Amended Form 2A.

COA Type	Description
	1.Access Roads/Drive: The access road/drive will be constructed with a Class 6 road base and then covered with recycled asphalt. Access road will be maintained to minimize development of 'washboard'. 2. Access Road/Drive: Operator shall utilize the additional mitigation measures of berms, bales, and/or sound walls to mitigate noise or light. Mitigation measures will be located on the south side of the access road/drive and be strategically placed as necessary to minimize vehicle light pollution to and excessive noise impacts on nearby residences. 3. Access Road/Drive: Operator shall implement a hard surface apron and vehicle tracking pad so vehicles do not track mud or debris onto City streets. Street sweeping services shall be provided if vehicle tracking occurs on public roadways. 4. Access Road/Drive: During construction, drilling, and completions operations, Operator will post warning signs to warn motorists of turning trucks ahead of each of the proposed public road access points. Operator will post signage before each access point to clarify that public access or turns are not allowed into any of the access roads/drives that the Operator will construct. Operator will post stop signs and turn movement restriction instructions at each of their exits. 5. Access Road/Drive: Operator will post 25 mile per hour speed limit signs along the access road/drive. Operator will assess and repost speed reductions as necessary. 6. Access Road/Drive: Operator will restrict non-essential traffic and permitted loads (oversize and/or overweight) traffic to and from Well Sites to periods outside of peak a.m. and p.m. traffic periods and during school hours (generally 7-9 a.m. and 3-6 p.m.).
	In addition to the samples collected in accordance with Rule 318A.f, Extraction shall submit the analytical results to COGCC of all other samples collected from permitted water wells and permitted springs in both Adams County and Broomfield that are within 1/2 mile of the Oil and Gas Location. The operator shall notify the director immediately if there are methane detections as described in Rule 318A.F(8) or if BTEX compounds or TPH are detected in a water sample. The operator shall submit the analytical results to COGCC via a Form 4 Sundry, in an electronic data deliverable (EDD) format, consistent with the procedures in Rule 318.f.(10).
	The Approved Form 2A permit will be posted at the location during construction, drilling, and completions operations.
	Once drilling and construction are complete, the Operator will submit a survey drawing via Form 4 Sundry with distances from the nearest well and production equipment to the nearest building unit to show all wells and production are no less than the distances on the Form 2A.

Best Management Practices

No	BMP/COA Type	Description
1	Planning	Flammable Material. All ground within twenty-five (25) feet of any tank, or other structure containing flammable or combustible materials, shall be kept free of dry weeds, grass or rubbish, and shall conform to COGCC 600 Series Safety Regulations and the applicable Fire Code.
2	Planning	803. Permanent lighting will be installed around the facility to allow both the operator and haulers to conduct safe operations at night. All lights will be directed downward, inward and shielded so light pollution is minimized. During the Drilling and Completion Phases, consistent with applicable law, Operator will construct a 32 foot perimeter wall surrounding the well pads and operations area to reduce light escaping from the site.
3	Planning	This location is subject to a Comprehensive Drilling Plan (CDP), as set forth in the Operator Agreement between Extraction Oil and Gas, Inc. and the City and County of Broomfield, dated October 24, 2017. Operator is currently working through the CDP with the City and County of Broomfield staff.

4	Planning	Blowout Prevention Equipment (“BOPE”): A double ram and annular preventer will be used during drilling. Stabbing valves shall be installed in the event of reverse circulation and shall be prior tested with low and high pressure fluid.
5	Planning	Extraction maintains a Tactical Response Plan (TRP), also at times referred to as the Emergency Response Plan, which is designed to provide Extraction employees and designated Emergency Response Team (ERT) members with the information necessary to respond to incidents in a safe, rapid, effective, and efficient manner. The TRP is kept at Extraction’s office and a copy is provided to the North Metro Fire Rescue District and the City of Broomfield. Extraction will place the TRP summary card in strategic places on the facilities during specific operations and copies of the summary card is provided to the North Metro Fire Rescue District to be kept in the responding fire engines.
6	Planning	Extraction will establish a live, 24-hour telephone hotline, as well as an email address, to receive feedback on our drilling and completion activities with the goal of having a tool for us to immediately investigate and address any complaints that arise. Prior to the initiation of 24-hour operations (drilling) Extraction will mail a post card (to include the email address and 24 hour manned phone number) to residents within 1/2 mile of the location.
7	Planning	This location is designed without permanent tanks. Oil, Gas, and produced water will be transported through a pipeline gathering to a Central Gathering Facility. Saleable gas will not be flared, it will be sent downline. For maintenance or upset conditions the use of a maintenance vessel and emission control devices will be utilized. Uncontrolled venting is prohibited other than where necessary for safety. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.
8	Planning	All loadlines shall be bull plugged or capped.
9	Planning	The location will be completely automated to monitor all production operations remotely. In the event that the facility is not operating under normal conditions, the automation system will immediately notify the operator. The automation system also has the ability to remotely perform an emergency shut down if necessary.
10	Traffic control	Access Roads: The access road will be constructed to accommodate local emergency vehicles. This road will be maintained for access at all times. Traffic will be routed to minimize local interruption. During construction and through the life of this location, Operator will utilize watering, via water trucks, to control fugitive dust. Additionally, the access road will be constructed with aggregate road base material and recycled asphalt and vehicle speeds will be limited to twenty five miles per hour to reduce dust. No untreated produced water or other process fluids shall be used for dust suppression.
11	Traffic control	A traffic plan is required by the City and County of Broomfield and shall be coordinated with the local jurisdiction prior to commencement of move in and rig up. Any subsequent modification to the traffic plan must be coordinated with the local jurisdiction.
12	Traffic control	Access Road/Drive: 24/7 security shall be provided at entrance of access road/drive to restrict unauthorized access.
13	General Housekeeping	Removal of Debris. All construction-related debris shall be removed from the site for proper disposal in a timely manner. The site shall be maintained free of debris and excess materials at all times during operation. Operator shall not burn or bury debris at any time on the Well Sites. Maintain appearance with garbage clean-up; a trash bin will be located on site to accumulate waste by the personnel drilling the wells. Site will have unused equipment, trash and junk removed immediately and legally disposed of as applicable.
14	General Housekeeping	Site security will be maintained at all times. Location will be adequately fenced to restrict access by unauthorized persons. The site will have gated access to keep unauthorized vehicles out and fencing will be placed around all production equipment.

15	Storm Water/Erosion Control	Implement and maintain BMPs to control stormwater runoff in a manner that minimizes erosion, transport of sediment offsite, and site degradation. Co-locate flowlines and/or gathering lines whenever feasible, and mitigate any erosion problems that arise due to the construction of any gathering lines. Location will be covered under Extraction Oil & Gas's field wide permit, permit number COR03M013. Typical stormwater BMPs installed include a diversion ditch and berm with sediment traps and installation of wattles where necessary. Please see the attached Stormwater BMP drawings.
16	Material Handling and Spill Prevention	Leak Detention Plan: Extraction will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads, tanks and fittings. Additionally annual SPCC inspections will be conducted and documented. Annual flowline testing will also occur according to COGCC rules 1101 and 1102. Inspection and record retention of flowline testing will be in accordance per COGCC regulation. All records will be made available to the COGCC upon request.
17	Material Handling and Spill Prevention	Automatic Safety Protective Systems and Surface Safety Valve. An automated safety system, governed by safety devices and a programmable logic computer, will be installed at the Well Sites. The automated safety system shall include the installation, monitoring and remote control of a Surface Safety Valve ("SSV") among many other engineered measures and devices that are implemented to greatly reduce or eliminate the potential for a well event. All New Wells will have a SSV installed prior to the commencement of the Production Phase connected to the production tubing at the surface. The SSV will be equipped to operate remotely via the automated safety protective system, which monitors multiple flowing pressures and rates which have predetermined maximum and/or minimum threshold values programmed and will remotely shut the well in should certain upset conditions be detected. Additionally, the automated safety system provides the ability to remotely shut-in wells on demand through operator remote intervention. The SSV will have documented quarterly testing to ensure functionality.
18	Material Handling and Spill Prevention	Containment Berms. The Operator shall utilize steel-rim berms around all separators at the Well Site with sufficient capacity to contain 1.5 times the maximum volume of all liquids that will be contained at a facility at any given time plus sufficient freeboard to prevent overflow. All berms and containment devices shall be inspected quarterly by the Operator and maintained in good condition. No potential ignition sources shall be installed inside the secondary containment area unless the containment area encloses a fired vessel or such sources are rated in accordance with industry codes and standards. Secondary containment such as duck ponds or lined earthen berms for temporary tanks shall also be used in addition to tankless and secondary containment around surface vessels. Permanent containment berms shall be constructed of steel rings, designed and installed to prevent leakage and resist degradation from erosion or routine operation. Secondary containment for separators shall be constructed with a synthetic or engineered liner that contains all primary containment vessels and is mechanically connected to the steel ring to prevent leakage.
19	Material Handling and Spill Prevention	The location will be completely automated to monitor all production operations remotely. In the event that the facility is not operating under normal conditions, the automation system will immediately notify the operator. The automation system also has the ability to remotely perform an emergency shut down if necessary.
20	Dust control	805.c. Operator shall employ practices for control of fugitive dust caused by their operations. Such practices shall include but are not limited to the use of speed restrictions, regular road maintenance, restriction of construction activity during high-wind days, and silica dust controls when handling sand used in hydraulic fracturing operations. Additional management practices such as road surfacing, wind breaks and barriers may be used. No untreated produced water or other process fluids shall be used for dust suppression.
21	Construction	Base beams will be used and not guy line anchors.
22	Noise mitigation	Quiet Technology. The Operator agrees to use the Liberty Quiet Fleet or comparable technology from an alternative vendor on all Well Sites for completion activities.

23	Noise mitigation	To provide long term noise mitigation at this location, all production equipment will powered by electricity. If needed, sound mitigation panels will be installed around the compressors during production operations to shield sensitive areas.
24	Noise mitigation	Thirty-two foot sound walls will be used during drilling and completion operations. Sound walls will be installed on the Northwest, Southwest, and south edges of the pad.
25	Noise mitigation	Baseline noise monitoring will be conducted prior to commencement of pad construction. Additional sound mitigation measures will be considered and implemented pursuant to third party recommendations. All noise survey data will be made available to the COGCC inspector upon request. The Operator shall continuously monitor noise and continuously collect and store noise readings with instruments placed between the Oil and Gas Location and residential Building Units. The Operator shall conduct the monitoring and data collection during construction, drilling, and completions operations. This data shall be available to COGCC on tables or graphs within 48 hours of being requested by COGCC. The Operator shall conduct a 72 hour baseline noise survey from a minimum of three points prior to the commencement of construction.
26	Noise mitigation	Electrified Drilling Rig - Extraction is working with United Power to supply sufficient electrical power for the drilling rig to drill the wells. Easements are being procured from the Landowners and the existing infrastructure is being upgraded in order to handle the larger electrical loads. While Extraction plans on drilling these wells on electrical power only, the rig will have diesel-powered generators in the event of an upset condition with the electrical supply from United Power. At that point, Extraction would use the diesel generators to power the rig until service from United Power was restored.
27	Emissions mitigation	Reduced Emission Completions (Commonly known as Green Completions). At Well Sites Operator shall employ reduced emission completions, also commonly known as green completions, which comply with federal and state requirements. In addition, Operator shall comply with the following: A. Gas gathering lines, separators, and sand traps capable of supporting green completions as described in COGCC Rule 805 shall be installed per the provisions of COGCC Rule 805. B. Operator shall comply with 40 CFR 60.5375(a)(1), (2) for green completions. C. Uncontrolled venting is prohibited other than where necessary for safety. D. Temporary flowback flaring and oxidizing equipment where allowed shall include the following: 1. Adequately sized equipment to handle 1.5 times the largest flowback volume of gas from a vertical/directional and/or horizontally completed well respectively as reported to the COGCC in a ten mile radius; 2. Valves and porting available to divert gas to flaring and oxidizing equipment; pursuant to the above Rules 40 CFR 60.5375 & COGCC Rule 805; 3. Auxiliary fueled with sufficient supply and heat to combust or oxidize non-combustible gases in order to control odors and hazardous gases. The flowback combustion device shall be equipped with a reliable continuous ignition source over the duration of flowback, except in conditions that may result in a fire hazard or explosion; and 4. The Operator has a general duty to safely maximize resource recovery and minimize releases to the atmosphere during flowback and subsequent recovery/operation.
28	Emissions mitigation	Exhaust. The exhaust from all engines, motors, coolers and other mechanized equipment shall be vented up or in a direction away from the nearest occupied building.
29	Emissions mitigation	Leak Detention Plan: Operator will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads and equipment. As part of Extraction’s Leak Detection and Repair (LDAR) program, all equipment including above ground flowlines and piping will be inspected quarterly with an infra-red camera for the first 5 years of production.
30	Emissions mitigation	Operator will bring a new oil, gas, and water pipelines, to send produced volumes immediately down the pipeline. No production will flow to tanks on this location. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.

31	Odor mitigation	805. Oil & gas facilities and equipment shall be operated in such a manner that odors do not constitute a nuisance or hazard to public welfare. Extraction will use a mud cooling system to control the release of odors within the drilling and fracturing fluids. Odor preventing additives will be on site for use if and when needed. Extraction will use a base fluid that will decrease the measurable BTEX and aromatic properties by more than 50% of regular diesel. Operator is prohibited from masking odors from any oil and gas facility site by using masking fragrances.
32	Drilling/Completion Operations	Well Integrity. Operator must equip the bradenhead access to the annulus between the production and the surface casing, as well as any intermediate casing, with a fitting to allow safe and convenient determinations of pressure and fluid flow. Valves used for annular pressure monitoring shall remain exposed and not buried to allow for visual inspection. The Operator shall take bradenhead pressure readings as required by the COGCC.
33	Drilling/Completion Operations	Bradenhead Monitoring. Operator will conduct bradenhead monitoring on the New Wells as required on the relevant Applications for Permit to Drill - Form 2.
34	Drilling/Completion Operations	Backup stabbing valves will be required on well servicing operations during reverse circulation. Valves shall be pressure tested before each well servicing operation using both low-pressure air and high-pressure fluid.
35	Drilling/Completion Operations	All fresh water for completions shall be transported to the well site via temporary water lines.
36	Drilling/Completion Operations	BOPE testing for drilling operations. Upon initial rig-up and at least once every thirty (30) days during drilling operations thereafter, pressure testing of the casing string and each component of the blowout prevention equipment including flange connections shall be performed to seventy percent (70%) of working pressure or seventy percent (70%) of the internal yield of casing, whichever is less. Pressure testing shall be conducted and the documented results shall be retained by the operator for inspection by the Director for a period of one (1) year. Activation of the pipe rams for function testing shall be conducted on a daily basis when practicable.
37	Drilling/Completion Operations	Closed chamber drill stem tests shall be allowed. All other drill stem tests shall require approval by the Director. None planned for this well.
38	Drilling/Completion Operations	Closed-Loop Pitless Systems for the Containment and/or Recycling of Drilling Fluids. Wells shall be drilled, completed and operated using closed-loop pitless systems for containment and/or recycling of all drilling, completion, flowback and produced fluids. Operator shall recycle fluids to the maximum extent practicable.
39	Drilling/Completion Operations	Flowback Monitoring System: Autonomous 4 gas monitors will be placed around the location during the flowback phase.
40	Interim Reclamation	Operator shall be responsible for segregating the topsoil, backfilling, re-compacting, reseeding, and re-contouring the surface of any disturbed area so as not to interfere with Owner’s operations and shall reclaim such area to be returned to pre-existing conditions as best as possible with control of all noxious weeds.
41	Final Reclamation	Within 90 days subsequent to the time of plugging and abandonment of the entire site, superfluous debris and equipment shall be removed from the site. Identification of plugged and abandoned wells will be identified pursuant to 319.a.(5)The operator shall also inscribe or imbed the well number and date of plugging upon the permanent monument.
42	Final Reclamation	Reclamation. Operator must submit an oil and gas site reclamation plan and reclaim a Well Site not later than six (6) months after plugging and abandoning the last New Well at such Well Site, weather and planting season permitting.

Total: 42 comment(s)

Attachment Check List

Att Doc Num	Name
2316364	ACCESS ROAD MAP
2316367	STORMWATER DRAWING B
2316368	LOCATION DRAWING
2316369	CORRESPONDENCE
2316370	STORMWATER DRAWINGS A
2316397	OPERATOR RESPONSE TO PUBLIC COMMENTS
2316398	SITING RATIONALE
2316417	COGCC RESPONSE TO PUBLIC COMMENTS
401477000	FORM 2A SUBMITTED
401484081	HYDROLOGY MAP
401484083	LOCATION PICTURES
401484084	MULTI-WELL PLAN
401484085	OTHER
401484088	OTHER
401484191	WASTE MANAGEMENT PLAN
401484234	NRCS MAP UNIT DESC
401484235	NRCS MAP UNIT DESC
401484236	NRCS MAP UNIT DESC
401484237	NRCS MAP UNIT DESC
401525632	FACILITY LAYOUT DRAWING

Total Attach: 20 Files

General Comments

User Group	Comment	Comment Date
Permit	Final Review Completed.	08/22/2018
OGLA	Updated the Containment Berms BMP to remove the reference to the bi-annual flowline pressure testing agreement with Broomfield. Bi-annual testing is not required at this location. The flowlines will be tested annually. The comment response document was also updated with this information.	08/21/2018
OGLA	The COGCC Commissioners reviewed the Form 2As for the Interchange A&B, Northwest A, and Northwest B Locations and heard comments regarding the Form 2As during the July 30-August 1, 2018 Hearing. A primary concern of the commenters was proximity of the access road for the Interchange A&B and the Northwest A and B Pads to Adams County residents. Many of the commenters were residents of the area and were concerned about potential noise, high traffic volumes, and dust, and lights. The Commissioners instructed the Director to address access road concerns and complete the review of the Form 2As. Staff worked with the operator to place the additional mitigation measure BMPs and COAs for the access road on the Form 2As. The access road was modified moving a portion closer to the Northwest Parkway and further from some of the Adams County residents.	08/16/2018
OGLA	Operator provided revised Access Road Map - replaced. Working on Access Road BMPs/COAs with the Operator. Added COAs and 1 BMP for Access Road with Operator Concurrence.	08/09/2018
Permit	Status Active - corrections made with Operator concurrence: - changed surface location Qtr/Qtr from "N2SW" to "NESW". - added 13 doc #s on the Related Forms tab for the Interchange "A" wells. Permitting review complete.	07/11/2018

OGLA	Operator responded with addition of NRCS map unit - added under comments as not enough space in soil and plant section, replaced location drawing and updated cultural distances for above ground utility, added stormwater drawings, attached correspondence and Exhibit B from City of Broomfield MOU.	07/09/2018	
OGLA	Updated BMPs based on meetings with Operator and City of Broomfield. Updated land use to dryland cropland from rangeland and remove reference area photos and map.	06/21/2018	
Permit	Status PENDING: - change Qtr/Qtr from N2SW to NESW. - need to add Related Forms doc #s for Interchange "A" APDs.	04/13/2018	
Agency	Comment submitted by Tami Yellico, Broomfield LGD Extraction shall implement the following actions to its Emergency Plan for all Broomfield wellsites: a. Develop enhanced hotwork planning and setback procedures b. Expand training and enforcement of hotwork permit implementation and management, re-issued STEPS alert to employees and vendors for hazard recognition and proper PPE. c. Add additional field management levels for specific flowback activities d. Implement stationary LEL monitoring grid with alarms on all flowback operations e. Evaluate and retrofitting sound wall placements or technologies to enhance ventilation f. Develop and implementing automated tank gauging on flowback operations g. Revise prestart-up safety review (PSSR) of Green Completion flowback setups, including, but not limited to: i. Site layout ii. Grounding requirements iii. Vessel depressurizing procedures h. Hold meetings with vendors regarding all corrective actions listed above and have scheduled ongoing meetings to continually discuss the process. i.Extraction shall provide a third party report of any incident as requested by Broomfield	03/01/2018	
Agency	By way of an update to the COGCC, on October 24, 2017, Extraction and Broomfield entered into an Amended and Restated Operator Agreement (Agreement). Section 9 of the Agreement provides that Extraction must submit a “Comprehensive Drilling Plan and Application” to Broomfield for such new wells or well sites (Plan). Per the Agreement, that Plan is subject to the review and approval by the City. Broomfield has not approved the Plan as required by the Agreement. Broomfield has been working diligently with Extraction on the Plan, through weekly meetings and timely and reasonable communications with Extraction. The COGCC spacing orders for these spacing units, dated as of October 31, 2017, indicate that any Permits for the wells within these spacing units must “comport with” the Agreement. As stated above, Section 9 of the Agreement provides that Extraction must submit a Comprehensive Drilling Plan for all of the well sites that is subject to Broomfield’s approval. On December 15, 2017, Extraction submitted a draft Plan for the Livingston and Interchange B well pads. On January 22, 2018, Broomfield submitted	03/01/2018	

220 comments on that draft Plan, which included the comment that the Agreement requires the Plan to be for all of the well sites (Comments). On January 26, 2018, Extraction submitted a draft Plan for the Northwest A B, United, and Interchange A B Pads. On February 15, 2018, Extraction responded to Broomfield's comments, which relate to the Livingston and Interchange B portion of the Plan. Broomfield is in the process of reviewing Extraction's February 15th comments and providing comments on the second Plan submitted by Extraction on January 26, 2018.

In both citizens' and staff comments we have identified areas where Broomfield is requesting additional information and where we believe the Plan is not complete. Broomfield believes that Extraction has an obligation to correct or update any deficient statements in the Plan. The issues that remain outstanding in the Plan include the following:

At meetings with Extraction on February 7, 2018, and February 14, 2018, Broomfield identified engineering issues that need to be resolved before permitting of the pipeline for all the well sites could go forward.

At a meeting on February 16, 2018, Broomfield outlined deficiencies in Extraction's proposed Traffic Plan that need to be corrected.

As of the date of these comments, Broomfield is still working with Extraction on required updates to its Emergency Response Plan and Risk Analysis Plan before those can be approved. Extraction has only provided a broad Risk Analysis Plan despite the requirement that risks and responses be identified.

Extraction has not identified each type of hazard for each location and specific responses by phases, including referencing Broomfield's Emergency Response Plan and the COGCC Emergency Response Plan.

It is Broomfield's understanding that Extraction has yet to talk with all Broomfield and Adams County residents to determine their desired mitigation measures for the well sites and truck roads to the north, even though Extraction committed to such individual communications.

Extraction has not committed in writing to any necessary specific mitigation measures between residents and well sites to the north and east of residents in Adams County and Broomfield.

Extraction has not yet committed in writing to necessary road improvements, stemming from increased truck traffic related to the Extraction operations.

Extraction has yet to identify all traffic signage or committed to install such signage on its traffic plans.

Extraction has yet to agree in the Plan that all class 7 and above vehicles are not allowed to operate on Public Roadways during the peak hours of 7-9 a.m. and 3-6 p.m. for Extraction activities

Extraction has not submitted a final pavement design report for approval by the City and County Engineer.

Extraction has yet to agree in the Plan to ensure the safety of emergency response teams, construction workers and the general public. Extraction has yet to agree in the Plan that Buffers shall be created as required on site to shield dust, noise, and light from residents

Extraction has yet to provide a complete stormwater management plan.

Extraction has failed to provide a more detailed GANTT chart on timing for all well sites.

Extraction has not provided a long term reclamation plan.

Extraction has not included practices it will use to address weeds at the sites.

Extraction has not provided a complete explanation of its noise modeling approach.

Extraction has not detailed the noise reduction levels it can achieve.

Extraction has not provided written detail on the process of “Conduct Recovery Operations” including involvement of Broomfield’s Public Health Division.

Despite the fact that many Broomfield and Adams County residents to the south of the well sites are on well water, Extraction has not included 12 additional requested requirements in its Water Quality Plan.

Extraction has not complied with 2 requirements for the Wetlands Plan.

Extraction has given only general responses to specific environmental site review requests.

Extraction has not provided details of planning and installation of electrical infrastructure at the well sites as required for the Electrification Plan and Extraction has indicated that they will be updating the plan.

Extraction has not provided a detailed visual mitigation plan for the well sites, service road, or pig launcher station.

Broomfield is requesting that the phrase “The meteorological data that was used are regional and could be applied to a range of sites in the area. If the proposed development is similar and has the same or fewer wells, then the results could be extended to further characterizations” be added to the Plan concerning air modeling.

Broomfield is requesting that the tank be removed from Figure 3 of the Plan since this tank will NOT be present. The diagram should correctly reflect what will be on site.

Extraction has not provided a list of the hazardous materials that will be used on-site.

Other Comments concerning Form 2 and 2A include:

Livingston Form 2A Comments and Questions

The FACILITIES section indicates there are 2 gas compressors planned for the location. Extraction should provide information associated with the purpose of the compressors and how will they be fueled.

The CONSTRUCTION section indicates that the size of the location after interim reclamation will be the same as the disturbed area during construction. Why will the location size remain the same after interim reclamation?

In the BEST MANAGEMENT PRACTICES section, Item 46 - Emissions mitigation 20. D. #4, #5 and #6 are not included

The waste management plan only addresses EP Waste. It does not discuss secondary containment and stormwater measures as required by Item 41 in the Best Management Practices of the Operator Agreement.

Livingston Form 2 Comments

Broomfield requests that the COGCC take a close look at the offset well evaluations provided by Extraction Oil and Gas to verify the estimates of offset distances of existing wells (including plugged and abandoned wells) from the new proposed horizontal wells. Broomfield was unable to confirm many of the distances indicated in the OPERATOR COMMENTS AND SUBMITTAL section of the Form 2s based on the OFFSET WELL EVALUATIONS spreadsheet or from the ANTI-COLLISION reports provided.

	According to the OFFSET WELL EVALUATIONS spreadsheet provided in the Form 2s, there are many plugged and abandoned wells and several producing wells that have horizontal offsets of less than 150 feet from the proposed new horizontal wells and it is indicated that No Remediation Is Required for these wells. Broomfield is very concerned about the short offset distance for some of these wells, for example new well Livingston S19-25-4N has an offset distance of only 19 feet from plugged and abandoned well McClintock MA 19-3J (API# 05-014-09137). Therefore, Broomfield requests that the COGCC take a close look to verify the proposed mitigation measures indicated by Extraction Oil and Gas are appropriate as defined by the DJ Basin Horizontal Offset Policy. For the Livingston S19-25-10N Form 2: In the SPACING AND UNIT INFORMATION section, the Distance from Completed Portion of Wellbore to Nearest Unit Boundary is blank. Interchange Form 2 A Comments The FACILITIES section indicates there are 2 gas compressors planned for the location. Extraction should provide information associated with the purpose of the compressors and how will they be fueled. Do CDOT and the Northwest Parkway Authority need to be notified since portions of I-25 and the Northwest Parkway are within the notification zone? The waste management plan only addresses EP Waste. It does not discuss secondary containment and stormwater measures as required by Item 41 in the Best Management Practices of the Operator Agreement. Interchange Form 2 Comments Broomfield requests that COGCC take a close look at the offset well evaluations provided by Extraction Oil and Gas to verify the estimates of offset distances of existing wells (including plugged and abandoned wells) from the new proposed horizontal wells. Broomfield was unable to confirm many of the distances indicated in the OPERATOR COMMENTS AND SUBMITTAL section of the Form 2s based on the OFFSET WELL EVALUATIONS spreadsheet or from the ANTI-COLLISION reports provided. According to the OFFSET WELL EVALUATIONS spreadsheet provided in the Form 2s, there are many plugged and abandoned wells and several producing wells that have horizontal offsets of less than 150 feet from the proposed new horizontal wells and it is indicated that No Remediation Is Required for these wells. Broomfield is very concerned about the short offset distance for some of these wells; therefore, Broomfield requests that COGCC take a close look to verify the proposed mitigation measures indicated by Extraction Oil and Gas are appropriate as defined by the DJ Basin Horizontal Offset Policy. Broomfield asks that COGCC leave the comment period on the Permits open until all issues are resolved regarding the Plan. Broomfield will continue to work diligently with Extraction on the Plan.		
OGLA	OGLA review: no production piping or storage for oil, gas, or produced water, rangeland pictures not during growing season, confirm cultural distances to high occupancy building unit and above ground utilities, 3 NRCS map units listed and 4 attached – request clarification, depth to water does not appear to be accurate based on other water wells in the area.	02/27/2018	
OGLA	In accordance with Rule 305.d.(3), the Director has extended the comment period by five days; therefore, the new deadline for public comment on this Oil and Gas Location Assessment Permit is THURSDAY, MARCH 1, 11:00am.	02/23/2018	
LGD	1)The COGCC mandated during the October 30, 2017 hearing that it reviews each of the Form 2A locations that impact Adams County residents in a public hearing.Adams County respectfully requests the following Form 2A’s be heard before the COGCC in public hearings;	02/22/2018	

a)Interchange A Pad (Doc. No. 401477000)

b)Interchange B Pad (Doc. No. 401477000)

c) United Pad (TBD)

d)Northwest A Pad (TBD)

e)Northwest B Pad (TBD)

2)In order for Extraction to comply with the Broomfield Comprehensive Plan's recommended setbacks from residences, the well pads were split into multiple pads with smaller numbers of wells. Extraction has now proposed combining four of these well pads into two Form 2A Oil and Gas Location Assessments to be filed with the Colorado Oil Gas Conservation Commission (COGCC). This would be extremely deceptive to the public and contrary to the intent of the Broomfield Comprehensive Plan recommendations. The COGCC mandated during the October 30, 2017 hearing that it reviews each of the Form 2A locations that impact Adams County residents in a public hearing. This consolidation of two well pads into one opportunity to comment would deny Adams County residents their chance to provide testimony on each location. We are concerned that this approach to consider these single locations within the COGCC process and two well pads within the Broomfield process has been selected to circumvent one or more elements of the public process.

a)Interchange A pad (Doc. No. 401477000)

b)Interchange B pad (Doc. No. 401477000)

c) Northwest A Pad (TBD)

d)Northwest B Pad (TBD)

3)Understanding that selecting an appropriate location for an oil and gas facility is the crux of compatibility, the proposed locations will impact the maximum number of residents by the proposed development. Four locations were initially proposed to access the identified minerals, and only 44 homes were within 1,500 feet of those locations. Today, six locations are proposed to access those same minerals, and approximately 94 homes are within 1,500 feet of those locations, more than doubling the number of people impacted by this proposed development. Those additional impacted residences are located within Adams County, yet as the elected representatives for this neighborhood, the Adams County Board of Commissioners did not have authority in the approval of these sites.

Adams County remains deeply concerned about the locations of the well pads and the cumulative impacts they will have on our residents. The Comprehensive Drilling Plan (CDP) that was shared with Adams County does not fully capture the entire proposed development and the cumulative impacts that will be felt by neighbors. Many Adams County residents will be impacted by four or more of the well pads at one time.

4)The Broomfield Comprehensive Plan setbacks necessitated Extraction break up the well pads so that each contains fewer wells. The result of fewer wells on each pad is the distribution of impacts over a larger area, ultimately shifting the burden to a larger number of residents. Adams County has seen increased development of oil and gas facilities, and the current industry standard is the consolidation of wells and their impacts on a single pad, rather than spreading those impacts over a larger area. The proposed Interchange A and B well pads total 33 wells and are proposed to consume over 21 acres of land and shrink to 9 acres during interim reclamation. In Adams County, by contrast, 30+ well pads disturb only about 11 acres of land and are shrunk to about 5.5 acres during interim reclamation. COGCC 1000 Series rules discuss proper reclamation of the land, including the minimization of surface area disturbance to reduce cumulative impacts, as well as facility consolidation to reduce the fragmentation of wildlife habitat. Extraction's proposal does the opposite of industry standard and COGCC rules.

	5)While minimizing the surface disturbance, the consolidation of many wells on a single pad reduces the need for haul roads. Haul roads are planned to be constructed to connect Sheridan Parkway to Huron Street, less than 400 feet from Adams County yards. These haul roads will see significant construction traffic, creating noise, dust, and safety concerns. Berms or walls have been proposed by the operator, and the mitigation of these significant impacts remains to be addressed in the plans. 6)Many residents have provided public testimony or written comments with concerns about potential impacts to public health, safety, welfare and the environment that this project may cause. There are also many residents who desired to provide testimony and were not awarded the opportunity when representatives of the COGCC were in Broomfield on October 12, 2017. As allowed by COGCC Rule 216 Comprehensive Drilling Plans, Adams County respectfully recommends the Director of the COGCC request a Comprehensive Drilling Plan from Extraction Oil and Gas for the well pads identified in comment one (1). a)Residents of the City and County of Broomfield as well as Adams County were under the impression that a Comprehensive Drilling Plan process was going to be part of Broomfield's Administrative Review by Memorandum of Understanding as outlined in section 9 of City and County of Broomfield Resolution No. 2017-186. i.City and County of Broomfield Oil and Gas Land Use Regulations Chapter 17-54-020 Definitions does not provide a definition for Comprehensive Drilling Plan which infers the definition provided by the COGCC Rule 216. b)The inclusion of agencies such as Colorado Department of Public Health and Environment, Colorado Parks and Wildlife, Local Government Designees as well as surface owners could aid in easing concerns expressed by many residents which will be impacted by this development. In addition, a CDP would ensure that appropriate parties are provided a fair and equitable opportunity to weigh in on concerns.	
Permit	Per Rule 305.d.(1)A. , the comment period has been extended from 20 days to 30 days at the request of the Broomfield County LGD; the comment period will end February 24, 2018.	01/26/2018
Permit	Passed Completeness.	01/25/2018
Permit	Returned to draft for: - attachment "FACILITY LAYOUT DRAWING" is damaged/corrupted and unable to be opened	01/25/2018
OGLA	THIS FORM 2A WILL REQUIRE A HEARING BEFORE THE COMMISSION FOR FINAL APPROVAL.	01/17/2018

Total: 17 comment(s)

Exhibit 6

FORM 42
Rev 03/15

State of Colorado
Oil and Gas Conservation Commission

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

OGCC RECEPTION

Receive Date: 12/12/2018

Document Number: 401871396

FIELD OPERATIONS NOTICE

The Form 42 shall be submitted as required by Rule, Notice to Operators, Policy, or Condition of Approval.
A Form 42 Update shall be submitted to revise the scheduled date or time on a previous Form 42 - Advance Notice of Field Operations.
A Form 42 Update must be for the same well, location, or facility and for the same Field Operation as a previous Form 42.
NOTE: Operator's Contact for Advance Notices of Field Operations should be available 24 hours a day, 7 days a week and should have the most current scheduling information for the operation. Operator's Contact for other notices should be able to respond to questions regarding the reported information.

Update of a previous Form 42 Notice: NO

Entity Information

OGCC Operator Number: 10459
Company Name: EXTRACTION OIL & GAS INC
Address: 370 17TH STREET SUITE 5300
City: DENVER State: CO Zip: 80202
Contact Person: Jeff Rickard
Phone: (720) 557-8300
Fax: ( )
Email: jrickard@extractionog.com

API #: 05 - - -
Facility ID:
Location ID: 456747
Facility Name: Interchange A & B Pad
Submit By Other Operator
Sec: 10 Twp: 1S Range: 68W QtrQtr: NESW
Lat: 39.978918 Long: -104.991656

NOTICE OF CONSTRUCTION OF A NEW LOCATION OR MAJOR CHANGE – 48-hour notice required

Start Date: 12/14/2018

I hereby certify all statements made in this form are, to the best of my knowledge, true, correct and complete.

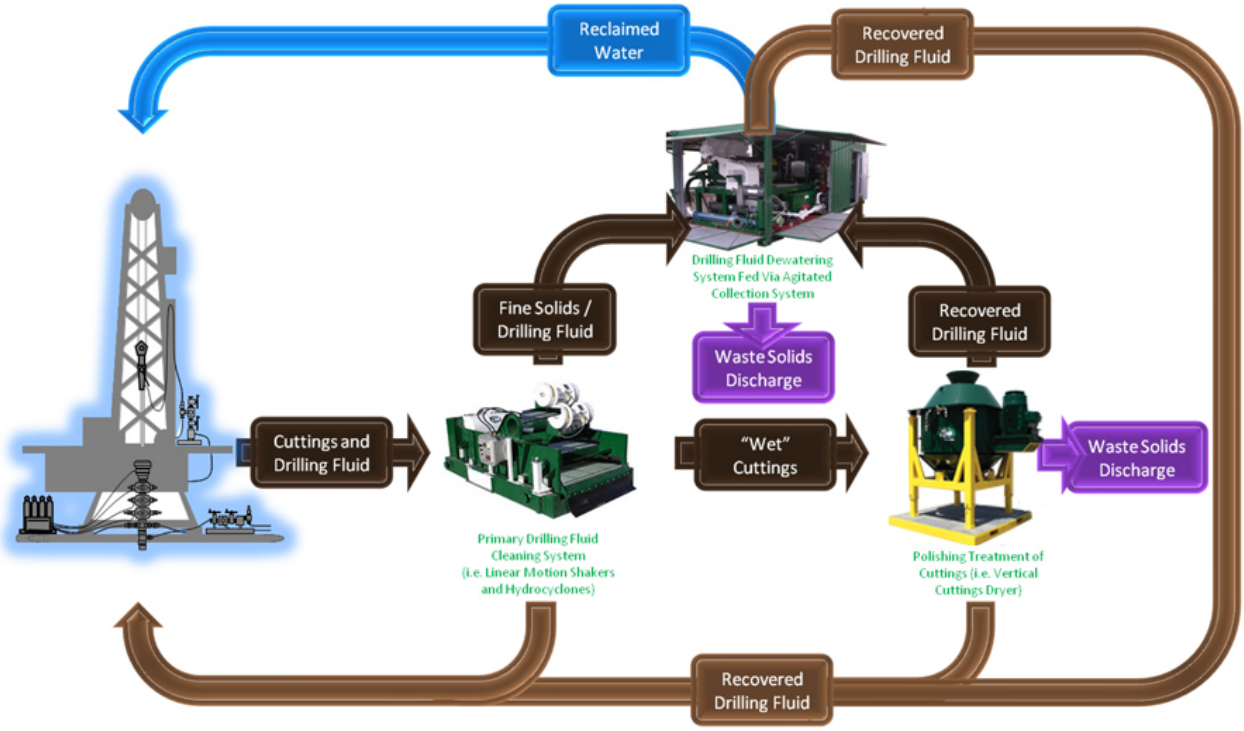
Print Name: Jeff Rickard
Email: jrickard@extractionog.com
Signature:
Title: jrickard@extractionog.com
Date: 12/12/2018

Exhibit 7

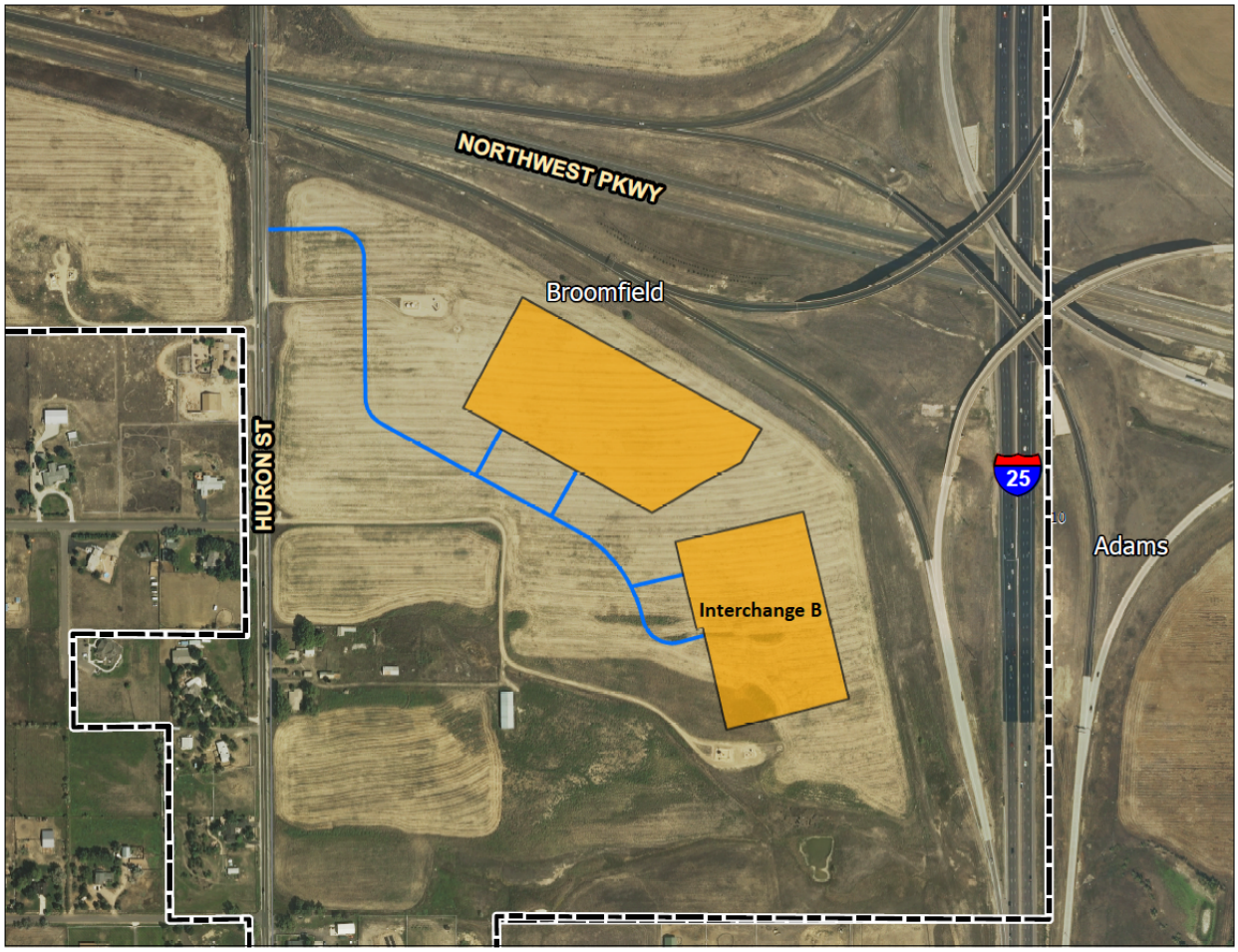
PUBLIC NOTICE - CONTINUATION OF DRILLING - INTERCHANGE B PAD SITE
Extraction Oil and Gas

Date: April 18, 2019

Summary: Arrival of the primary drill rig at the Interchange B Pad Site (indicated by the most southern yellow box in the map below), signifies the continuation of drilling operations as described in the released Comprehensive Development Plan (Reference this document at Extraction's Comprehensive Drilling Plan). An initial spudder rig has already been used at the Interchange B Pad to drill and set conductor and surface casing for ten wells per the Comprehensive Development Plan. The primary drilling rig is on site and will be used to drill below the surface casing to the total borehole depth and to set the well production casing. The primary rig is electric and will be equipped with a closed loop drilling system to reduce the water required to drill the well and eliminate the need for a reserve pit. A typical closed-loop drilling system is shown in the diagram below.



Location of Upcoming Construction Activity: The Colorado Oil and Gas Conservation Commission (COGCC) approved form 2 and 2A drilling permits allowing for the drilling operations at the Interchange pad sites generally located south of the Northwest Parkway, east of Huron Street, and West of Interstate 25, as shown in the map below.



What to Expect During Drilling: All access and drilling activity will be within the identified drill site and along the Interchange access. Drilling operations will include the mobilization of rig equipment to site, assembly of the rig, drilling the horizontal leg of each borehole, and installing production casing per the COGCC issued drilling permits. A picture of the drill rig on location is shown in the equipment section of this document. Street sweeping activities will continue throughout the construction and drilling process.

Estimated Start Date: Drilling is scheduled to begin on April 19th.

Estimated Schedule: Drilling on the Interchange B pad will continue on to late May and possibly early June. The drilling schedule is dependent on many different factors including weather.

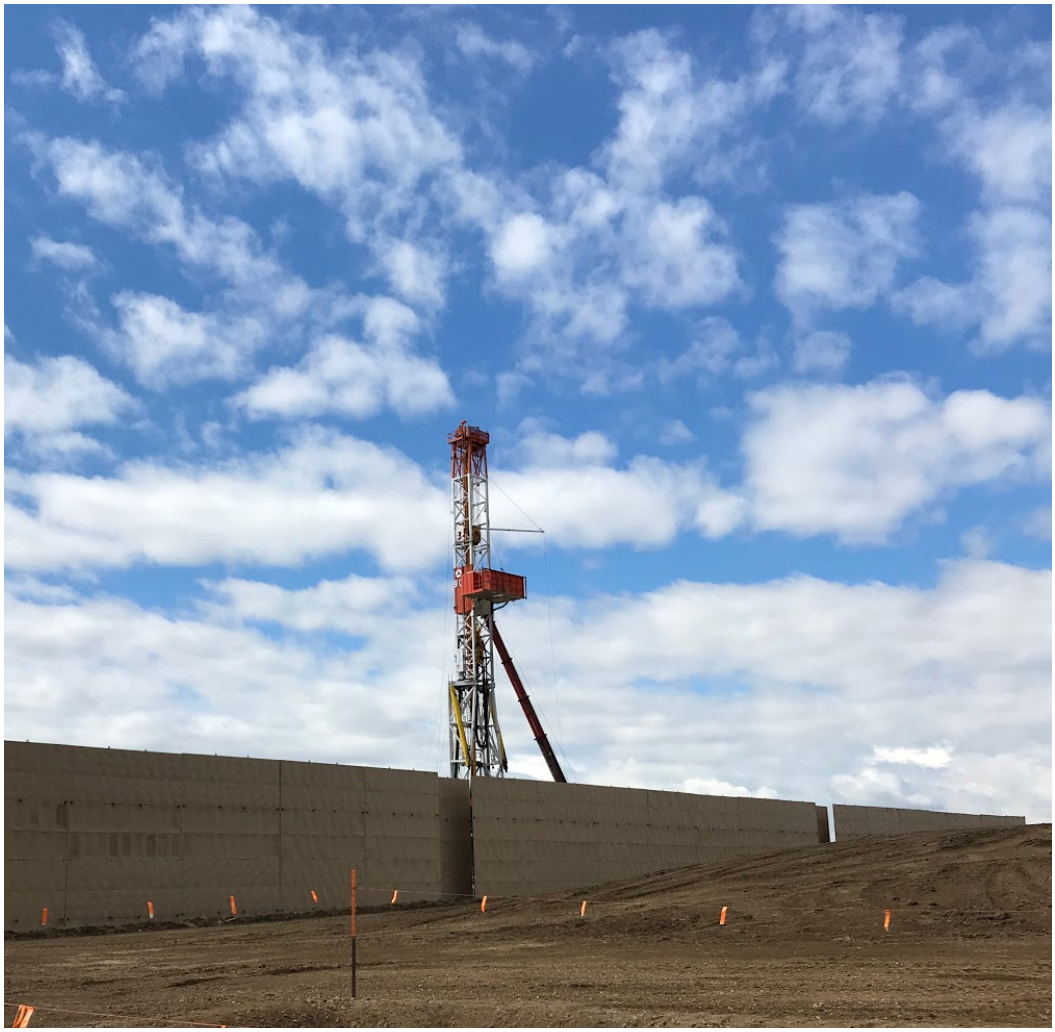
(The start date, and duration of drilling are estimated)

Contact: If you should have any questions regarding this activity, please do not hesitate to contact Extraction at (720) 974-7740.

Additional information regarding Oil and Gas Development in Broomfield is available at www.Broomfield.org/oilandgas

Equipment:

Drilling Rig on Interchange B



Water Truck

Truck with Drilling pipe

Crane

Matt Meason/Elk City Daily News

Loader

Side Dump

Exhibit 8

FORM 2A Rev 08/13

State of Colorado
Oil and Gas Conservation Commission

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

Oil and Gas Location Assessment

Document Number: 401524113

Date Received: 02/26/2018

☒ New Location ☐ Refile ☐ Amend Existing Location Location#: _____

This Oil and Gas Location Assessment is to be submitted to the COGCC for approval prior to any ground disturbance activity associated with oil and gas operations. Approval of this Oil and Gas Location Assessment will allow for the construction of the below specified Location; however, it does not supersede any land use rules applied by the local land use authority. Please see the COGCC website at http://cogcc.state.co.us/ for all accompanying information pertinent this Oil and Gas Location Assessment.

Location ID: **456769**

Expiration Date: **08/22/2021**

☒ This location assessment is included as part of a permit application.

CONSULTATION

☐ This location is included in a Comprehensive Drilling Plan. CDP # _____
☐ This location is in a sensitive wildlife habitat area.
☐ This location is in a wildlife restricted surface occupancy area.
☐ This location includes a Rule 306.d.(1)A.ii. variance request.

Operator

Operator Number: 10459
Name: EXTRACTION OIL & GAS INC
Address: 370 17TH STREET SUITE 5300
City: DENVER State: CO Zip: 80202

Contact Information

Name: Alyssa Andrews
Phone: (720) 481-2379
Fax: ( )
email: aandrews@extractionog.com

RECLAMATION FINANCIAL ASSURANCE

☒ Plugging and Abandonment Bond Surety ID: 20130028 ☐ Gas Facility Surety ID: _____
☐ Waste Management Surety ID: _____

LOCATION IDENTIFICATION

Name: NORTHWEST A PAD Number: _____
County: BROOMFIELD

QuarterQuarter: NWNW Section: 9 Township: 1S Range: 68W Meridian: 6 Ground Elevation: 5314

Define a single point as a location reference for the facility location. When the location is to be used as a well site then the point shall be a well location.

Footage at surface: 1305 feet FNL from North or South section line
744 feet FWL from East or West section line

Latitude: 39.983115 Longitude: -105.013168

PDOP Reading: 1.3 Date of Measurement: 12/21/2017

Instrument Operator's Name: T. WINNICKI

RELATED REMOTE LOCATIONS

(Enter as many Related Locations as necessary. Enter the Form 2A document # only if there is no established COGCC Location ID#)

This proposed Oil and Gas Location is:	LOCATION ID #	FORM 2A DOC #
Well Site is served by Production Facilities		401606721
		401525931
		401606738

FACILITIES

Indicate the number of each type of oil and gas facility planned on location

Wells	8	Oil Tanks*		Condensate Tanks*		Water Tanks*		Buried Produced Water Vaults*	
Drilling Pits		Production Pits*		Special Purpose Pits		Multi-Well Pits*		Modular Large Volume Tanks	
Pump Jacks		Separators*		Injection Pumps*		Cavity Pumps*		Gas Compressors*	
Gas or Diesel Motors*		Electric Motors		Electric Generators*		Fuel Tanks*		LACT Unit*	
Dehydrator Units*		Vapor Recovery Unit*		VOC Combustor*		Flare*		Pigging Station*	

OTHER FACILITIES*

Other Facility Type	Number
GAS LIFT METERED BUILDING	1

*Those facilities indicated by an asterisk (*) shall be used to determine the distance from the Production Facility to the nearest cultural feature on the Cultural Setbacks Tab.

Per Rule 303.b.(3)C, description of all oil, gas, and/or water pipelines:

Extraction will trench flowlines in one piping corridor that runs between the drill pad and the separator pad and be placed at 12" centers. These lines will most likely be 2" or 3" fusion bonded SCH160 steel pipe and have proper cathodic protection throughout the run. Extraction will then sweep up with a long radius that will tie off each line to the appropriate separator. All welds on these are 100% x-ray and hydro tested to the API and Manufactures specs for a class 1500 series flange. Also meets ASME code B31.4.

CONSTRUCTION

Date planned to commence construction: 09/01/2018 Size of disturbed area during construction in acres: 4.43

Estimated date that interim reclamation will begin: 12/01/2018 Size of location after interim reclamation in acres: 1.07

Estimated post-construction ground elevation: 5314

DRILLING PROGRAM

Will a closed loop system be used for drilling fluids: Yes

Is H_2S anticipated? No

Will salt sections be encountered during drilling: No

Will salt based mud (>15,000 ppm Cl) be used? No

Will oil based drilling fluids be used? Yes

DRILLING WASTE MANAGEMENT PROGRAM

Drilling Fluids Disposal: OFFSITE Drilling Fluids Disposal Method: Commercial Disposal

Cutting Disposal: OFFSITE Cuttings Disposal Method: Commercial Disposal

Other Disposal Description:

The oil-based cuttings will be disposed of similarly and the water-based cuttings may be applied to the land application, facility ID 449314. Both disposal methods may be used for the water-based cuttings.

Beneficial reuse or land application plan submitted? _____

Reuse Facility ID: _____ or Document Number: _____

Centralized E&P Waste Management Facility ID, if applicable: _____

SURFACE & MINERALS & RIGHT TO CONSTRUCT

Name: City&County of Broomfield Phone: _____

Address: One DesCombes Dr. Fax: _____

Address: _____ Email: _____

City: Broomfield State: CO Zip: 80020

Surface Owner: ☒ Fee ☐ State ☐ Federal ☐ Indian

Check all that apply. The Surface Owner:
- ☒ is the mineral owner
- ☒ is committed to an oil and Gas Lease
- ☒ has signed the Oil and Gas Lease
- ☐ is the applicant

The Mineral Owner beneath this Oil and Gas Location is: ☒ Fee ☐ State ☐ Federal ☐ Indian

The Minerals beneath this Oil and Gas Location will be developed from or produced to this Oil and Gas Location: No

The right to construct this Oil and Gas Location is granted by: Surface Use Agreement

Surface damage assurance if no agreement is in place: _____ Surface Surety ID: _____

Date of Rule 306 surface owner consultation _____

CURRENT AND FUTURE LAND USE

Current Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	_____
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

Future Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	_____
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

CULTURAL DISTANCE INFORMATION

Provide the distance to the nearest cultural feature as measured from Wells or Production Facilities onsite.

	From WELL	From PRODUCTION FACILITY
Building:	816 Feet	910 Feet
Building Unit:	1045 Feet	1104 Feet
High Occupancy Building Unit:	4147 Feet	4044 Feet
Designated Outside Activity Area:	5280 Feet	5280 Feet
Public Road:	318 Feet	224 Feet
Above Ground Utility:	1246 Feet	1150 Feet
Railroad:	5280 Feet	5280 Feet
Property Line:	66 Feet	6 Feet

INSTRUCTIONS:
- All measurements shall be provided from center of nearest Well or edge of nearest Production Facility to nearest of each cultural feature as described in Rule 303.b.(3)A.
- Enter 5280 for distance greater than 1 mile.
- Building - nearest building of any type. If nearest Building is a Building Unit, enter same distance for both.
- Building Unit, High Occupancy Building Unit, and Designated Outside Activity Area - as defined in 100-Series Rules.
-For measurement purposes only, Production Facilities should only include those items with an asterisk(*) on the Facilities Tab.

DESIGNATED SETBACK LOCATION INFORMATION

Check all that apply. This location is within a:

- [ ] Buffer Zone
- [ ] Exception Zone
- [ ] Urban Mitigation Area

- Buffer Zone - as described in Rule 604.a.(2), within 1,000' of a Building Unit.
- Exception Zone - as described in Rule 604.a.(1), within 500' of a Building Unit.
- Urban Mitigation Area - as defined in 100-Series Rules.
- Large UMA Facility – as defined in 100-Series Rules.

Pre-application Notifications (required if location is within 1,000 feet of a building unit):

Date of Rule 305.a.(1) Urban Mitigation Area Notification to Local Government: _____

Date of Rule 305.a.(2) Buffer Zone Notification to Building Unit Owners: _____

FOR MULTI-WELL PADS AND PRODUCTION FACILTIES WITHIN DESIGNATED SETBACK LOCATIONS ONLY:

- [ ] Check this box if this Oil and Gas Location has or will have Production Facilities that serve multiple wells (on or offsite) and the Production Facilities are proposed to be located less than 1,000 feet from a Building Unit. *(Pursuant to Rule 604.c.(2)E.i., the operator must evaluate alternative locations for the Production Facilities that are farther from the Building Unit, and determine whether those alternative locations were technically feasible and economically practicable for the same proposed development.)*

- [ ] By checking this box, I certify that no alternative placements for the Production Facilities, farther from the nearest Building Unit, were available based on the analysis conducted pursuant to Rule 604.c.(2)E.i.

In the space below, explain rationale for siting the multi-well Production Facility(ies) that supports your Rule 604.c.(2)E.i determination. Attach documentation that supports your determination to this Form 2A.

SOIL

List all soil map units that occur within the proposed location. attach the National Resource Conservation Service (NRCS) report showing the "Map Unit Description" report listing the soil typical vertical profile. This data is to used when segregating topsoil.

The required information can be obtained from the NRCS web site at http://soildatamart.nrcs.usda.org/ or from the COGCC web site GIS Online map page found at http://colorado.gov/cogcc. Instructions are provided within the COGCC web site help section.

NRCS Map Unit Name: ReD—Renohill loam, 3 to 9 percent slopes

NRCS Map Unit Name: UlC—Ulm loam, 3 to 5 percent slopes

NRCS Map Unit Name:

PLANT COMMUNITY:

Complete this section only if any portion of the disturbed area of the location's current land use is on non-crop land.

Are noxious weeds present: Yes ☐ No ☒

Plant species from: ☐ NRCS or, ☐ field observation Date of observation:

List individual species:

Check all plant communities that exist in the disturbed area.

- ☐ Disturbed Grassland (Cactus, Yucca, Cheatgrass, Rye)
- ☐ Native Grassland (Bluestem, Grama, Wheatgrass, Buffalograss, Fescue, Oatgrass, Brome)
- ☐ Shrub Land (Mahogany, Oak, Sage, Serviceberry, Chokecherry)
- ☐ Plains Riparian (Cottonwood, Willow, Aspen, Maple, Poplar, Russian Olive, Tamarisk)
- ☐ Mountain Riparian (Cottonwood, Willow, Blue Spruce)
- ☐ Forest Land (Spruce, Fir, Ponderosa Pine, Lodgepole Pine, Juniper, Pinyon, Aspen)
- ☐ Wetlands Aquatic (Bullrush, Sedge, Cattail, Arrowhead)
- ☐ Alpine (above timberline)
- ☐ Other (describe):

WATER RESOURCES

Is this a sensitive area: ☐ No ☒ Yes

Distance to nearest

downgradient surface water feature: 60 Feet

water well: 956 Feet

Estimated depth to ground water at Oil and Gas Location 50 Feet

Basis for depth to groundwater and sensitive area determination:

Surface water feature: Ditch 314' E from the reference area point - 60 feet from the edge of disturbance.
Nearest water well: Permit # 90995- - , 675' S abandoned, Active water well permit 88207 is 956 feet north with a depth of 70 feet.
Monitoring well permit number 47271MH approx 1130 feet SW has a depth of 50 feet - used 50 feet as depth to groundwater

Is the location in a riparian area: ☒ No ☐ Yes

Was an Army Corps of Engineers Section 404 permit filed ☒ No ☐ Yes If yes attach permit.

Is the location within a Rule 317B Surface Water Supply Area buffer zone: No

If the location is within a Rule 317B Surface Water Supply Area buffer have all public water supply systems within 15 miles been notified:

Is the Location within a Floodplain? ☒ No ☐ Yes

Floodplain Data Sources Reviewed (check all that apply)

- ☐ Federal (FEMA)
- ☒ State
- ☐ County
- ☐ Local
- ☐ Other

GROUNDWATER BASELINE SAMPLING AND MONITORING AND WATER WELL SAMPLING

Water well sampling required per Rule 318A

WILDLIFE

☐

This location is included in a Wildlife Mitigation Plan

☐ This location was subject to a pre-consultation meeting with CPW held on _____

DESIGNATED SETBACK LOCATION EXCEPTIONS

Check all that apply:

☐ Rule 604.a.(1)A. Exception Zone (within 500' of a Building Unit) and is in an Urban Mitigation Area

☐ Rule 604.b.(1)A. Exception Location (existing or approved Oil & Gas Location now within a Designated Setback as a result of Rule 604.a.)

☐ Rule 604.b.(1)B. Exception Location (existing or approved Oil & Gas Location is within a Designated Setback due to Building Unit construction after Location approval)

☐ Rule 604.b.(2) Exception Location (SUA or site-specific development plan executed on or before August 1, 2013)

☐ Rule 604.b.(3) Exception Location (Building Units constructed after August 1, 2013 within setback per an SUA or site-specific development plan)

RULE 502.b VARIANCE REQUEST

☐ Rule 502.b. Variance Request from COGCC Rule or Spacing Order Number _____

ALL exceptions and variances require attached Request Letter(s). Refer to applicable rule for additional required attachments (e.g. waivers, certifications, SUAs).

OPERATOR COMMENTS AND SUBMITTAL

Comments: Reference well for Location Identification: Northwest A S20-25-6N

Notification Zone Drawing and UMA Check Exhibit both attached as "OTHER". This location is not in a buffer zone. This location is not within a Large UMA.

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct and complete.

Signed: _____ Date: 02/26/2018 Email: aandrews@extractionog.com

Print Name: Alyssa Andrews Title: Regulatory Analyst

Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.

COGCC Approved: _____ **Director of COGCC** Date: 8/23/2018

Conditions Of Approval

All representations, stipulations and conditions of approval stated in this Form 2A for this location shall constitute representations, stipulations and conditions of approval for any and all subsequent operations on the location unless this Form 2A is modified by Sundry Notice, Form 4 or an Amended Form 2A.

COA Type	Description
	1.Access Roads/Drive: The access road/drive will be constructed with a Class 6 road base and then covered with recycled asphalt. Access road will be maintained to minimize development of 'washboard'. 2. Access Road/Drive: Operator shall utilize the additional mitigation measures of berms, bales, and/or sound walls to mitigate noise or light. Mitigation measures will be located on the south side of the access road/drive and be strategically placed as necessary to minimize vehicle light pollution to and excessive noise impacts on nearby residences. 3. Access Road/Drive: Operator shall implement a hard surface apron and vehicle tracking pad so vehicles do not track mud or debris onto City streets. Street sweeping services shall be provided if vehicle tracking occurs on public roadways. 4. Access Road/Drive: During construction, drilling, and completions operations, Operator will post warning signs to warn motorists of turning trucks ahead of each of the proposed public road access points. Operator will post signage before each access point to clarify that public access or turns are not allowed into any of the access roads/drives that the Operator will construct. Operator will post stop signs and turn movement restriction instructions at each of their exits. 5. Access Road/Drive: Operator will post 25 mile per hour speed limit signs along the access road/drive. Operator will assess and repost speed reductions as necessary. 6. Access Road/Drive: Operator will restrict non-essential traffic and permitted loads (oversize and/or overweight) traffic to and from Well Sites to periods outside of peak a.m. and p.m. traffic periods and during school hours (generally 7-9 a.m. and 3-6 p.m.).
	In addition to the samples collected in accordance with Rule 318A.f, Extraction shall submit the analytical results to COGCC of all other samples collected from permitted water wells and permitted springs in both Adams County and Broomfield that are within 1/2 mile of the Oil and Gas Location. The operator shall notify the director immediately if there are methane detections as described in Rule 318A.F(8) or if BTEX compounds or TPH are detected in a water sample. The operator shall submit the analytical results to COGCC via a Form 4 Sundry, in an electronic data deliverable (EDD) format, consistent with the procedures in Rule 318.f.(10).
	The Approved Form 2A permit will be posted at the location during construction, drilling, and completions operations.

Best Management Practices

No	BMP/COA Type	Description
1	Planning	Site security will be maintained at all times. Location will be adequately fenced to restrict access by unauthorized persons. The site will have gated access to keep unauthorized vehicles out and fencing will be placed around all production equipment.
2	Planning	The location was approved by an Oil and Gas Operator Agreement with Broomfield on October 24, 2017. The development of this location is subject to a Comprehensive Drilling Plan (CDP) approval from The City and County of Broomfield. Operator is currently working through the CDP application with the City and County of Broomfield staff.
3	Planning	Backup stabbing valves will be required on well servicing operations during reverse circulation. Valves shall be pressure tested before each well servicing operation using both low-pressure air and high-pressure fluid.
4	Planning	All ground within twenty-five (25) feet of any tank, or other structure containing flammable or combustible materials, shall be kept free of dry weeds, grass or rubbish, and shall conform to COGCC 600 Series Safety Regulations and the applicable Fire Code.

5	Planning	Extraction maintains a Tactical Response Plan (TRP), also at times referred to as the Emergency Response Plan, which is designed to provide Extraction employees and designated Emergency Response Team (ERT) members with the information necessary to respond to incidents in a safe, rapid, effective, and efficient manner. The TRP is kept at Extraction's office and a copy is provided to the North Metro Fire Rescue District and the City of Broomfield. Extraction will place the TRP summary card in strategic places on the facilities during specific operational and copies of the summary card is provided to the North Metro Fire Rescue District to be kept in the responding fire engines.
6	Planning	Operator will bring a new oil, gas, and water pipelines, to send produced volumes immediately down the pipeline. No production will flow to tanks on this location. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.
7	Community Outreach and Notification	Extraction will establish a live, 24-hour telephone hotline, as well as an email address, to receive feedback on our drilling and completion activities with the goal of having a tool for us to immediately investigate and address any complaints that arise. Prior to the initiation of 24-hour operations (drilling) Extraction will mail a post card (to include the email address and 24 hour manned phone number) to residents within 1/2 mile of the location.
8	Traffic control	Access Roads: The access road will be constructed to accommodate local emergency vehicles. This road will be maintained for access at all times. Traffic will be routed to minimize local interruption. During construction and through the life of this location, Operator will utilize watering, via water trucks, to control fugitive dust. Additionally, the access road will be constructed with aggregate road base material and recycled asphalt and vehicle speeds will be limited to twenty five miles per hour to reduce dust. No untreated produced water or other process fluids shall be used for dust suppression.
9	Traffic control	A traffic plan is required by the City and County of Broomfield and shall be coordinated with the local jurisdiction prior to commencement of move in and rig up. Any subsequent modification to the traffic plan must be coordinated with the local jurisdiction.
10	Traffic control	Access Road/Drive: 24/7 security shall be provided at entrance of access road/drive to restrict unauthorized access.
11	General Housekeeping	Removal of Debris. All construction-related debris shall be removed from the site for proper disposal in a timely manner. The site shall be maintained free of debris and excess materials at all times during operation. Operator shall not burn or bury debris at any time on the Well Sites. Maintain appearance with garbage clean-up; a trash bin will be located on site to accumulate waste by the personnel drilling the wells. Site will have unused equipment, trash and junk removed immediately and legally disposed of as applicable.
12	General Housekeeping	Leak Detention Plan: Extraction will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads, tanks and fittings. Additionally annual SPCC inspections will be conducted and documented. Annual flowline testing will also occur according to COGCC rules 1101 and 1102. Inspection and record retention of flowline testing will be in accordance per COGCC regulation. All records will be made available to the COGCC upon request.
13	Storm Water/Erosion Control	Implement and maintain BMPs to control stormwater runoff in a manner that minimizes erosion, transport of sediment offsite, and site degradation. Co-locate flowlines and/or gathering lines whenever feasible, and mitigate any erosion problems that arise due to the construction of any gathering lines. Location will be covered under Extraction Oil & Gas's field wide permit, permit number COR03M013. Typical stormwater BMPs installed include a diversion ditch and berm with sediment traps and installation of wattles where necessary. Please see the attached Stormwater BMP drawings.

14	Material Handling and Spill Prevention	Automatic Safety Protective Systems and Surface Safety Valve. An automated safety system, governed by safety devices and a programmable logic computer, will be installed at the Well Sites. The automated safety system shall include the installation, monitoring and remote control of a Surface Safety Valve ("SSV") among many other engineered measures and devices that are implemented to greatly reduce or eliminate the potential for a well event. All New Wells will have a SSV installed prior to the commencement of the Production Phase connected to the production tubing at the surface. The SSV will be equipped to operate remotely via the automated safety protective system, which monitors multiple flowing pressures and rates which have predetermined maximum and/or minimum threshold values programmed and will remotely shut the well in should certain upset conditions be detected. Additionally, the automated safety system provides the ability to remotely shut-in wells on demand through operator remote intervention. The SSV will have documented quarterly testing to ensure functionality.
15	Material Handling and Spill Prevention	The location will be completely automated to monitor all production operations remotely. In the event that the facility is not operating under normal conditions, the automation system will immediately notify the operator. The automation system also has the ability to remotely perform an emergency shut down if necessary.
16	Dust control	805.c. Operator shall employ practices for control of fugitive dust caused by their operations. Such practices shall include but are not limited to the use of speed restrictions, regular road maintenance, restriction of construction activity during highwind days, and silica dust controls when handling sand used in hydraulic fracturing operations. Additional management practices such as road surfacing, wind breaks and barriers may be used. No untreated produced water or other process fluids shall be used for dust suppression.
17	Construction	803. Permanent lighting will be installed around the facility to allow both the operator and haulers to conduct safe operations at night. All lights will be directed downward, inward and shielded so light pollution is minimized. During the Drilling and Completion Phases, consistent with applicable law, Operator will construct a 32 foot perimeter wall surrounding the well pads and operations area, as permitted, to reduce light escaping from the site.
18	Construction	Base beams will be used and not guy line anchors.
19	Construction	Containment Berms. The Operator shall utilize steel-rim berms around all permanent facility equipment at the Well Sites with sufficient capacity to contain 1.5 times the maximum volume of all liquids that will be contained at a facility at any given time plus sufficient freeboard to prevent overflow. All berms and containment devices shall be inspected quarterly by the Operator and maintained in good condition. No potential ignition sources shall be installed inside the secondary containment area unless the containment area encloses a fired vessel or such sources are rated in accordance with industry codes and standards. Secondary containment such as duck ponds or lined earthen berms for temporary tanks shall also be used. A. Permanent containment berms shall be constructed of steel rings, designed and installed to prevent leakage and resist degradation from erosion or routine operation. B. Secondary containment for tanks shall be constructed with a synthetic or engineered liner that contains all primary containment vessels and is mechanically connected to the steel ring to prevent leakage.
20	Noise mitigation	Quiet Technology. The Operator agrees to use the Liberty Quiet Fleet or comparable technology from an alternative vendor on all Well Sites for completion activities.
21	Noise mitigation	Thirty-two foot sound walls will be used during drilling and completion operations. Sound walls will be installed on the edges impacting nearest neighbors. Sound walls will be placed on the west, south, and south-east corner edges of the pad.

22	Noise mitigation	Baseline noise monitoring will be conducted prior to commencement of pad construction. Additional sound mitigation measures will be considered and implemented pursuant to third party recommendations. All noise survey data will be made available to the COGCC inspector upon request. The Operator shall continuously monitor noise and continuously collect and store noise readings with instruments placed between the Oil and Gas Location and residential Building Units. The Operator shall conduct the monitoring and data collection during construction, drilling, and completions operations. This data shall be available to COGCC on tables or graphs within 48 hours of being requested by COGCC. The Operator shall conduct a 72 hour baseline noise survey from a minimum of three points prior to the commencement of construction.
23	Noise mitigation	For the development wells, to provide long term noise mitigation at this location all production equipment will powered by electricity. If needed, sound mitigation panels will be installed around the compressors during production operations to shield sensitive areas.
24	Noise mitigation	Electrified Drilling Rig - Extraction is working with United Power to supply sufficient electrical power for the drilling rig to drill the wells. Easements are being procured from the Landowners and the existing infrastructure is being upgraded in order to handle the larger electrical loads. While Extraction plans on drilling these wells on electrical power only, the rig will have diesel-powered generators in the event of an upset condition with the electrical supply from United Power. At that point, Extraction would use the diesel generators to power the rig until service from United Power was restored.
25	Emissions mitigation	This location is designed without permanent tanks. Oil, Gas, and produced water will be transported through a pipeline gathering to a Central Gathering Facility. Saleable gas will not be flared, it will be sent downline. For maintenance or upset conditions the use of a maintenance vessel and emission control devices will be utilized. Uncontrolled venting is prohibited other than where necessary for safety. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.
26	Emissions mitigation	Reduced Emission Completions (Commonly known as Green Completions). At Well Sites Operator shall employ reduced emission completions, also commonly known as green completions, which comply with federal and state requirements. In addition, Operator shall comply with the following: A. Gas gathering lines, separators, and sand traps capable of supporting green completions as described in COGCC Rule 805 shall be installed per the provisions of COGCC Rule 805. B. Operator shall comply with 40 CFR 60.5375(a)(1), (2) for green completions. C. Uncontrolled venting is prohibited other than where necessary for safety. D. Temporary flowback flaring and oxidizing equipment where allowed shall include the following: 1. Adequately sized equipment to handle 1.5 times the largest flowback volume of gas from a vertical/directional and/or horizontally completed well respectively as reported to the COGCC in a ten mile radius; 2. Valves and porting available to divert gas to flaring and oxidizing equipment; pursuant to the above Rules 40 CFR 60.5375 & COGCC Rule 805; 3. Auxiliary fueled with sufficient supply and heat to combust or oxidize noncombustible gases in order to control odors and hazardous gases. The flowback combustion device shall be equipped with a reliable continuous ignition source over the duration of flowback, except in conditions that may result in a fire hazard or explosion; and 4. The Operator has a general duty to safely maximize resource recovery and minimize releases to the atmosphere during flowback and subsequent recovery/operation.
27	Emissions mitigation	Leak Detention Plan: Operator will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads and equipment. As part of Extraction’s Leak Detection and Repair (LDAR) program, all equipment including above ground flowlines and piping will be inspected quarterly with an infra-red camera for the first 5 years of production.

28	Emissions mitigation	Exhaust. The exhaust from all engines, motors, coolers and other mechanized equipment shall be vented up or in a direction away from the nearest occupied building.
29	Odor mitigation	805. Oil & gas facilities and equipment shall be operated in such a manner that odors do not constitute a nuisance or hazard to public welfare. Extraction will use a mud cooling system to control the release of odors within the drilling and fracturing fluids. Odor preventing additives will be on site for use if and when needed. Extraction will use a base fluid that will decrease the measurable BTEX and aromatic properties by more than 50% of regular diesel. Operator is prohibited from masking odors from any oil and gas facility site by using masking fragrances.
30	Drilling/Completion Operations	Blowout Prevention Equipment ("BOPE"): A double ram and annular preventer will be used during drilling. Stabbing valves shall be installed in the event of reverse circulation and shall be prior tested with low and high pressure fluid.
31	Drilling/Completion Operations	All fresh water for completions shall be transported to the well site via temporary water lines.
32	Drilling/Completion Operations	BOPE testing for drilling operations. Upon initial rig-up and at least once every thirty (30) days during drilling operations thereafter, pressure testing of the casing string and each component of the blowout prevention equipment including flange connections shall be performed to seventy percent (70%) of working pressure or seventy percent (70%) of the internal yield of casing, whichever is less. Pressure testing shall be conducted and the documented results shall be retained by the operator for inspection by the Director for a period of one (1) year. Activation of the pipe rams for function testing shall be conducted on a daily basis when practicable.
33	Drilling/Completion Operations	Closed chamber drill stem tests shall be allowed. All other drill stem tests shall require approval by the Director. None planned for this well.
34	Drilling/Completion Operations	All loadlines shall be bull plugged or capped.
35	Drilling/Completion Operations	Closed-Loop Pitless Systems for the Containment and/or Recycling of Drilling Fluids. Wells shall be drilled, completed and operated using closed-loop pitless systems for containment and/or recycling of all drilling, completion, flowback and produced fluids. Operator shall recycle fluids to the maximum extent practicable.
36	Drilling/Completion Operations	Flowback Monitoring System: Autonomous 4 gas monitors will be placed around the location during the flowback phase.
37	Drilling/Completion Operations	Bradenhead Monitoring. Operator will conduct bradenhead monitoring on the New Wells as required on the relevant Applications for Permit to Drill - Form 2.
38	Drilling/Completion Operations	Well Integrity. Operator must equip the bradenhead access to the annulus between the production and the surface casing, as well as any intermediate casing, with a fitting to allow safe and convenient determinations of pressure and fluid flow. Valves used for annular pressure monitoring shall remain exposed and not buried to allow for visual inspection. The Operator shall take bradenhead pressure readings as required by the COGCC.
39	Interim Reclamation	Operator shall be responsible for segregating the topsoil, backfilling, re-compacting, reseeding, and re-contouring the surface of any disturbed area so as not to interfere with Owner's operations and shall reclaim such area to be returned to pre-existing conditions as best as possible with control of all noxious weeds.
40	Final Reclamation	Within 90 days subsequent to the time of plugging and abandonment of the entire site, superfluous debris and equipment shall be removed from the site. Identification of plugged and abandoned wells will be identified pursuant to 319.a.(5)The operator shall also inscribe or imbed the well number and date of plugging upon the permanent monument.
41	Final Reclamation	Reclamation. Operator must submit an oil and gas site reclamation plan and reclaim a Well Site not later than six (6) months after plugging and abandoning the last New Well at such Well Site, weather and planting season permitting.

Total: 41 comment(s)

Attachment Check List

Att Doc Num	Name
2316363	ACCESS ROAD MAP
2316365	LOCATION DRAWING
2316366	HYDROLOGY MAP
2316371	CORRESPONDENCE
2316397	OPERATOR RESPONSE TO PUBLIC COMMENTS
2316398	SITING RATIONALE
2316416	COGCC RESPONSE TO PUBLIC COMMENTS
401524113	FORM 2A SUBMITTED
401526544	OTHER
401526587	FACILITY LAYOUT DRAWING
401526611	LOCATION PICTURES
401526612	MULTI-WELL PLAN
401526642	OTHER
401526649	NRCS MAP UNIT DESC
401526650	NRCS MAP UNIT DESC
401526653	SURFACE AGRMT/SURETY
401562835	OTHER
401573025	WASTE MANAGEMENT PLAN

Total Attach: 18 Files

General Comments

User Group	Comment	Comment Date
Permit	Final Review Completed.	08/22/2018
OGLA	The comment response document was updated to remove the reference to bi-annual flowline testing. Bi-annual flowline testing is not required at this location by the Broomfield agreement; flowlines will be tested annually.	08/22/2018
OGLA	The COGCC Commissioners reviewed the Form 2As for the Interchange A&B, Northwest A, and Northwest B Locations and heard comments regarding the Form 2As during the July 30-August 1, 2018 Hearing. A primary concern of the commenters was proximity of the access road for the Interchange A&B and the Northwest A and B Pads to Adams County residents. Many of the commenters were residents of the area and were concerned about potential noise, high traffic volumes, and dust, and lights. The Commissioners instructed the Director to address access road concerns and complete the review of the Form 2As. Staff worked with the operator to place the additional mitigation measure BMPs and COAs for the access road on the Form 2As. The access road was modified moving a portion closer to the Northwest Parkway and further from some of the Adams County residents.	08/16/2018
OGLA	Operator provided revised Access Road map - replaced. Working with Operator on Access Road COA/BMPs. COAs and 1 BMP for Access Road with Operator Concurrence.	08/09/2018
OGLA	Email from Operator for updated distances to HOBU and replaced location drawing, updated water information and replaced hydrology map - disucssed monitoring well depth to water via phone, updated disposal info for water based cuttings, updated BMPs per discussions between City of Broomfield, COGCC, and Operator. Attached Exibit B from City of Broomfield MOU as reference.	07/06/2018
Permit	Permitting review complete.	07/05/2018

OGLA	OGLA review: Add related remote locations, need more for beneficial reuse as referenced in waste management plan, HOBU appears to be closer than indicated on 2A or location drawing, dryland cropland, but NRCS is checked, water resources – surface water body is closer, should be sensitive area based on surface water, water well on 2A is abandoned; monitoring well with shallower depth and active well to the north, Hydrology map appears to have buffer from reference area point.	06/27/2018	
LGD	As the Local Government Designee for the City and County of Broomfield (Broomfield), Broomfield would like to provide the COGCC with an update related to Extraction Oil and Gas, LLC (Extraction) Form 2A permits, by the Colorado Oil and Gas Conservation Commission (COGCC), including the following permit applications: 401524109 United Pad 401524113 Northwest A Pad 401525931 Northwest B Pad By way of an update to the COGCC, on October 24, 2017, Extraction and Broomfield entered into an Amended and Restated Operator Agreement (Agreement).Section 9 of the Agreement provides that Extraction must submit a “Comprehensive Drilling Plan and Application” to Broomfield for such new wells or well sites (Plan).Per the Agreement, that Plan is subject to the review and approval by the City. Broomfield has not approved the Plan as required by the Agreement.Broomfield has been working diligently with Extraction on the Plan, through weekly meetings and timely and reasonable communications with Extraction. The COGCC spacing orders for these spacing units, dated as of October 31, 2017, indicate that any Permits for the wells within these spacing units must “comport with” the Agreement. As stated above, Section 9 of the Agreement provides that Extraction must submit the Plan for all of the well sites that is subject to Broomfield’s approval. On December 15, 2017, Extraction submitted a draft Plan for the Livingston and Interchange B well pads. On January 22, 2018, Broomfield submitted 220 comments on that draft Plan, which included the comment that the Agreement requires the Plan to be for all of the well sites (Comments). Broomfield is still reviewing the last draft of the Plan, which is over 1460 pages in length.Many of Broomfield’s comments on the Plan and Extraction’s responses have included the addition of best management practices that may be enforceable by the COGCC. In both citizens’ and staff comments we have identified areas where Broomfield is requesting additional information and where we believe the Plan is not complete.Broomfield believes that Extraction has an obligation to correct or update any deficient statements in the Plan. The issues that remain outstanding in the Plan include the following: •At meetings with Extraction, Broomfield continues to identify engineering issues that need to be resolved before permitting of the pipeline for all the well sites could go forward. •As of the date of these comments, Broomfield is still working with Extraction on required updates to its Emergency Response Plan and Risk Analysis Plan before those can be approved. Extraction has not identified each type of hazard for each location and specific mitigation measures. •It is Broomfield’s understanding that Extraction has yet to talk with all affected Broomfield and Adams County residents to determine their desired mitigation measures for the well sites and truck roads to the north, even though Extraction committed to such individual communications. •Extraction has not committed in writing to all necessary specific mitigation measures between residents and well sites to the north and east of residents in Adams County and Broomfield.	05/25/2018	

•Extraction has not submitted a final pavement design report for approval by the City and County Engineer.

•Extraction has yet to agree in the Plan to ensure the safety of emergency response teams, construction workers and the general public. Extraction has yet to agree in the Plan that Buffers shall be created as required on site to shield dust, noise, and light from residents

•Broomfield is still reviewing Extraction'slong term reclamation plan.

•Extraction has not provided a complete explanation of its noise modeling approach.

•Extraction has not detailed the noise reduction levels it can achieve.

•Extraction has not provided written detail on the process of "Conduct Recovery Operations" including involvement of Broomfield's Public Health Division.

•

•Extraction has not complied with 2 requirements for the Wetlands Plan.

•Extraction has given only general responses to specific environmental site review requests.

•Extraction has not provided a detailed visual mitigation plan for the well sites, service road, or pig launcher station.

•Extraction has not provided a Drainage Report signed and stamped by a Colorado RegisteredProfessional Engineer. Should be in accordance with Section 100 and 600 of the Broomfield Standards and Specifications.

oPer section 610.00 All ponding facilities shall be of the detention type. Retention Ponds will not be approved

oAll ponds should provide water quality

oAll ponds must drain completely within 72 hours.

oShould be designed for a minor storm of 10yr and a major of 100yr

oAll reports should include the SDI spreadsheet. For more information see the following website:https://maperture.digitaldataservices.com/gvh/?viewer=cswdif

•Provide a Drainage letter for the access road plans.

oProvide historic and proposed drainage basin map

oProvide location and sizing for crossroad pipes both existing and proposed

Other Comments concerning the Form 2A permits include:

Interchange, Northwest, and United Pads Form 2 A Comments

•The FACILITIES section indicates there are 2 gas compressors planned for the location.Extraction should provide information associated with the purpose of the compressors and how will they be fueled.

•The waste management plan only addresses EP Waste.It does not discuss secondary containment and stormwater measures as required by Item 41 in the Best Management Practices of the Operator Agreement.

Interchange, Northwest, and United Pads Form 2 A Comments

•Extraction has committed to a Form 2A BMP on weed control in their Comprehensive Development Plan for Broomfield.Please verify that the weed

	control BMP is included in the Interchange, Northwest, and United Pad Form 2As. •Broomfield requests that COGCC take a close look at the offset well evaluations provided by Extraction Oil and Gas to verify the estimates of offset distances of existing wells (including plugged and abandoned wells) from the new proposed horizontal wells.Broomfield was unable to confirm many of the distances indicated in the OPERATOR COMMENTS AND SUBMITTAL section of the Form 2s based on the OFFSET WELL EVALUATIONS spreadsheet or from the ANTI-COLLISION reports provided. •According to the OFFSET WELL EVALUATIONS spreadsheet provided in the Form 2s, there are many plugged and abandoned wells and several producing wells that have horizontal offsets of less than 150 feet from the proposed new horizontal wells and it is indicated that No Remediation Is Required for these wells.Broomfield is very concerned about the short offset distance for some of these wells; therefore, Broomfield requests that COGCC take a close look to verify the proposed mitigation measures indicated by Extraction Oil and Gas are appropriate as defined by the DJ Basin Horizontal Offset Policy. Broomfield asks that COGCC leave the comment period on the Permits open until all issues are resolved regarding the Plan.Broomfield will continue to work diligently with Extraction on the Plan.		
LGD	1)The COGCC mandated during the October 30, 2017 hearing that it reviews each of the Form 2A locations that impact Adams County residents in a public hearing.Adams County respectfully requests the following Form 2A's be heard before the COGCC in public hearings; a)Interchange A Pad b)Interchange B Pad c) United Pad d)Northwest A Pad e)Northwest B Pad 2)Understanding that selecting an appropriate location for an oil and gas facility is the crux of compatibility, the proposed locations will impact the maximum number of residents by the proposed development. Four locations were initially proposed to access the identified minerals, and only 44 homes were within 1,500 feet of those locations. Today, six locations are proposed to access those same minerals, and approximately 94 homes are within 1,500 feet of those locations, more than doubling the number of people impacted by this proposed development. Those additional impacted residences are located within Adams County, yet as the elected representatives for this neighborhood, the Adams County Board of Commissioners did not have authority in the approval of these sites. Adams County remains deeply concerned about the locations of the well pads and the cumulative impacts they will have on our residents. The Comprehensive Drilling Plan (CDP) that was shared with Adams County does not fully capture the entire proposed development and the cumulative impacts that will be felt by neighbors. Many Adams County residents will be impacted by four or more of the well pads at one time. 3)The Broomfield Comprehensive Plan setbacks necessitated Extraction break up the well pads so that each contains fewer wells. The result of fewer wells on each pad is the distribution of impacts over a larger area, ultimately shifting the burden to a larger number of residents. Adams County has seen increased development of oil and gas facilities, and the current industry standard is the consolidation of wells and their impacts on a single pad, rather than spreading those impacts over a larger area. The proposed Interchange A and B well pads total 33 wells and are proposed to consume over 21 acres of land and shrink to 9 acres during interim reclamation. In Adams County, by contrast, 30+ well pads disturb only about 11 acres of land	05/01/2018	

	and are shrunk to about 5.5 acres during interim reclamation. COGCC 1000 Series rules discuss proper reclamation of the land, including the minimization of surface area disturbance to reduce cumulative impacts, as well as facility consolidation to reduce the fragmentation of wildlife habitat. Extraction's proposal does the opposite of industry standard and COGCC rules. 4)While minimizing the surface disturbance, the consolidation of many wells on a single pad reduces the need for haul roads. Haul roads are planned to be constructed to connect Sheridan Parkway to Huron Street, across the backyards of Adams County residences. These haul roads will see significant construction traffic, creating noise, dust, and safety concerns. Berms or walls have been proposed by the operator, and the mitigation of these significant impacts remains to be addressed in the plans. 5)Many residents have provided public testimony or written comments with concerns about potential impacts to public health, safety, welfare and the environment that this project may cause. There are also many residents who desired to provide testimony and were not awarded the opportunity by Broomfield throughout the process or by the COGCC when representatives of the COGCC were in Broomfield on October 12, 2017. As allowed by COGCC Rule 216 Comprehensive Drilling Plans, Adams County respectfully recommends the Director of the COGCC request a Comprehensive Drilling Plan from Extraction Oil and Gas for the well pads identified in comment one (1). a)Residents of the City and County of Broomfield as well as Adams County were under the impression that a Comprehensive Drilling Plan process was going to be part of Broomfield's Administrative Review by Memorandum of Understanding as outlined in section 9 of City and County of Broomfield Resolution No. 2017-186. i.City and County of Broomfield Oil and Gas Land Use Regulations Chapter 17-54-020 Definitions does not provide a definition for Comprehensive Drilling Plan which infers the definition provided by the COGCC Rule 216. b)The inclusion of agencies such as Colorado Department of Public Health and Environment, Colorado Parks and Wildlife, Local Government Designees as well as surface owners could aid in easing concerns expressed by many residents which will be impacted by this development. In addition, a CDP would ensure that appropriate parties are provided a fair and equitable opportunity to weigh in on concerns.	
OGLA	Comment period extended 10 days at the request of the Broomfield LGD now ending on 5/27/18	04/30/2018
Agency	Passed Completeness.	04/27/2018
OGLA	Passed OGLA Completeness review. Address BMPs/COAs and other issues during the technical review.	04/27/2018
OGLA	This 2A is being pushed back to draft for lack of production information. No completions information is provided. Groundwater depth and comments are not consistent on the 2A. BMPs for engineering controls of storm water and erosion control for this location are not provided. COGCC staff has discussed the same issues on previous permits (Livingston and Interchange A and B) with the Operator.	02/28/2018

Total: 13 comment(s)

FORM 2A Rev 08/13

State of Colorado
Oil and Gas Conservation Commission

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

Oil and Gas Location Assessment

Document Number: 401525931

Date Received: 04/13/2018

☒ New Location ☐ Refile ☐ Amend Existing Location Location#: _____

This Oil and Gas Location Assessment is to be submitted to the COGCC for approval prior to any ground disturbance activity associated with oil and gas operations. Approval of this Oil and Gas Location Assessment will allow for the construction of the below specified Location; however, it does not supersede any land use rules applied by the local land use authority. Please see the COGCC website at http://cogcc.state.co.us/ for all accompanying information pertinent this Oil and Gas Location Assessment.

Location ID: **456775**

Expiration Date: **08/22/2021**

☒ This location assessment is included as part of a permit application.

CONSULTATION

☐ This location is included in a Comprehensive Drilling Plan. CDP # _____
☐ This location is in a sensitive wildlife habitat area.
☐ This location is in a wildlife restricted surface occupancy area.
☐ This location includes a Rule 306.d.(1)A.ii. variance request.

Operator

Operator Number: 10459
Name: EXTRACTION OIL & GAS INC
Address: 370 17TH STREET SUITE 5300
City: DENVER State: CO Zip: 80202

Contact Information

Name: Alyssa Andrews
Phone: (720) 481-2379
Fax: ( )
email: aandrews@extractionog.com

RECLAMATION FINANCIAL ASSURANCE

☒ Plugging and Abandonment Bond Surety ID: 20130028 ☐ Gas Facility Surety ID: _____
☐ Waste Management Surety ID: _____

LOCATION IDENTIFICATION

Name: NORTHWEST B PAD Number: _____
County: BROOMFIELD

QuarterQuarter: NENW Section: 9 Township: 1S Range: 68W Meridian: 6 Ground Elevation: 5298

Define a single point as a location reference for the facility location. When the location is to be used as a well site then the point shall be a well location.

Footage at surface: 1145 feet FNL from North or South section line
1665 feet FWL from East or West section line

Latitude: 39.983547 Longitude: -105.009884

PDOP Reading: 1.3 Date of Measurement: 12/21/2017

Instrument Operator's Name: T. WINNICKI

RELATED REMOTE LOCATIONS

(Enter as many Related Locations as necessary. Enter the Form 2A document # only if there is no established COGCC Location ID#)

This proposed Oil and Gas Location is:	LOCATION ID #	FORM 2A DOC #
Production Facilities Location serves Well(s)		401524113
Well Site is served by Production Facilities		401606721
		401606738

FACILITIES

Indicate the number of each type of oil and gas facility planned on location

Wells	8	Oil Tanks*		Condensate Tanks*		Water Tanks*		Buried Produced Water Vaults*	
Drilling Pits		Production Pits*		Special Purpose Pits		Multi-Well Pits*		Modular Large Volume Tanks	
Pump Jacks		Separators*	16	Injection Pumps*		Cavity Pumps*		Gas Compressors*	4
Gas or Diesel Motors*		Electric Motors		Electric Generators*		Fuel Tanks*		LACT Unit*	
Dehydrator Units*		Vapor Recovery Unit*		VOC Combustor*		Flare*		Pigging Station*	

OTHER FACILITIES*

Other Facility Type	Number
MAINTENANCE VESSEL	1
PRODUCED WATER SURGE DRUM	1
SALES GAS METER	1
ELECTRICAL SWITCHRACK	1
TRANSFORMER	1
OIL SURGE DRUM	1
EMISSIONS CONTROL DEVICE	1
AIR COMPRESSOR	1
GAS LIFT METERING BUILDING	2
PIG LAUNCHER	2

*Those facilities indicated by an asterisk (*) shall be used to determine the distance from the Production Facility to the nearest cultural feature on the Cultural Setbacks Tab.

Per Rule 303.b.(3)C, description of all oil, gas, and/or water pipelines:

Extraction will trench flowlines in one piping corridor that runs between the drill pad and the separator pad and be placed at 12” centers. These lines will most likely be 2” or 3” fusion bonded SCH160 steel pipe and have proper cathodic protection throughout the run. Extraction will then sweep up with a long radius that will tie off each line to the appropriate separator. All welds on these are 100% x-ray and hydro tested to the API and Manufactures specs for a class 1500 series flange. Also meets ASME code B31.4.

CONSTRUCTION

Date planned to commence construction: 09/01/2018 Size of disturbed area during construction in acres: 8.76

Estimated date that interim reclamation will begin: 12/01/2018 Size of location after interim reclamation in acres: 4.56

Estimated post-construction ground elevation: 5298

DRILLING PROGRAM

Will a closed loop system be used for drilling fluids: Yes

Is H_2S anticipated? No

Will salt sections be encountered during drilling: No

Will salt based mud (>15,000 ppm Cl) be used? No

Will oil based drilling fluids be used? Yes

DRILLING WASTE MANAGEMENT PROGRAM

Drilling Fluids Disposal: OFFSITE Drilling Fluids Disposal Method: Commercial Disposal

Cutting Disposal: OFFSITE Cuttings Disposal Method: Commercial Disposal

Other Disposal Description:

The oil-based cuttings will be disposed of similarly and the water-based cuttings may be applied to the land application, facility ID 449314. Both disposal methods may be used for the water-based cuttings.

Beneficial reuse or land application plan submitted?

Reuse Facility ID: or Document Number:

Centralized E&P Waste Management Facility ID, if applicable:

SURFACE & MINERALS & RIGHT TO CONSTRUCT

Name: City&County of Broomfield Phone:

Address: One DesCombes Dr. Fax:

Address: Email:

City: Broomfield State: CO Zip: 80020

Surface Owner: ☒ Fee ☐ State ☐ Federal ☐ Indian

Check all that apply. The Surface Owner:
- ☒ is the mineral owner
- ☒ is committed to an oil and Gas Lease
- ☒ has signed the Oil and Gas Lease
- ☐ is the applicant

The Mineral Owner beneath this Oil and Gas Location is: ☒ Fee ☐ State ☐ Federal ☐ Indian

The Minerals beneath this Oil and Gas Location will be developed from or produced to this Oil and Gas Location: Yes

The right to construct this Oil and Gas Location is granted by: oil and gas lease

Surface damage assurance if no agreement is in place: Surface Surety ID:

Date of Rule 306 surface owner consultation

CURRENT AND FUTURE LAND USE

Current Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

Future Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

CULTURAL DISTANCE INFORMATION

Provide the distance to the nearest cultural feature as measured from Wells or Production Facilities onsite.

	From WELL	From PRODUCTION FACILITY
Building:	728 Feet	616 Feet
Building Unit:	1010 Feet	791 Feet
High Occupancy Building Unit:	4304 Feet	4238 Feet
Designated Outside Activity Area:	5280 Feet	5280 Feet
Public Road:	353 Feet	263 Feet
Above Ground Utility:	1106 Feet	1003 Feet
Railroad:	5280 Feet	5280 Feet
Property Line:	116 Feet	12 Feet

INSTRUCTIONS:
- All measurements shall be provided from center of nearest Well or edge of nearest Production Facility to nearest of each cultural feature as described in Rule 303.b.(3)A.
- Enter 5280 for distance greater than 1 mile.
- Building - nearest building of any type. If nearest Building is a Building Unit, enter same distance for both.
- Building Unit, High Occupancy Building Unit, and Designated Outside Activity Area - as defined in 100-Series Rules.
-For measurement purposes only, Production Facilities should only include those items with an asterisk(*) on the Facilities Tab.

DESIGNATED SETBACK LOCATION INFORMATION

Check all that apply. This location is within a:

- [x] Buffer Zone
- [ ] Exception Zone
- [ ] Urban Mitigation Area

- Buffer Zone - as described in Rule 604.a.(2), within 1,000' of a Building Unit.
- Exception Zone - as described in Rule 604.a.(1), within 500' of a Building Unit.
- Urban Mitigation Area - as defined in 100-Series Rules.
- Large UMA Facility – as defined in 100-Series Rules.

Pre-application Notifications (required if location is within 1,000 feet of a building unit):

Date of Rule 305.a.(1) Urban Mitigation Area Notification to Local Government:

Date of Rule 305.a.(2) Buffer Zone Notification to Building Unit Owners: 01/29/2018

FOR MULTI-WELL PADS AND PRODUCTION FACILTIES WITHIN DESIGNATED SETBACK LOCATIONS ONLY:

- [x] Check this box if this Oil and Gas Location has or will have Production Facilities that serve multiple wells (on or offsite) and the Production Facilities are proposed to be located less than 1,000 feet from a Building Unit. *(Pursuant to Rule 604.c.(2)E.i., the operator must evaluate alternative locations for the Production Facilities that are farther from the Building Unit, and determine whether those alternative locations were technically feasible and economically practicable for the same proposed development.)*

- [x] By checking this box, I certify that no alternative placements for the Production Facilities, farther from the nearest Building Unit, were available based on the analysis conducted pursuant to Rule 604.c.(2)E.i.

In the space below, explain rationale for siting the multi-well Production Facility(ies) that supports your Rule 604.c.(2)E.i determination. Attach documentation that supports your determination to this Form 2A.

Please see the siting rationale attached.

SOIL

List all soil map units that occur within the proposed location. attach the National Resource Conservation Service (NRCS) report showing the "Map Unit Description" report listing the soil typical vertical profile. This data is to used when segregating topsoil.

The required information can be obtained from the NRCS web site at http://soildatamart.nrcs.usda.org/ or from the COGCC web site GIS Online map page found at http://colorado.gov/cogcc. Instructions are provided within the COGCC web site help section.

NRCS Map Unit Name: PlB—Platner loam, 0 to 3 percent slopes

NRCS Map Unit Name: UlC—Ulm loam, 3 to 5 percent slopes

NRCS Map Unit Name:

PLANT COMMUNITY:

Complete this section only if any portion of the disturbed area of the location's current land use is on non-crop land.

Are noxious weeds present: Yes ☐ No ☒

Plant species from: ☐ NRCS or, ☐ field observation Date of observation:

List individual species:

Check all plant communities that exist in the disturbed area.

- ☐ Disturbed Grassland (Cactus, Yucca, Cheatgrass, Rye)
- ☐ Native Grassland (Bluestem, Grama, Wheatgrass, Buffalograss, Fescue, Oatgrass, Brome)
- ☐ Shrub Land (Mahogany, Oak, Sage, Serviceberry, Chokecherry)
- ☐ Plains Riparian (Cottonwood, Willow, Aspen, Maple, Poplar, Russian Olive, Tamarisk)
- ☐ Mountain Riparian (Cottonwood, Willow, Blue Spruce)
- ☐ Forest Land (Spruce, Fir, Ponderosa Pine, Lodgepole Pine, Juniper, Pinyon, Aspen)
- ☐ Wetlands Aquatic (Bullrush, Sedge, Cattail, Arrowhead)
- ☐ Alpine (above timberline)
- ☐ Other (describe):

WATER RESOURCES

Is this a sensitive area: ☐ No ☒ Yes

Distance to nearest

downgradient surface water feature: 27 Feet

water well: 824 Feet

Estimated depth to ground water at Oil and Gas Location 50 Feet

Basis for depth to groundwater and sensitive area determination:

Surface water feature: Ditch 27' NW
Abandoned Monitoring water well (permit no. 47271MH) is 824 feet southeast with a total depth of 50 feet.

Is the location in a riparian area: ☒ No ☐ Yes

Was an Army Corps of Engineers Section 404 permit filed ☒ No ☐ Yes If yes attach permit.

Is the location within a Rule 317B Surface Water Supply Area buffer zone: No

If the location is within a Rule 317B Surface Water Supply Area buffer have all public water supply systems within 15 miles been notified:

Is the Location within a Floodplain? ☒ No ☐ Yes

Floodplain Data Sources Reviewed (check all that apply)

- ☐ Federal (FEMA)
- ☒ State
- ☐ County
- ☐ Local
- ☐ Other

GROUNDWATER BASELINE SAMPLING AND MONITORING AND WATER WELL SAMPLING

Water well sampling required per Rule 318A

WILDLIFE

☐ This location is included in a Wildlife Mitigation Plan

☐ This location was subject to a pre-consultation meeting with CPW held on _____

DESIGNATED SETBACK LOCATION EXCEPTIONS

Check all that apply:

☐ Rule 604.a.(1)A. Exception Zone (within 500' of a Building Unit) and is in an Urban Mitigation Area

☐ Rule 604.b.(1)A. Exception Location (existing or approved Oil & Gas Location now within a Designated Setback as a result of Rule 604.a.)

☐ Rule 604.b.(1)B. Exception Location (existing or approved Oil & Gas Location is within a Designated Setback due to Building Unit construction after Location approval)

☐ Rule 604.b.(2) Exception Location (SUA or site-specific development plan executed on or before August 1, 2013)

☐ Rule 604.b.(3) Exception Location (Building Units constructed after August 1, 2013 within setback per an SUA or site-specific development plan)

RULE 502.b VARIANCE REQUEST

☐ Rule 502.b. Variance Request from COGCC Rule or Spacing Order Number _____

ALL exceptions and variances require attached Request Letter(s). Refer to applicable rule for additional required attachments (e.g. waivers, certifications, SUAs).

OPERATOR COMMENTS AND SUBMITTAL

Comments: Reference well for Location Identification: Northwest B S16-20-1C

Notification Zone Drawing and UMA Check Exhibit both attached as "OTHER". This location is within a buffer zone. This location is not within a Large UMA.

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct and complete.

Signed: _____ Date: 04/13/2018 Email: aandrews@extractionog.com

Print Name: Alyssa Andrews Title: Regulatory Analyst

Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.

COGCC Approved: _____ **Director of COGCC** Date: 8/23/2018

Conditions Of Approval

All representations, stipulations and conditions of approval stated in this Form 2A for this location shall constitute representations, stipulations and conditions of approval for any and all subsequent operations on the location unless this Form 2A is modified by Sundry Notice, Form 4 or an Amended Form 2A.

COA Type	Description
	1.Access Roads/Drive: The access road/drive will be constructed with a Class 6 road base and then covered with recycled asphalt. Access road will be maintained to minimize development of 'washboard'. 2. Access Road/Drive: Operator shall utilize the additional mitigation measures of berms, bales, and/or sound walls to mitigate noise or light. Mitigation measures will be located on the south side of the access road/drive and be strategically placed as necessary to minimize vehicle light pollution to and excessive noise impacts on nearby residences. 3. Access Road/Drive: Operator shall implement a hard surface apron and vehicle tracking pad so vehicles do not track mud or debris onto City streets. Street sweeping services shall be provided if vehicle tracking occurs on public roadways. 4. Access Road/Drive: During construction, drilling, and completions operations, Operator will post warning signs to warn motorists of turning trucks ahead of each of the proposed public road access points. Operator will post signage before each access point to clarify that public access or turns are not allowed into any of the access roads/drives that the Operator will construct. Operator will post stop signs and turn movement restriction instructions at each of their exits. 5. Access Road/Drive: Operator will post 25 mile per hour speed limit signs along the access road/drive. Operator will assess and repost speed reductions as necessary. 6. Access Road/Drive: Operator will restrict non-essential traffic and permitted loads (oversize and/or overweight) traffic to and from Well Sites to periods outside of peak a.m. and p.m. traffic periods and during school hours (generally 7-9 a.m. and 3-6 p.m.).
	In addition to the samples collected in accordance with Rule 318A.f, Extraction shall submit the analytical results to COGCC of all other samples collected from permitted water wells and permitted springs in both Adams County and Broomfield that are within 1/2 mile of the Oil and Gas Location. The operator shall notify the director immediately if there are methane detections as described in Rule 318A.F(8) or if BTEX compounds or TPH are detected in a water sample. The operator shall submit the analytical results to COGCC via a Form 4 Sundry, in an electronic data deliverable (EDD) format, consistent with the procedures in Rule 318.f.(10).
	The Approved Form 2A permit will be posted at the location during construction, drilling, and completions operations.

Best Management Practices

No	BMP/COA Type	Description
1	Planning	Site security will be maintained at all times. Location will be adequately fenced to restrict access by unauthorized persons. The site will have gated access to keep unauthorized vehicles out and fencing will be placed around all production equipment.
2	Planning	The location was approved by an Oil and Gas Operator Agreement with Broomfield on October 24, 2017. The development of this location is subject to a Comprehensive Drilling Plan (CDP) approval from The City and County of Broomfield. Operator is currently working through the CDP application with the City and County of Broomfield staff.
3	Planning	Backup stabbing valves will be required on well servicing operations during reverse circulation. Valves shall be pressure tested before each well servicing operation using both low-pressure air and high-pressure fluid.
4	Planning	All ground within twenty-five (25) feet of any tank, or other structure containing flammable or combustible materials, shall be kept free of dry weeds, grass or rubbish, and shall conform to COGCC 600 Series Safety Regulations and the applicable Fire Code.

5	Planning	Extraction maintains a Tactical Response Plan (TRP), also at times referred to as the Emergency Response Plan, which is designed to provide Extraction employees and designated Emergency Response Team (ERT) members with the information necessary to respond to incidents in a safe, rapid, effective, and efficient manner. The TRP is kept at Extraction's office and a copy is provided to the North Metro Fire Rescue District and the City of Broomfield. Extraction will place the TRP summary card in strategic places on the facilities during specific operational and copies of the summary card is provided to the North Metro Fire Rescue District to be kept in the responding fire engines.
6	Community Outreach and Notification	Extraction will establish a live, 24-hour telephone hotline, as well as an email address, to receive feedback on our drilling and completion activities with the goal of having a tool for us to immediately investigate and address any complaints that arise. Prior to the initiation of 24-hour operations (drilling) Extraction will mail a post card (to include the email address and 24 hour manned phone number) to residents within 1/2 mile of the location.
7	Traffic control	Access Roads: The access road will be constructed to accommodate local emergency vehicles. This road will be maintained for access at all times. Traffic will be routed to minimize local interruption. During construction and through the life of this location, Operator will utilize watering, via water trucks, to control fugitive dust. Additionally, the access road will be constructed with aggregate road base material and recycled asphalt and vehicle speeds will be limited to twenty five miles per hour to reduce dust. No untreated produced water or other process fluids shall be used for dust suppression.
8	Traffic control	A traffic plan is required by the City and County of Broomfield and shall be coordinated with the local jurisdiction prior to commencement of move in and rig up. Any subsequent modification to the traffic plan must be coordinated with the local jurisdiction.
9	Traffic control	Access Road/Drive: 24/7 security shall be provided at entrance of access road/drive to restrict unauthorized access.
10	General Housekeeping	Removal of Debris. All construction-related debris shall be removed from the site for proper disposal in a timely manner. The site shall be maintained free of debris and excess materials at all times during operation. Operator shall not burn or bury debris at any time on the Well Sites. Maintain appearance with garbage clean-up; a trash bin will be located on site to accumulate waste by the personnel drilling the wells. Site will have unused equipment, trash and junk removed immediately and legally disposed of as applicable.
11	Storm Water/Erosion Control	Implement and maintain BMPs to control stormwater runoff in a manner that minimizes erosion, transport of sediment offsite, and site degradation. Co-locate flowlines and/or gathering lines whenever feasible, and mitigate any erosion problems that arise due to the construction of any gathering lines. Location will be covered under Extraction Oil & Gas's field wide permit, permit number COR03M013. Typical stormwater BMPs installed include a diversion ditch and berm with sediment traps and installation of wattles where necessary. Please see the attached Stormwater BMP drawings. Please see the attached Stormwater and Management Plan.
12	Material Handling and Spill Prevention	All loadlines shall be bull plugged or capped.
13	Material Handling and Spill Prevention	The location will be completely automated to monitor all production operations remotely. In the event that the facility is not operating under normal conditions, the automation system will immediately notify the operator. The automation system also has the ability to remotely perform an emergency shut down if necessary.

14	Material Handling and Spill Prevention	Automatic Safety Protective Systems and Surface Safety Valve. An automated safety system, governed by safety devices and a programmable logic computer, will be installed at the Well Sites. The automated safety system shall include the installation, monitoring and remote control of a Surface Safety Valve ("SSV") among many other engineered measures and devices that are implemented to greatly reduce or eliminate the potential for a well event. All New Wells will have a SSV installed prior to the commencement of the Production Phase connected to the production tubing at the surface. The SSV will be equipped to operate remotely via the automated safety protective system, which monitors multiple flowing pressures and rates which have predetermined maximum and/or minimum threshold values programmed and will remotely shut the well in should certain upset conditions be detected. Additionally, the automated safety system provides the ability to remotely shut-in wells on demand through operator remote intervention. The SSV will have documented quarterly testing to ensure functionality.
15	Dust control	805.c. Operator shall employ practices for control of fugitive dust caused by their operations. Such practices shall include but are not limited to the use of speed restrictions, regular road maintenance, restriction of construction activity during high-wind days, and silica dust controls when handling sand used in hydraulic fracturing operations. Additional management practices such as road surfacing, wind breaks and barriers may be used. No untreated produced water or other process fluids shall be used for dust suppression.
16	Construction	803. Permanent lighting will be installed around the facility to allow both the operator and haulers to conduct safe operations at night. All lights will be directed downward, inward and shielded so light pollution is minimized. During the Drilling and Completion Phases, consistent with applicable law, Operator will construct a 32 foot perimeter wall surrounding the well pads and operations area, as permitted, to reduce light escaping from the site.
17	Construction	Base beams will be used and not guy line anchors.
18	Construction	Containment Berms. The Operator shall utilize steel-rim berms around all permanent facility equipment at the Well Sites with sufficient capacity to contain 1.5 times the maximum volume of all liquids that will be contained at a facility at any given time plus sufficient freeboard to prevent overflow. All berms and containment devices shall be inspected quarterly by the Operator and maintained in good condition. No potential ignition sources shall be installed inside the secondary containment area unless the containment area encloses a fired vessel or such sources are rated in accordance with industry codes and standards. Secondary containment such as duck ponds or lined earthen berms for temporary tanks shall also be used. A. Permanent containment berms shall be constructed of steel rings, designed and installed to prevent leakage and resist degradation from erosion or routine operation. B. Secondary containment for tanks shall be constructed with a synthetic or engineered liner that contains all primary containment vessels and is mechanically connected to the steel ring to prevent leakage.
19	Noise mitigation	Quiet Technology. The Operator agrees to use the Liberty Quiet Fleet or comparable technology from an alternative vendor on all Well Sites for completion activities.
20	Noise mitigation	Thirty-two foot sound walls will be used during drilling and completion operations. Sound walls will be installed on the edges impacting nearest neighbors. Sound walls will be placed on the southwest, south, and southeast edges of the pad.

21	Noise mitigation	Baseline noise monitoring will be conducted prior to commencement of pad construction. Additional sound mitigation measures will be considered and implemented pursuant to third party recommendations. All noise survey data will be made available to the COGCC inspector upon request. The Operator shall continuously monitor noise and continuously collect and store noise readings with instruments placed between the Oil and Gas Location and residential Building Units. The Operator shall conduct the monitoring and data collection during construction, drilling, and completions operations. This data shall be available to COGCC on tables or graphs within 48 hours of being requested by COGCC. The Operator shall conduct a 72 hour baseline noise survey from a minimum of three points prior to the commencement of construction.
22	Noise mitigation	For the development wells, to provide long term noise mitigation at this location all production equipment will powered by electricity. If needed, sound mitigation panels will be installed around the compressors during production operations to shield sensitive areas.
23	Noise mitigation	Electrified Drilling Rig - Extraction is working with United Power to supply sufficient electrical power for the drilling rig to drill the wells. Easements are being procured from the Landowners and the existing infrastructure is being upgraded in order to handle the larger electrical loads. While Extraction plans on drilling these wells on electrical power only, the rig will have diesel-powered generators in the event of an upset condition with the electrical supply from United Power. At that point, Extraction would use the diesel generators to power the rig until service from United Power was restored.
24	Emissions mitigation	This location is designed without permanent tanks. Oil, Gas, and produced water will be transported through a pipeline gathering to a Central Gathering Facility. Saleable gas will not be flared, it will be sent downline. For maintenance or upset conditions the use of a maintenance vessel and emission control devices will be utilized. Uncontrolled venting is prohibited other than where necessary for safety. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.
25	Emissions mitigation	Reduced Emission Completions (Commonly known as Green Completions). At Well Sites Operator shall employ reduced emission completions, also commonly known as green completions, which comply with federal and state requirements. In addition, Operator shall comply with the following: A. Gas gathering lines, separators, and sand traps capable of supporting green completions as described in COGCC Rule 805 shall be installed per the provisions of COGCC Rule 805. B. Operator shall comply with 40 CFR 60.5375(a)(1), (2) for green completions. C. Uncontrolled venting is prohibited other than where necessary for safety. D. Temporary flowback flaring and oxidizing equipment where allowed shall include the following: 1. Adequately sized equipment to handle 1.5 times the largest flowback volume of gas from a vertical/directional and/or horizontally completed well respectively as reported to the COGCC in a ten mile radius; 2. Valves and porting available to divert gas to flaring and oxidizing equipment; pursuant to the above Rules 40 CFR 60.5375 & COGCC Rule 805; 3. Auxiliary fueled with sufficient supply and heat to combust or oxidize noncombustible gases in order to control odors and hazardous gases. The flowback combustion device shall be equipped with a reliable continuous ignition source over the duration of flowback, except in conditions that may result in a fire hazard or explosion; and 4. The Operator has a general duty to safely maximize resource recovery and minimize releases to the atmosphere during flowback and subsequent recovery/operation.
26	Emissions mitigation	Leak Detention Plan: Operator will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads and equipment. As part of Extraction's Leak Detection and Repair (LDAR) program, all equipment including above ground flowlines and piping will be inspected quarterly with an infra-red camera for the first 5 years of production.

27	Emissions mitigation	Operator will bring a new oil, gas, and water pipelines, to send produced volumes immediately down the pipeline. No production will flow to tanks on this location. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.
28	Emissions mitigation	Exhaust. The exhaust from all engines, motors, coolers and other mechanized equipment shall be vented up or in a direction away from the nearest occupied building.
29	Odor mitigation	805. Oil & gas facilities and equipment shall be operated in such a manner that odors do not constitute a nuisance or hazard to public welfare. Extraction will use a mud cooling system to control the release of odors within the drilling and fracturing fluids. Odor preventing additives will be on site for use if and when needed. Extraction will use a base fluid that will decrease the measurable BTEX and aromatic properties by more than 50% of regular diesel. Operator is prohibited from masking odors from any oil and gas facility site by using masking fragrances.
30	Drilling/Completion Operations	Blowout Prevention Equipment ("BOPE"): A double ram and annular preventer will be used during drilling. Stabbing valves shall be installed in the event of reverse circulation and shall be prior tested with low and high pressure fluid.
31	Drilling/Completion Operations	Leak Detention Plan: Extraction will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads, tanks and fittings. Additionally annual SPCC inspections will be conducted and documented. Annual flowline testing will also occur according to COGCC rules 1101 and 1102. Inspection and record retention of flowline testing will be in accordance per COGCC regulation. All records will be made available to the COGCC upon request.
32	Drilling/Completion Operations	All fresh water for completions shall be transported to the well site via temporary water lines.
33	Drilling/Completion Operations	BOPE testing for drilling operations. Upon initial rig-up and at least once every thirty (30) days during drilling operations thereafter, pressure testing of the casing string and each component of the blowout prevention equipment including flange connections shall be performed to seventy percent (70%) of working pressure or seventy percent (70%) of the internal yield of casing, whichever is less. Pressure testing shall be conducted and the documented results shall be retained by the operator for inspection by the Director for a period of one (1) year. Activation of the pipe rams for function testing shall be conducted on a daily basis when practicable.
34	Drilling/Completion Operations	Closed chamber drill stem tests shall be allowed. All other drill stem tests shall require approval by the Director. None planned for this well.
35	Drilling/Completion Operations	Closed-Loop Pitless Systems for the Containment and/or Recycling of Drilling Fluids. Wells shall be drilled, completed and operated using closed-loop pitless systems for containment and/or recycling of all drilling, completion, flowback and produced fluids. Operator shall recycle fluids to the maximum extent practicable.
36	Drilling/Completion Operations	Flowback Monitoring System: Autonomous 4 gas monitors will be placed around the location during the flowback phase.
37	Drilling/Completion Operations	Well Integrity. Operator must equip the bradenhead access to the annulus between the production and the surface casing, as well as any intermediate casing, with a fitting to allow safe and convenient determinations of pressure and fluid flow. Valves used for annular pressure monitoring shall remain exposed and not buried to allow for visual inspection. The Operator shall take bradenhead pressure readings as required by the COGCC.
38	Drilling/Completion Operations	Bradenhead Monitoring. Operator will conduct bradenhead monitoring on the New Wells as required on the relevant Applications for Permit to Drill - Form 2.
39	Interim Reclamation	Operator shall be responsible for segregating the topsoil, backfilling, re-compacting, reseeding, and re-contouring the surface of any disturbed area so as not to interfere with Owner's operations and shall reclaim such area to be returned to pre-existing conditions as best as possible with control of all noxious weeds.
40	Final Reclamation	Within 90 days subsequent to the time of plugging and abandonment of the entire site, superfluous debris and equipment shall be removed from the site. Identification of plugged and abandoned wells will be identified pursuant to 319.a.(5)The operator shall also inscribe or imbed the well number and date of plugging upon the permanent monument.

41	Final Reclamation	Reclamation. Operator must submit an oil and gas site reclamation plan and reclaim a Well Site not later than six (6) months after plugging and abandoning the last New Well at such Well Site, weather and planting season permitting.

Total: 41 comment(s)

Attachment Check List

Att Doc Num	Name
2316356	LOCATION DRAWING
2316357	HYDROLOGY MAP
2316358	RULE 306.E. CERTIFICATION
2316362	ACCESS ROAD MAP
2316372	CORRESPONDENCE
2316397	OPERATOR RESPONSE TO PUBLIC COMMENTS
2316398	SITING RATIONALE
2316416	COGCC RESPONSE TO PUBLIC COMMENTS
401525931	FORM 2A SUBMITTED
401526656	SITING RATIONALE
401526660	FACILITY LAYOUT DRAWING
401526673	LOCATION PICTURES
401526675	MULTI-WELL PLAN
401526683	NRCS MAP UNIT DESC
401526684	NRCS MAP UNIT DESC
401526685	SURFACE AGRMT/SURETY
401543292	OTHER
401543294	OTHER
401555283	PRE-APPLICATION NOTIFICATION CERTIFICATION
401562836	OTHER
401573026	WASTE MANAGEMENT PLAN
401600699	PRE-APPLICATION NOTIFICATION CERTIFICATION

Total Attach: 22 Files

General Comments

User Group	Comment	Comment Date
Permit	Final Review Completed.	08/22/2018
OGLA	The comment response document was updated to remove the reference to bi-annual flowline testing. Bi-annual flowline testing is not required at this location by the Broomfield agreement; flowlines will be tested annually.	08/22/2018
OGLA	The COGCC Commissioners reviewed the Form 2As for the Interchange A&B, Northwest A, and Northwest B Locations and heard comments regarding the Form 2As during the July 30-August 1, 2018 Hearing. A primary concern of the commenters was proximity of the access road for the Interchange A&B and the Northwest A and B Pads to Adams County residents. Many of the commenters were residents of the area and were concerned about potential noise, high traffic volumes, and dust, and lights. The Commissioners instructed the Director to address access road concerns and complete the review of the Form 2As. Staff worked with the operator to place the additional mitigation measure BMPs and COAs for the access road on the Form 2As. The access road was modified moving a portion closer to the Northwest Parkway and further from some of the Adams County residents.	08/16/2018
OGLA	Operator provided revised Access Road Map - replaced. Working with Operator on Access Road COA/BMPs. COAs and 1 BMP for Access Road with Operator Concurrence.	08/09/2018

Permit	Status Active - with operator concurrence: - changed right to construct from "SUA" to "Lease". - changed "minerals beneath this location will be developed" to YES. - changed distance to nearest road from 356' to 353'. Permitting review complete.	07/16/2018	
Permit	Status Pending - contacted Operator for corrections: - change right to construct from SUA to Lease, and change "minerals beneath this location will be developed" from NO to YES, as the Northwest 1C & 2N wells are developing the lease under the surface in section 9.	07/05/2018	
OGLA	Reviewed BMPs and updated as agreed on by the Operator and discussions with City of Broomfield added Exibit B from City of Broomfield MOU.	07/03/2018	
OGLA	Operator provided updated location drawing with high occupancy building unit, updated hydrology map, and 306.e. certification - attached. Added information for water based drill cuttings, added related remote locations.	07/02/2018	
LGD	As the Local Government Designee for the City and County of Broomfield (Broomfield), Broomfield would like to provide the COGCC with an update related to Extraction Oil and Gas, LLC (Extraction) Form 2A permits, by the Colorado Oil and Gas Conservation Commission (COGCC), including the following permit applications: 401524109 United Pad 401524113 Northwest A Pad 401525931 Northwest B Pad By way of an update to the COGCC, on October 24, 2017, Extraction and Broomfield entered into an Amended and Restated Operator Agreement (Agreement).Section 9 of the Agreement provides that Extraction must submit a “Comprehensive Drilling Plan and Application” to Broomfield for such new wells or well sites (Plan).Per the Agreement, that Plan is subject to the review and approval by the City. Broomfield has not approved the Plan as required by the Agreement.Broomfield has been working diligently with Extraction on the Plan, through weekly meetings and timely and reasonable communications with Extraction. The COGCC spacing orders for these spacing units, dated as of October 31, 2017, indicate that any Permits for the wells within these spacing units must “comport with” the Agreement. As stated above, Section 9 of the Agreement provides that Extraction must submit the Plan for all of the well sites that is subject to Broomfield’s approval. On December 15, 2017, Extraction submitted a draft Plan for the Livingston and Interchange B well pads. On January 22, 2018, Broomfield submitted 220 comments on that draft Plan, which included the comment that the Agreement requires the Plan to be for all of the well sites (Comments). Broomfield is still reviewing the last draft of the Plan, which is over 1460 pages in length.Many of Broomfield’s comments on the Plan and Extraction’s responses have included the addition of best management practices that may be enforceable by the COGCC. In both citizens’ and staff comments we have identified areas where Broomfield is requesting additional information and where we believe the Plan is not complete.Broomfield believes that Extraction has an obligation to correct or update any deficient statements in the Plan. The issues that remain outstanding in the Plan include the following: •At meetings with Extraction, Broomfield continues to identify engineering issues that need to be resolved before permitting of the pipeline for all the well sites could go forward. •As of the date of these comments, Broomfield is still working with Extraction on required updates to its Emergency Response Plan and Risk Analysis Plan before those can be approved. Extraction has not identified each type of hazard for each	05/25/2018	

location and specific mitigation measures.

•It is Broomfield's understanding that Extraction has yet to talk with all affected Broomfield and Adams County residents to determine their desired mitigation measures for the well sites and truck roads to the north, even though Extraction committed to such individual communications.

•Extraction has not committed in writing to all necessary specific mitigation measures between residents and well sites to the north and east of residents in Adams County and Broomfield.

•Extraction has not submitted a final pavement design report for approval by the City and County Engineer.

•Extraction has yet to agree in the Plan to ensure the safety of emergency response teams, construction workers and the general public. Extraction has yet to agree in the Plan that Buffers shall be created as required on site to shield dust, noise, and light from residents

•Broomfield is still reviewing Extraction'slong term reclamation plan.

•Extraction has not provided a complete explanation of its noise modeling approach.

•Extraction has not detailed the noise reduction levels it can achieve.

•Extraction has not provided written detail on the process of "Conduct Recovery Operations" including involvement of Broomfield's Public Health Division.

•

•Extraction has not complied with 2 requirements for the Wetlands Plan.

•Extraction has given only general responses to specific environmental site review requests.

•Extraction has not provided a detailed visual mitigation plan for the well sites, service road, or pig launcher station.

•Extraction has not provided a Drainage Report signed and stamped by a Colorado RegisteredProfessional Engineer. Should be in accordance with Section 100 and 600 of the Broomfield Standards and Specifications.

oPer section 610.00 All ponding facilities shall be of the detention type. Retention Ponds will not be approved

oAll ponds should provide water quality

oAll ponds must drain completely within 72 hours.

oShould be designed for a minor storm of 10yr and a major of 100yr

oAll reports should include the SDI spreadsheet. For more information see the following website:https://maperture.digitaldataservices.com/gvh/?viewer=cswdif

•Provide a Drainage letter for the access road plans.

oProvide historic and proposed drainage basin map

oProvide location and sizing for crossroad pipes both existing and proposed

Other Comments concerning the Form 2A permits include:

Interchange, Northwest, and United Pads Form 2 A Comments

•The FACILITIES section indicates there are 2 gas compressors planned for the

	location.Extraction should provide information associated with the purpose of the compressors and how will they be fueled. •The waste management plan only addresses EP Waste.It does not discuss secondary containment and stormwater measures as required by Item 41 in the Best Management Practices of the Operator Agreement. Interchange, Northwest, and United Pads Form 2 A Comments •Extraction has committed to a Form 2A BMP on weed control in their Comprehensive Development Plan for Broomfield.Please verify that the weed control BMP is included in the Interchange, Northwest, and United Pad Form 2As. •Broomfield requests that COGCC take a close look at the offset well evaluations provided by Extraction Oil and Gas to verify the estimates of offset distances of existing wells (including plugged and abandoned wells) from the new proposed horizontal wells.Broomfield was unable to confirm many of the distances indicated in the OPERATOR COMMENTS AND SUBMITTAL section of the Form 2s based on the OFFSET WELL EVALUATIONS spreadsheet or from the ANTI-COLLISION reports provided. •According to the OFFSET WELL EVALUATIONS spreadsheet provided in the Form 2s, there are many plugged and abandoned wells and several producing wells that have horizontal offsets of less than 150 feet from the proposed new horizontal wells and it is indicated that No Remediation Is Required for these wells.Broomfield is very concerned about the short offset distance for some of these wells; therefore, Broomfield requests that COGCC take a close look to verify the proposed mitigation measures indicated by Extraction Oil and Gas are appropriate as defined by the DJ Basin Horizontal Offset Policy. Broomfield asks that COGCC leave the comment period on the Permits open until all issues are resolved regarding the Plan.Broomfield will continue to work diligently with Extraction on the Plan.		
LGD	1)The COGCC mandated during the October 30, 2017 hearing that it reviews each of the Form 2A locations that impact Adams County residents in a public hearing.Adams County respectfully requests the following Form 2A's be heard before the COGCC in public hearings; a)Interchange A Pad b)Interchange B Pad c) United Pad d)Northwest A Pad e)Northwest B Pad 2)Understanding that selecting an appropriate location for an oil and gas facility is the crux of compatibility, the proposed locations will impact the maximum number of residents by the proposed development. Four locations were initially proposed to access the identified minerals, and only 44 homes were within 1,500 feet of those locations. Today, six locations are proposed to access those same minerals, and approximately 94 homes are within 1,500 feet of those locations, more than doubling the number of people impacted by this proposed development. Those additional impacted residences are located within Adams County, yet as the elected representatives for this neighborhood, the Adams County Board of Commissioners did not have authority in the approval of these sites. Adams County remains deeply concerned about the locations of the well pads and the cumulative impacts they will have on our residents. The Comprehensive Drilling Plan (CDP) that was shared with Adams County does not fully capture the entire proposed development and the cumulative impacts that will be felt by neighbors. Many Adams County residents will be impacted by four or more of the well pads at	05/01/2018	

	one time. 3)The Broomfield Comprehensive Plan setbacks necessitated Extraction break up the well pads so that each contains fewer wells. The result of fewer wells on each pad is the distribution of impacts over a larger area, ultimately shifting the burden to a larger number of residents. Adams County has seen increased development of oil and gas facilities, and the current industry standard is the consolidation of wells and their impacts on a single pad, rather than spreading those impacts over a larger area. The proposed Interchange A and B well pads total 33 wells and are proposed to consume over 21 acres of land and shrink to 9 acres during interim reclamation. In Adams County, by contrast, 30+ well pads disturb only about 11 acres of land and are shrunk to about 5.5 acres during interim reclamation. COGCC 1000 Series rules discuss proper reclamation of the land, including the minimization of surface area disturbance to reduce cumulative impacts, as well as facility consolidation to reduce the fragmentation of wildlife habitat. Extraction's proposal does the opposite of industry standard and COGCC rules. 4)While minimizing the surface disturbance, the consolidation of many wells on a single pad reduces the need for haul roads. Haul roads are planned to be constructed to connect Sheridan Parkway to Huron Street, across the backyards of Adams County residences. These haul roads will see significant construction traffic, creating noise, dust, and safety concerns. Berms or walls have been proposed by the operator, and the mitigation of these significant impacts remains to be addressed in the plans. 5)Many residents have provided public testimony or written comments with concerns about potential impacts to public health, safety, welfare and the environment that this project may cause. There are also many residents who desired to provide testimony and were not awarded the opportunity by Broomfield throughout the process or by the COGCC when representatives of the COGCC were in Broomfield on October 12, 2017. As allowed by COGCC Rule 216 Comprehensive Drilling Plans, Adams County respectfully recommends the Director of the COGCC request a Comprehensive Drilling Plan from Extraction Oil and Gas for the well pads identified in comment one (1). a)Residents of the City and County of Broomfield as well as Adams County were under the impression that a Comprehensive Drilling Plan process was going to be part of Broomfield's Administrative Review by Memorandum of Understanding as outlined in section 9 of City and County of Broomfield Resolution No. 2017-186. i.City and County of Broomfield Oil and Gas Land Use Regulations Chapter 17-54-020 Definitions does not provide a definition for Comprehensive Drilling Plan which infers the definition provided by the COGCC Rule 216. b)The inclusion of agencies such as Colorado Department of Public Health and Environment, Colorado Parks and Wildlife, Local Government Designees as well as surface owners could aid in easing concerns expressed by many residents which will be impacted by this development. In addition, a CDP would ensure that appropriate parties are provided a fair and equitable opportunity to weigh in on concerns.	
OGLA	Comment period extended 10 days at the request of the Broomfield LGD now ending on 5/27/18	04/30/2018
Permit	Passed Completeness.	04/27/2018
OGLA	Passed OGLA Completeness review. Address BMPs/COAs and other issues during the technical review.	04/27/2018

Total: 13 comment(s)

Exhibit 9

Monthly Project Schedule

April 2019 Update*

{Provided 4/8/2019}

Broomfield Project Schedule - Monthly Forecast as of ~April 2019*

		2019												2020												2021											
		Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Broomfield Project Area	Permitting	State & Local Permit Processes - - >																																			
	Pipeline Construction	Installing Segments & Crossings - -						Testing			**Pipeline Operational**																											--->
Interchange B 17 Wells with two Phases 1st Initial Wells 2nd Remaining Wells	**Construction**	Pad & Access Drive																								Interim Reclamation											
	Drilling																																				
	Completions																																				
	Frac																																				
	Coil																																				
	Tubing																																				
	Flowback																																				
	Production																																				--->
	Related Legacy Well P&A										P&A Legacy Wells																											
Livingston 19 Wells	**Construction**		Pad																					Interim Reclamation													
	Drilling																																				
	Completions																																				
	Frac																																				
	Coil																																				
	Tubing																																				
	Flowback																																				
	Production																																				--->
	Related Legacy Well P&A																				P&A Legacy Wells															
Northwest A 8 Wells	**Construction**				Pad																			Interim Reclamation													
	Drilling																																				
	Completions																																				
	Frac																																				
	Coil																																				
	Tubing																																				
	Flowback																																				
	Production																																				--->
	Related Legacy Well P&A																				P&A Legacy Wells															
Northwest B 8 Wells	**Construction**							Pad																Interim Reclamation													
	Drilling																																				
	Completions																																				
	Frac																																				
	Coil																																				
	Tubing																																				
	Flowback																																				
	Production																																				--->
	Related Legacy Well P&A																				P&A Legacy Wells															
United 16 Wells	**Construction**								Pad															Interim Reclamation													
	Drilling																																				
	Completions																																				
	Frac																																				
	Coil																																				
	Tubing																																				
	Flowback																																				
	Production																																				--->
	Related Legacy Well P&A																					P&A Legacy Wells														
Interchange A 16 Wells	**Construction**		Pad																											Interim Reclamation							
	Drilling																																				
	Completions																																				
	Frac																																				
	Coil																																				
	Tubing																																				
	Flowback																																				
	Production																																				--->
	Related Legacy Well P&A																												P&A Legacy Wells							

*The project schedule is a monthly forecast of upcoming activities and has multiple influencing factors and is subject to frequent changes, such as impacts from permit approvals, weather events, and operational progressions.

Exhibit 10

FORM 2A Rev 08/13

State of Colorado
Oil and Gas Conservation Commission

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

Oil and Gas Location Assessment

Document Number: 401524109

Date Received: 04/13/2018

☒ New Location ☐ Refile ☐ Amend Existing Location Location#: _____

This Oil and Gas Location Assessment is to be submitted to the COGCC for approval prior to any ground disturbance activity associated with oil and gas operations. Approval of this Oil and Gas Location Assessment will allow for the construction of the below specified Location; however, it does not supersede any land use rules applied by the local land use authority. Please see the COGCC website at http://cogcc.state.co.us/ for all accompanying information pertinent this Oil and Gas Location Assessment.

Location ID: **457722**

Expiration Date: **10/01/2021**

☒ This location assessment is included as part of a permit application.

CONSULTATION

☐ This location is included in a Comprehensive Drilling Plan. CDP # _____
☐ This location is in a sensitive wildlife habitat area.
☐ This location is in a wildlife restricted surface occupancy area.
☐ This location includes a Rule 306.d.(1)A.ii. variance request.

Operator

Operator Number: 10459
Name: EXTRACTION OIL & GAS INC
Address: 370 17TH STREET SUITE 5300
City: DENVER State: CO Zip: 80202

Contact Information

Name: Alyssa Andrews
Phone: (720) 481-2379
Fax: ( )
email: aandrews@extractionog.com

RECLAMATION FINANCIAL ASSURANCE

☒ Plugging and Abandonment Bond Surety ID: 20130028 ☐ Gas Facility Surety ID: _____
☐ Waste Management Surety ID: _____

LOCATION IDENTIFICATION

Name: UNITED PAD Number: _____
County: BROOMFIELD

QuarterQuarter: NENE Section: 9 Township: 1S Range: 68W Meridian: 6 Ground Elevation: 5259

Define a single point as a location reference for the facility location. When the location is to be used as a well site then the point shall be a well location.

Footage at surface: 479 feet FNL from North or South section line
1232 feet FEL from East or West section line

Latitude: 39.985363 Longitude: -105.001614

PDOP Reading: 1.2 Date of Measurement: 10/19/2017

Instrument Operator's Name: T. WINNICKI

RELATED REMOTE LOCATIONS

(Enter as many Related Locations as necessary. Enter the Form 2A document # only if there is no established COGCC Location ID#)

This proposed Oil and Gas Location is:	LOCATION ID #	FORM 2A DOC #
Well Site is served by Production Facilities		401606738
		401606721

FACILITIES

Indicate the number of each type of oil and gas facility planned on location

Wells	16	Oil Tanks*		Condensate Tanks*		Water Tanks*		Buried Produced Water Vaults*	
Drilling Pits		Production Pits*		Special Purpose Pits		Multi-Well Pits*		Modular Large Volume Tanks	
Pump Jacks		Separators*	16	Injection Pumps*		Cavity Pumps*		Gas Compressors*	3
Gas or Diesel Motors*		Electric Motors		Electric Generators*		Fuel Tanks*		LACT Unit*	
Dehydrator Units*		Vapor Recovery Unit*		VOC Combustor*		Flare*		Pigging Station*	

OTHER FACILITIES*

Other Facility Type	Number
OIL SURGE DRUM	1
ELECTRICAL SWITCHRACK	1
GAS LIFT METERING BUILDING	2
SALES GAS METER	1
AIR COMPRESSOR	1
TRANSFORMER	1
EMISSIONS CONTROL DEVICE	1
MAINTENANCE VESSEL	1
COMPRESSOR DRAIN TANK	1
PIG LAUNCHER	2
PRODUCED WATER SURGE DRUM	1

*Those facilities indicated by an asterisk (*) shall be used to determine the distance from the Production Facility to the nearest cultural feature on the Cultural Setbacks Tab.

Per Rule 303.b.(3)C, description of all oil, gas, and/or water pipelines:

Extraction will trench flowlines in one piping corridor that runs between the drill pad and the separator pad and be placed at 12” centers. These lines will most likely be 2” or 3” fusion bonded SCH160 steel pipe and have proper cathodic protection throughout the run. Extraction will then sweep up with a long radius that will tie off each line to the appropriate separator. All welds on these are 100% x-ray and hydro tested to the API and Manufactures specs for a class 1500 series flange. Also meets ASME code B31.4.

CONSTRUCTION

Date planned to commence construction: 05/01/2019 Size of disturbed area during construction in acres: 17.33

Estimated date that interim reclamation will begin: 11/01/2019 Size of location after interim reclamation in acres: 6.86

Estimated post-construction ground elevation: 5259

DRILLING PROGRAM

Will a closed loop system be used for drilling fluids: Yes

Is H_2S anticipated? No

Will salt sections be encountered during drilling: No

Will salt based mud (>15,000 ppm Cl) be used? No

Will oil based drilling fluids be used? Yes

DRILLING WASTE MANAGEMENT PROGRAM

Drilling Fluids Disposal: OFFSITE Drilling Fluids Disposal Method: Commercial Disposal

Cutting Disposal: OFFSITE Cuttings Disposal Method: Commercial Disposal

Other Disposal Description:

The oil-based cuttings will be disposed of similarly and the water-based cuttings may be applied to the land application, facility ID 449314. Both disposal methods may be used for the water-based cuttings.

Beneficial reuse or land application plan submitted?

Reuse Facility ID: or Document Number:

Centralized E&P Waste Management Facility ID, if applicable:

SURFACE & MINERALS & RIGHT TO CONSTRUCT

Name: City&County of Broomfield Phone:

Address: One DesCombes Dr. Fax:

Address: Email:

City: Broomfield State: CO Zip: 80020

Surface Owner: ☒ Fee ☐ State ☐ Federal ☐ Indian

Check all that apply. The Surface Owner:
- ☒ is the mineral owner
- ☒ is committed to an oil and Gas Lease
- ☒ has signed the Oil and Gas Lease
- ☐ is the applicant

The Mineral Owner beneath this Oil and Gas Location is: ☒ Fee ☐ State ☐ Federal ☐ Indian

The Minerals beneath this Oil and Gas Location will be developed from or produced to this Oil and Gas Location: Yes

The right to construct this Oil and Gas Location is granted by: oil and gas lease

Surface damage assurance if no agreement is in place: Surface Surety ID:

Date of Rule 306 surface owner consultation

CURRENT AND FUTURE LAND USE

Current Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

Future Land Use (Check all that apply):

Crop Land:	☐ Irrigated	☒ Dry land	☐ Improved Pasture	☐ Hay Meadow	☐ CRP
Non-Crop Land:	☐ Rangeland	☐ Timber	☐ Recreational	☐ Other (describe):	
Subdivided:	☐ Industrial	☐ Commercial	☐ Residential		

CULTURAL DISTANCE INFORMATION

Provide the distance to the nearest cultural feature as measured from Wells or Production Facilities onsite.

	From WELL	From PRODUCTION FACILITY
Building:	1125 Feet	790 Feet
Building Unit:	1125 Feet	790 Feet
High Occupancy Building Unit:	5203 Feet	5280 Feet
Designated Outside Activity Area:	5280 Feet	5280 Feet
Public Road:	278 Feet	213 Feet
Above Ground Utility:	318 Feet	322 Feet
Railroad:	5280 Feet	5280 Feet
Property Line:	15 Feet	125 Feet

INSTRUCTIONS:
- All measurements shall be provided from center of nearest Well or edge of nearest Production Facility to nearest of each cultural feature as described in Rule 303.b.(3)A.
- Enter 5280 for distance greater than 1 mile.
- Building - nearest building of any type. If nearest Building is a Building Unit, enter same distance for both.
- Building Unit, High Occupancy Building Unit, and Designated Outside Activity Area - as defined in 100-Series Rules.
-For measurement purposes only, Production Facilities should only include those items with an asterisk(*) on the Facilities Tab.

DESIGNATED SETBACK LOCATION INFORMATION

Check all that apply. This location is within a:

- ☒ Buffer Zone
- ☐ Exception Zone
- ☐ Urban Mitigation Area

- Buffer Zone - as described in Rule 604.a.(2), within 1,000' of a Building Unit.
- Exception Zone - as described in Rule 604.a.(1), within 500' of a Building Unit.
- Urban Mitigation Area - as defined in 100-Series Rules.
- Large UMA Facility – as defined in 100-Series Rules.

Pre-application Notifications (required if location is within 1,000 feet of a building unit):

Date of Rule 305.a.(1) Urban Mitigation Area Notification to Local Government:

Date of Rule 305.a.(2) Buffer Zone Notification to Building Unit Owners: 01/29/2018

FOR MULTI-WELL PADS AND PRODUCTION FACILTIES WITHIN DESIGNATED SETBACK LOCATIONS ONLY:

☒ Check this box if this Oil and Gas Location has or will have Production Facilities that serve multiple wells (on or offsite) and the Production Facilities are proposed to be located less than 1,000 feet from a Building Unit. *(Pursuant to Rule 604.c.(2)E.i., the operator must evaluate alternative locations for the Production Facilities that are farther from the Building Unit, and determine whether those alternative locations were technically feasible and economically practicable for the same proposed development.)*

☒ By checking this box, I certify that no alternative placements for the Production Facilities, farther from the nearest Building Unit, were available based on the analysis conducted pursuant to Rule 604.c.(2)E.i.

In the space below, explain rationale for siting the multi-well Production Facility(ies) that supports your Rule 604.c.(2)E.i determination. Attach documentation that supports your determination to this Form 2A.

Please see the siting rationale attached.

SOIL

List all soil map units that occur within the proposed location. attach the National Resource Conservation Service (NRCS) report showing the "Map Unit Description" report listing the soil typical vertical profile. This data is to used when segregating topsoil.

The required information can be obtained from the NRCS web site at http://soildatamart.nrcs.usda.org/ or from the COGCC web site GIS Online map page found at http://colorado.gov/cogcc. Instructions are provided within the COGCC web site help section.

NRCS Map Unit Name: PlB—Platner loam, 0 to 3 percent slopes

NRCS Map Unit Name:

NRCS Map Unit Name:

PLANT COMMUNITY:

Complete this section only if any portion of the disturbed area of the location's current land use is on non-crop land.

Are noxious weeds present: Yes ☐ No ☒

Plant species from: ☐ NRCS or, ☐ field observation Date of observation: .

List individual species:

Check all plant communities that exist in the disturbed area.

- ☐ Disturbed Grassland (Cactus, Yucca, Cheatgrass, Rye)
- ☐ Native Grassland (Bluestem, Grama, Wheatgrass, Buffalograss, Fescue, Oatgrass, Brome)
- ☐ Shrub Land (Mahogany, Oak, Sage, Serviceberry, Chokecherry)
- ☐ Plains Riparian (Cottonwood, Willow, Aspen, Maple, Poplar, Russian Olive, Tamarisk)
- ☐ Mountain Riparian (Cottonwood, Willow, Blue Spruce)
- ☐ Forest Land (Spruce, Fir, Ponderosa Pine, Lodgepole Pine, Juniper, Pinyon, Aspen)
- ☐ Wetlands Aquatic (Bullrush, Sedge, Cattail, Arrowhead)
- ☐ Alpine (above timberline)
- ☐ Other (describe):

WATER RESOURCES

Is this a sensitive area: ☐ No ☒ Yes

Distance to nearest

downgradient surface water feature: 0 Feet

water well: 302 Feet

Estimated depth to ground water at Oil and Gas Location 15 Feet

Basis for depth to groundwater and sensitive area determination:

Surface water feature: Ditch 0' N
Nearest water well: Permit #24143- - , 400' SE
Depth to ground water: 170' provided by water well Permit #24143- - , 400' SE
Groundwater monitoring well located approximately 500 feet southwest has a depth to water of 15 feet.

Is the location in a riparian area: ☒ No ☐ Yes

Was an Army Corps of Engineers Section 404 permit filed ☒ No ☐ Yes If yes attach permit.

Is the location within a Rule 317B Surface Water Supply Area buffer zone: No

If the location is within a Rule 317B Surface Water Supply Area buffer have all public water supply systems within 15 miles been notified:

Is the Location within a Floodplain? ☒ No ☐ Yes

Floodplain Data Sources Reviewed (check all that apply)

- ☐ Federal (FEMA)
- ☒ State
- ☐ County
- ☐ Local
- ☐ Other

GROUNDWATER BASELINE SAMPLING AND MONITORING AND WATER WELL SAMPLING

Water well sampling required per Rule 318A

WILDLIFE

- ☐ This location is included in a Wildlife Mitigation Plan
- ☐ This location was subject to a pre-consultation meeting with CPW held on

DESIGNATED SETBACK LOCATION EXCEPTIONS

Check all that apply:

- ☐ Rule 604.a.(1)A. Exception Zone (within 500’ of a Building Unit) and is in an Urban Mitigation Area
- ☐ Rule 604.b.(1)A. Exception Location (existing or approved Oil & Gas Location now within a Designated Setback as a result of Rule 604.a.)
- ☐ Rule 604.b.(1)B. Exception Location (existing or approved Oil & Gas Location is within a Designated Setback due to Building Unit construction after Location approval)
- ☐ Rule 604.b.(2) Exception Location (SUA or site-specific development plan executed on or before August 1, 2013)
- ☐ Rule 604.b.(3) Exception Location (Building Units constructed after August 1, 2013 within setback per an SUA or site-specific development plan)

RULE 502.b VARIANCE REQUEST

☐ Rule 502.b. Variance Request from COGCC Rule or Spacing Order Number _____

ALL exceptions and variances require attached Request Letter(s). Refer to applicable rule for additional required attachments (e.g. waivers, certifications, SUAs).

OPERATOR COMMENTS AND SUBMITTAL

Comments: Reference well for Location Identification: United A S16-20-3N

Notification Zone Drawing and UMA Check Exhibit both attached as "OTHER". This location is in a buffer zone. This location is not within a Large UMA.

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct and complete.
Signed: _____ Date: 04/13/2018 Email: aandrews@extractionog.com

Print Name: Alyssa Andrews Title: Regulatory Analyst

Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.

COGCC Approved: _____ **Director of COGCC** Date: 10/2/2018

Conditions Of Approval

All representations, stipulations and conditions of approval stated in this Form 2A for this location shall constitute representations, stipulations and conditions of approval for any and all subsequent operations on the location unless this Form 2A is modified by Sundry Notice, Form 4 or an Amended Form 2A.

COA Type	Description
	In addition to the samples collected in accordance with Rule 318A.f, Extraction shall submit the analytical results to COGCC of all other samples collected from permitted water wells and permitted springs in both Adams County and Broomfield that are within 1/2 mile of the Oil and Gas Location. The operator shall notify the director immediately if there are methane detections as described in Rule 318A.F(8) or if BTEX compounds or TPH are detected in a water sample. The operator shall submit the analytical results to COGCC via a Form 4 Sundry, in an electronic data deliverable (EDD) format, consistent with the procedures in Rule 318.f.(10).
	The Approved Form 2A permit will be posted at the location during construction, drilling, and completions operations.

Best Management Practices

No	BMP/COA Type	Description
1	Planning	Site security will be maintained at all times. Location will be adequately fenced to restrict access by unauthorized persons. The site will have gated access to keep unauthorized vehicles out and fencing will be placed around all production equipment.
2	Planning	The location was approved by an Oil and Gas Operator Agreement with Broomfield on October 24, 2017. The development of this location is subject to a Comprehensive Drilling Plan (CDP) approval from The City and County of Broomfield.
3	Planning	Backup stabbing valves will be required on well servicing operations during reverse circulation. Valves shall be pressure tested before each well servicing operation using both low-pressure air and high-pressure fluid.
4	Planning	All ground within twenty-five (25) feet of any tank, or other structure containing flammable or combustible materials, shall be kept free of dry weeds, grass or rubbish, and shall conform to COGCC 600 Series Safety Regulations and the applicable Fire Code.

5	Planning	Extraction maintains a Tactical Response Plan (TRP), also at times referred to as the Emergency Response Plan, which is designed to provide Extraction employees and designated Emergency Response Team (ERT) members with the information necessary to respond to incidents in a safe, rapid, effective, and efficient manner. The TRP is kept at Extraction's office and a copy is provided to the North Metro Fire Rescue District and the City of Broomfield. Extraction will place the TRP summary card in strategic places on the facilities during specific operational and copies of the summary card is provided to the North Metro Fire Rescue District to be kept in the responding fire engines.
6	Community Outreach and Notification	Extraction will establish a live, 24-hour telephone hotline, as well as an email address, to receive feedback on our drilling and completion activities with the goal of having a tool for us to immediately investigate and address any complaints that arise. Prior to the initiation of 24-hour operations (drilling) Extraction will mail a post card (to include the email address and 24 hour manned phone number) to residents within 1/2 mile of the location.
7	Traffic control	Access Roads: The access road will be constructed to accommodate local emergency vehicles. This road will be maintained for access at all times. Traffic will be routed to minimize local interruption. During construction and through the life of this location, Operator will utilize watering, via water trucks, to control fugitive dust. Additionally, the access road will be constructed with aggregate road base material and recycled asphalt and vehicle speeds will be limited to twenty five miles per hour to reduce dust. No untreated produced water or other process fluids shall be used for dust suppression.
8	Traffic control	A traffic plan is required by the City and County of Broomfield and shall be coordinated with the local jurisdiction prior to commencement of move in and rig up. Any subsequent modification to the traffic plan must be coordinated with the local jurisdiction.
9	General Housekeeping	Removal of Debris. All construction-related debris shall be removed from the site for proper disposal in a timely manner. The site shall be maintained free of debris and excess materials at all times during operation. Operator shall not burn or bury debris at any time on the Well Sites. Maintain appearance with garbage clean-up; a trash bin will be located on site to accumulate waste by the personnel drilling the wells. Site will have unused equipment, trash and junk removed immediately and legally disposed of as applicable.
10	General Housekeeping	Leak Detention Plan: Extraction will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads, tanks and fittings. Additionally annual SPCC inspections will be conducted and documented. Annual flowline testing will also occur according to COGCC rules 1101 and 1102. Inspection and record retention of flowline testing will be in accordance per COGCC regulation. All records will be made available to the COGCC upon request.
11	Storm Water/Erosion Control	Implement and maintain BMPs to control stormwater runoff in a manner that minimizes erosion, transport of sediment offsite, and site degradation. Co-locate flowlines and/or gathering lines whenever feasible, and mitigate any erosion problems that arise due to the construction of any gathering lines. Location will be covered under Extraction Oil & Gas's field wide permit, permit number COR03M013. Typical stormwater BMPs installed include a diversion ditch and berm with sediment traps and installation of wattles where necessary. Please see the attached Stormwater BMP drawings
12	Material Handling and Spill Prevention	The location will be completely automated to monitor all production operations remotely. In the event that the facility is not operating under normal conditions, the automation system will immediately notify the operator. The automation system also has the ability to remotely perform an emergency shut down if necessary.

13	Material Handling and Spill Prevention	Automatic Safety Protective Systems and Surface Safety Valve. An automated safety system, governed by safety devices and a programmable logic computer, will be installed at the Well Sites. The automated safety system shall include the installation, monitoring and remote control of a Surface Safety Valve ("SSV") among many other engineered measures and devices that are implemented to greatly reduce or eliminate the potential for a well event. All New Wells will have a SSV installed prior to the commencement of the Production Phase connected to the production tubing at the surface. The SSV will be equipped to operate remotely via the automated safety protective system, which monitors multiple flowing pressures and rates which have predetermined maximum and/or minimum threshold values programmed and will remotely shut the well in should certain upset conditions be detected. Additionally, the automated safety system provides the ability to remotely shut-in wells on demand through operator remote intervention. The SSV will have documented quarterly testing to ensure functionality.
14	Dust control	805.c. Operator shall employ practices for control of fugitive dust caused by their operations. Such practices shall include but are not limited to the use of speed restrictions, regular road maintenance, restriction of construction activity during high-wind days, and silica dust controls when handling sand used in hydraulic fracturing operations. Additional management practices such as road surfacing, wind breaks and barriers may be used. No untreated produced water or other process fluids shall be used for dust suppression.
15	Construction	803. Permanent lighting will be installed around the facility to allow both the operator and haulers to conduct safe operations at night. All lights will be directed downward, inward and shielded so light pollution is minimized. During the Drilling and Completion Phases, consistent with applicable law, Operator will construct a 32 foot perimeter wall surrounding the well pads and operations area, as permitted, to reduce light escaping from the site.
16	Construction	Base beams will be used and not guy line anchors.
17	Construction	Containment Berms. The Operator shall utilize steel-rim berms around all permanent facility equipment at the Well Sites with sufficient capacity to contain 1.5 times the maximum volume of all liquids that will be contained at a facility at any given time plus sufficient freeboard to prevent overflow. All berms and containment devices shall be inspected quarterly by the Operator and maintained in good condition. No potential ignition sources shall be installed inside the secondary containment area unless the containment area encloses a fired vessel or such sources are rated in accordance with industry codes and standards. Secondary containment such as duck ponds or lined earthen berms for temporary tanks shall also be used. A. Permanent containment berms shall be constructed of steel rings, designed and installed to prevent leakage and resist degradation from erosion or routine operation. B. Secondary containment for tanks shall be constructed with a synthetic or engineered liner that contains all primary containment vessels and is mechanically connected to the steel ring to prevent leakage.
18	Noise mitigation	Quiet Technology. The Operator agrees to use the Liberty Quiet Fleet or comparable technology from an alternative vendor on all Well Sites for completions.
19	Noise mitigation	Thirty-two foot sound walls will be used during drilling and completion operations. Sound walls will be installed on the edges impacting nearest neighbors. Sound walls will be placed on the northeast corner of the pad.

20	Noise mitigation	Baseline noise monitoring will be conducted prior to commencement of pad construction. Additional sound mitigation measures will be considered and implemented pursuant to third party recommendations. All noise survey data will be made available to the COGCC inspector upon request. The Operator shall continuously monitor noise and continuously collect and store noise readings with instruments placed between the Oil and Gas Location and residential Building Units. The Operator shall conduct the monitoring and data collection during construction, drilling, and completions operations. This data shall be available to COGCC on tables or graphs within 48 hours of being requested by COGCC. The Operator shall conduct a 72 hour baseline noise survey from a minimum of three points prior to the commencement of construction.
21	Noise mitigation	For the development wells, to provide long term noise mitigation at this location all production equipment will powered by electricity. If needed, sound mitigation panels will be installed around the compressors during production operations to shield sensitive areas.
22	Noise mitigation	Electrified Drilling Rig - Extraction is working with United Power to supply sufficient electrical power for the drilling rig to drill the wells. Easements are being procured from the Landowners and the existing infrastructure is being upgraded in order to handle the larger electrical loads. While Extraction plans on drilling these wells on electrical power only, the rig will have diesel-powered generators in the event of an upset condition with the electrical supply from United Power. At that point, Extraction would use the diesel generators to power the rig until service from United Power was restored.
23	Noise mitigation	To provide long term noise mitigation at this location, all production equipment will powered by electricity. If needed, sound mitigation panels will be installed around the compressors during production operations to shield sensitive areas.
24	Noise mitigation	Exhaust. The exhaust from all engines, motors, coolers and other mechanized equipment shall be vented up or in a direction away from the nearest occupied building.
25	Emissions mitigation	Operator will bring a new oil, gas, and water pipelines, to send produced volumes immediately down the pipeline. No production will flow to tanks on this location. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.
26	Emissions mitigation	This location is designed without permanent tanks. Oil, Gas, and produced water will be transported through a pipeline gathering to a Central Gathering Facility. Saleable gas will not be flared, it will be sent downline. For maintenance or upset conditions the use of a maintenance vessel and emission control devices will be utilized. Uncontrolled venting is prohibited other than where necessary for safety. Production will be piped to the Central Gathering System. If the CGF is not ready at the time of production, the wells will be temporarily shut in.

27	Emissions mitigation	Reduced Emission Completions (Commonly known as Green Completions). At Well Sites Operator shall employ reduced emission completions, also commonly known as green completions, which comply with federal and state requirements. In addition, Operator shall comply with the following: A. Gas gathering lines, separators, and sand traps capable of supporting green completions as described in COGCC Rule 805 shall be installed per the provisions of COGCC Rule 805. B. Operator shall comply with 40 CFR 60.5375(a)(1), (2) for green completions. C. Uncontrolled venting is prohibited other than where necessary for safety. D. Temporary flowback flaring and oxidizing equipment where allowed shall include the following: 1. Adequately sized equipment to handle 1.5 times the largest flowback volume of gas from a vertical/directional and/or horizontally completed well respectively as reported to the COGCC in a ten mile radius; 2. Valves and porting available to divert gas to flaring and oxidizing equipment; pursuant to the above Rules 40 CFR 60.5375 & COGCC Rule 805; 3. Auxiliary fueled with sufficient supply and heat to combust or oxidize non-combustible gases in order to control odors and hazardous gases. The flowback combustion device shall be equipped with a reliable continuous ignition source over the duration of flowback, except in conditions that may result in a fire hazard or explosion; and 4. The Operator has a general duty to safely maximize resource recovery and minimize releases to the atmosphere during flowback and subsequent recovery/operation.
28	Emissions mitigation	Leak Detention Plan: Operator will monitor production facilities weekly at a minimum to a maximum of daily to identify fluid leaks, including, but not limited to, visually inspecting all wellheads and equipment. As part of Extraction's Leak Detection and Repair (LDAR) program, all equipment including above ground flowlines and piping will be inspected quarterly with an infra-red camera for the first 5 years of production.
29	Odor mitigation	805. Oil & gas facilities and equipment shall be operated in such a manner that odors do not constitute a nuisance or hazard to public welfare. Extraction will use a mud cooling system to control the release of odors within the drilling and fracturing fluids. Odor preventing additives will be on site for use if and when needed. Extraction will use a base fluid that will decrease the measurable BTEX and aromatic properties by more than 50% of regular diesel. Operator is prohibited from masking odors from any oil and gas facility site by using masking fragrances.
30	Drilling/Completion Operations	Blowout Prevention Equipment ("BOPE"): A double ram and annular preventer will be used during drilling. Stabbing valves shall be installed in the event of reverse circulation and shall be prior tested with low and high pressure fluid.
31	Drilling/Completion Operations	All fresh water for completions shall be transported to the well site via temporary water lines.
32	Drilling/Completion Operations	BOPE testing for drilling operations. Upon initial rig-up and at least once every thirty (30) days during drilling operations thereafter, pressure testing of the casing string and each component of the blowout prevention equipment including flange connections shall be performed to seventy percent (70%) of working pressure or seventy percent (70%) of the internal yield of casing, whichever is less. Pressure testing shall be conducted and the documented results shall be retained by the operator for inspection by the Director for a period of one (1) year. Activation of the pipe rams for function testing shall be conducted on a daily basis when practicable.
33	Drilling/Completion Operations	Closed chamber drill stem tests shall be allowed. All other drill stem tests shall require approval by the Director. None planned for this well.
34	Drilling/Completion Operations	All loadlines shall be bull plugged or capped.
35	Drilling/Completion Operations	Closed-Loop Pitless Systems for the Containment and/or Recycling of Drilling Fluids. Wells shall be drilled, completed and operated using closed-loop pitless systems for containment and/or recycling of all drilling, completion, flowback and produced fluids. Operator shall recycle fluids to the maximum extent practicable.
36	Drilling/Completion Operations	Well Integrity. Operator must equip the bradenhead access to the annulus between the production and the surface casing, as well as any intermediate casing, with a fitting to allow safe and convenient determinations of pressure and fluid flow. Valves used for annular pressure monitoring shall remain exposed and not buried to allow for visual inspection. The Operator shall take bradenhead pressure readings as required by the COGCC.
37	Drilling/Completion Operations	Bradenhead Monitoring. Operator will conduct bradenhead monitoring on the New Wells as required on the relevant Applications for Permit to Drill - Form 2.

38	Drilling/Completion Operations	Flowback Monitoring System: Autonomous 4 gas monitors will be placed around the location during the flowback phase.
39	Interim Reclamation	Operator shall be responsible for segregating the topsoil, backfilling, re-compacting, reseeding, and re-contouring the surface of any disturbed area so as not to interfere with Owner's operations and shall reclaim such area to be returned to pre-existing conditions as best as possible with control of all noxious weeds.
40	Final Reclamation	Within 90 days subsequent to the time of plugging and abandonment of the entire site, superfluous debris and equipment shall be removed from the site. Identification of plugged and abandoned wells will be identified pursuant to 319.a.(5)The operator shall also inscribe or imbed the well number and date of plugging upon the permanent monument.
41	Final Reclamation	Reclamation. Operator must submit an oil and gas site reclamation plan and reclaim a Well Site not later than six (6) months after plugging and abandoning the last New Well at such Well Site, weather and planting season permitting.

Total: 41 comment(s)

Attachment Check List

Att Doc Num	Name
2316326	EXHIBIT B
2316327	CORRESPONDENCE
2316355	RULE 306.E. CERTIFICATION
2316420	LOCATION DRAWING
2316421	CORRESPONDENCE
401524109	FORM 2A SUBMITTED
401525732	SURFACE AGRMT/SURETY
401525739	ACCESS ROAD MAP
401525740	FACILITY LAYOUT DRAWING
401525741	HYDROLOGY MAP
401525746	OTHER
401525871	NRCS MAP UNIT DESC
401526734	SITING RATIONALE
401526735	MULTI-WELL PLAN
401543287	OTHER
401555280	PRE-APPLICATION NOTIFICATION CERTIFICATION
401562821	OTHER
401573023	WASTE MANAGEMENT PLAN
401600701	PRE-APPLICATION NOTIFICATION CERTIFICATION
401600702	LOCATION PICTURES

Total Attach: 20 Files

General Comments

User Group	Comment	Comment Date
Permit	Final review complete.	10/01/2018
Permit	Contacted Operator to confirm changing right to construct from "oil & gas lease" to SUA per OGLA staff comments, and if it should also be changed on the 16 associated APDs. Operator requested changing right to construct back to "lease", and verified it should remain "lease" on all associated APDs. (Right to construct changed back to lease.) Permitting review complete.	09/28/2018
OGLA	OGLA review complete and task passed.	08/30/2018

OGLA	Public comment summary and response; one public comment was placed on the United Pad Form 2A and one public comment was placed on two of the United Pad Form 2s. The commenters requested that COGCC deny the permit applications; due to threats to health, safety and the environment. The COGCC Oil and Gas Location Assessment (OGLA) group, Engineering group, and Permitting group reviewed the permits for compliance with COGCC rules. COGCC Staff found the Form 2 and Form 2A applications to be in compliance with COGCC's rules and with COGCC's mission to foster the responsible development of the state's oil and gas resource in a manner that will avoid or minimize adverse impacts, and protect public health, safety and welfare and the environment. It is not within COGCC's statutory mandate to deny a permit for a well that the operator has a demonstrable right to construct and mineral interest to develop unless the application fails to comply with COGCC Rules or the Colorado Oil and Gas Conservation Act. The LGD placed a comment on the Form 2A on May 25, 2018. The comment was an update regarding the status of the agreements between Broomfield and Extraction. Broomfield approved its Comprehensive Drilling Plan with Extraction on August 20, 2018.	08/29/2018	
OGLA	Updated groundwater to nearest abondoned monitoring well with groundwater at 15 feet. Updated BMPs.	08/15/2018	
OGLA	Operator provided information for waste management - updated description, Updated plant species as is cropland, updated depth to water, water well on location (in production area) has been abandoned - field verified by Operator. Checking on distances to HOBU. Changed Oil and Gas lease to SUA per phone conversation.	07/06/2018	
Permit	Permitting review complete.	07/02/2018	
OGLA	OGLA reveiw: Waste Management plan does not match 2A, plant community is checked but has dryland cropland, water resources has depth to water at 170 feet, but monitoring well has depth at 15 feet. BMPs - fencing and security for the location, flammable liquids missing, will bi-annual flowline testing or annual, lighting BMP and noise BMP not consistent for placement of 32 foot walls, need 306.e. certification. Added related remote locations for production.	06/25/2018	
LGD	As the Local Government Designee for the City and County of Broomfield (Broomfield), Broomfield would like to provide the COGCC with an update related to Extraction Oil and Gas, LLC (Extraction) Form 2A permits, by the Colorado Oil and Gas Conservation Commission (COGCC), including the following permit applications: 401524109 United Pad 401524113 Northwest A Pad 401525931 Northwest B Pad By way of an update to the COGCC, on October 24, 2017, Extraction and Broomfield entered into an Amended and Restated Operator Agreement (Agreement).Section 9 of the Agreement provides that Extraction must submit a "Comprehensive Drilling Plan and Application" to Broomfield for such new wells or well sites (Plan).Per the Agreement, that Plan is subject to the review and approval by the City. Broomfield has not approved the Plan as required by the Agreement.Broomfield has been working diligently with Extraction on the Plan, through weekly meetings and timely and reasonable communications with Extraction. The COGCC spacing orders for these spacing units, dated as of October 31, 2017, indicate that any Permits for the wells within these spacing units must "comport with" the Agreement. As stated above, Section 9 of the Agreement provides that Extraction must submit the Plan for all of the well sites that is subject to Broomfield's approval. On December 15, 2017, Extraction submitted a draft Plan for the Livingston and	05/25/2018	

Interchange B well pads. On January 22, 2018, Broomfield submitted 220 comments on that draft Plan, which included the comment that the Agreement requires the Plan to be for all of the well sites (Comments). Broomfield is still reviewing the last draft of the Plan, which is over 1460 pages in length.Many of Broomfield's comments on the Plan and Extraction's responses have included the addition of best management practices that may be enforceable by the COGCC.

In both citizens' and staff comments we have identified areas where Broomfield is requesting additional information and where we believe the Plan is not complete.Broomfield believes that Extraction has an obligation to correct or update any deficient statements in the Plan. The issues that remain outstanding in the Plan include the following:

•At meetings with Extraction, Broomfield continues to identify engineering issues that need to be resolved before permitting of the pipeline for all the well sites could go forward.

•As of the date of these comments, Broomfield is still working with Extraction on required updates to its Emergency Response Plan and Risk Analysis Plan before those can be approved. Extraction has not identified each type of hazard for each location and specific mitigation measures.

•It is Broomfield's understanding that Extraction has yet to talk with all affected Broomfield and Adams County residents to determine their desired mitigation measures for the well sites and truck roads to the north, even though Extraction committed to such individual communications.

•Extraction has not committed in writing to all necessary specific mitigation measures between residents and well sites to the north and east of residents in Adams County and Broomfield.

•Extraction has not submitted a final pavement design report for approval by the City and County Engineer.

•Extraction has yet to agree in the Plan to ensure the safety of emergency response teams, construction workers and the general public. Extraction has yet to agree in the Plan that Buffers shall be created as required on site to shield dust, noise, and light from residents

•Broomfield is still reviewing Extraction'slong term reclamation plan.

•Extraction has not provided a complete explanation of its noise modeling approach.

•Extraction has not detailed the noise reduction levels it can achieve.

•Extraction has not provided written detail on the process of "Conduct Recovery Operations" including involvement of Broomfield's Public Health Division.

•Extraction has not complied with 2 requirements for the Wetlands Plan.

•Extraction has given only general responses to specific environmental site review requests.

•Extraction has not provided a detailed visual mitigation plan for the well sites, service road, or pig launcher station.

•Extraction has not provided a Drainage Report signed and stamped by a Colorado RegisteredProfessional Engineer. Should be in accordance with Section 100 and 600 of the Broomfield Standards and Specifications.

oPer section 610.00 All ponding facilities shall be of the detention type. Retention Ponds will not be approved

oAll ponds should provide water quality

	oAll ponds must drain completely within 72 hours. oShould be designed for a minor storm of 10yr and a major of 100yr oAll reports should include the SDI spreadsheet. For more information see the following website:https://maperture.digitaldataservices.com/gvh/?viewer=cswdif •Provide a Drainage letter for the access road plans. oProvide historic and proposed drainage basin map oProvide location and sizing for crossroad pipes both existing and proposed Other Comments concerning the Form 2A permits include: Interchange, Northwest, and United Pads Form 2 A Comments •The FACILITIES section indicates there are 2 gas compressors planned for the location.Extraction should provide information associated with the purpose of the compressors and how will they be fueled. •The waste management plan only addresses EP Waste.It does not discuss secondary containment and stormwater measures as required by Item 41 in the Best Management Practices of the Operator Agreement. Interchange, Northwest, and United Pads Form 2 A Comments •Extraction has committed to a Form 2A BMP on weed control in their Comprehensive Development Plan for Broomfield.Please verify that the weed control BMP is included in the Interchange, Northwest, and United Pad Form 2As. •Broomfield requests that COGCC take a close look at the offset well evaluations provided by Extraction Oil and Gas to verify the estimates of offset distances of existing wells (including plugged and abandoned wells) from the new proposed horizontal wells.Broomfield was unable to confirm many of the distances indicated in the OPERATOR COMMENTS AND SUBMITTAL section of the Form 2s based on the OFFSET WELL EVALUATIONS spreadsheet or from the ANTI-COLLISION reports provided. •According to the OFFSET WELL EVALUATIONS spreadsheet provided in the Form 2s, there are many plugged and abandoned wells and several producing wells that have horizontal offsets of less than 150 feet from the proposed new horizontal wells and it is indicated that No Remediation Is Required for these wells.Broomfield is very concerned about the short offset distance for some of these wells; therefore, Broomfield requests that COGCC take a close look to verify the proposed mitigation measures indicated by Extraction Oil and Gas are appropriate as defined by the DJ Basin Horizontal Offset Policy. Broomfield asks that COGCC leave the comment period on the Permits open until all issues are resolved regarding the Plan.Broomfield will continue to work diligently with Extraction on the Plan.		
LGD	1)The COGCC mandated during the October 30, 2017 hearing that it reviews each of the Form 2A locations that impact Adams County residents in a public hearing.Adams County respectfully requests the following Form 2A's be heard before the COGCC in public hearings; a)Interchange A Pad b)Interchange B Pad c) United Pad d)Northwest A Pad	05/01/2018	

e)Northwest B Pad

2)Understanding that selecting an appropriate location for an oil and gas facility is the crux of compatibility, the proposed locations will impact the maximum number of residents by the proposed development. Four locations were initially proposed to access the identified minerals, and only 44 homes were within 1,500 feet of those locations. Today, six locations are proposed to access those same minerals, and approximately 94 homes are within 1,500 feet of those locations, more than doubling the number of people impacted by this proposed development. Those additional impacted residences are located within Adams County, yet as the elected representatives for this neighborhood, the Adams County Board of Commissioners did not have authority in the approval of these sites.

Adams County remains deeply concerned about the locations of the well pads and the cumulative impacts they will have on our residents. The Comprehensive Drilling Plan (CDP) that was shared with Adams County does not fully capture the entire proposed development and the cumulative impacts that will be felt by neighbors. Many Adams County residents will be impacted by four or more of the well pads at one time.

3)The Broomfield Comprehensive Plan setbacks necessitated Extraction break up the well pads so that each contains fewer wells. The result of fewer wells on each pad is the distribution of impacts over a larger area, ultimately shifting the burden to a larger number of residents. Adams County has seen increased development of oil and gas facilities, and the current industry standard is the consolidation of wells and their impacts on a single pad, rather than spreading those impacts over a larger area. The proposed Interchange A and B well pads total 33 wells and are proposed to consume over 21 acres of land and shrink to 9 acres during interim reclamation. In Adams County, by contrast, 30+ well pads disturb only about 11 acres of land and are shrunk to about 5.5 acres during interim reclamation. COGCC 1000 Series rules discuss proper reclamation of the land, including the minimization of surface area disturbance to reduce cumulative impacts, as well as facility consolidation to reduce the fragmentation of wildlife habitat. Extraction's proposal does the opposite of industry standard and COGCC rules.

4)While minimizing the surface disturbance, the consolidation of many wells on a single pad reduces the need for haul roads. Haul roads are planned to be constructed to connect Sheridan Parkway to Huron Street, across the backyards of Adams County residences. These haul roads will see significant construction traffic, creating noise, dust, and safety concerns. Berms or walls have been proposed by the operator, and the mitigation of these significant impacts remains to be addressed in the plans.

5)Many residents have provided public testimony or written comments with concerns about potential impacts to public health, safety, welfare and the environment that this project may cause. There are also many residents who desired to provide testimony and were not awarded the opportunity by Broomfield throughout the process or by the COGCC when representatives of the COGCC were in Broomfield on October 12, 2017.

As allowed by COGCC Rule 216 Comprehensive Drilling Plans, Adams County respectfully recommends the Director of the COGCC request a Comprehensive Drilling Plan from Extraction Oil and Gas for the well pads identified in comment one (1).

a)Residents of the City and County of Broomfield as well as Adams County were under the impression that a Comprehensive Drilling Plan process was going to be part of Broomfield's Administrative Review by Memorandum of Understanding as outlined in section 9 of City and County of Broomfield Resolution No. 2017-186.

i.City and County of Broomfield Oil and Gas Land Use Regulations Chapter 17-54-020 Definitions does not provide a definition for Comprehensive Drilling Plan which infers the definition provided by the COGCC Rule 216.

b)The inclusion of agencies such as Colorado Department of Public Health and

	Environment, Colorado Parks and Wildlife, Local Government Designees as well as surface owners could aid in easing concerns expressed by many residents which will be impacted by this development. In addition, a CDP would ensure that appropriate parties are provided a fair and equitable opportunity to weigh in on concerns.	
OGLA	Comment period extended 10 days at the request of the Broomfield LGD now ending on 5/27/18	04/30/2018
Permit	Passed Completeness.	04/27/2018
OGLA	Passed OGLA Completeness review. Address BMPs/COAs and other issues during the technical review.	04/27/2018

Total: 13 comment(s)

Exhibit 11

EXTRACTION OIL & GAS
BROOMFIELD DEVELOPMENT PROJECT

Emissions Inventory and Impact Analysis

Prepared for: Extraction Oil & Gas

July 2017

Emissions Inventory and Impact Analysis

Prepared for:

Extraction Oil & Gas

370 17th Street
Suite 5300
Denver, CO 80202

This document has been prepared by SLR International Corporation. The material and data in this report were prepared under the supervision and direction of the undersigned.

Bruce Macdonald, Ph.D.
Principal Scientist

Kenneth A. Malmquist
Principal Engineer

CONTENTS

CONTENTS (CONTINUED)

FIGURES

TABLES

ACRONYMS

AERMOD	American Meteorological Society EPA Regulatory Model
APCD	Colorado Air Pollution Control Division, Department of Public Health and Environment
ARM2	Ambient Ratio Method 2, for calculation NO_X to NO_2 conversion
Bhp	brake horsepower
BPIP	Building Profile and Input Program
BSER	best system of emission reduction
BSFC	brake specific fuel consumption
BTEX	benzene, toluene, ethylbenzene, and xylenes
Btu	British thermal units
CFR	Code of Federal Regulations
CI-ICE	Compression ignition internal combustion engine
CO	carbon monoxide
CO_2	carbon dioxide
CTU	coil tubing unit
DRE	destruction/removal efficiency (thermal oxidation)
dscf	dry standard cubic feet
ECD	Enclosed combustion device
EPA	United States Environmental Protection Agency
Fd	Fuel-specific oxygen-based “F factor”, dry basis, from EPA Method 19 (dscf/MMBtu)
g	gram
GOR	gas to oil ratio
HHV	lower heating value (also gross calorific value)
hp	horsepower
ICE	Internal Combustion Engine
kW	kilowatt
LACT	Lease Automated Custody Transfer
lb	pound
LHV	lower heating value (also net calorific value)
MM	million
NAAQS	National Ambient Air Quality Standards
NAD	North American Datum

ACRONYMS (CONTINUED)

NED	National Elevation Dataset
NMHC	non-methane hydrocarbons
NO	nitric oxide
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NRE	nonroad engine (also known as off highway engine)
NSPS	New Source Performance Standards
PM	particulate matter
$PM_{2.5}$	particulate matter (with aerodynamic diameter of 2.5 microns or less)
PM_{10}	particulate matter (with aerodynamic diameter of 10 microns or less)
ppm	parts per million
REC	reduced emissions completion (hydraulic fracturing flowback)
tpy	tons per year
ULSD	ultra low-sulfur diesel
USEPA	U.S. Environmental Protection Agency
UTM	Universal Transverse Mercator (map projection)
VOC	volatile organic compound
µm	micron or micrometer

SUMMARY

This report provides a detailed analysis of the input, assumptions, techniques, and interpretation of a dispersion modeling exercise that evaluated impacts from two natural-gas well pads to be developed by Extraction Oil and Gas in Broomfield Colorado. The document includes an overview of emissions and impacts from the Sheridan well pad, with 19 directionally drilled wells, and the Lowell well pad with 29 directionally drilled wells. Air emissions associated with well drilling, completions (including flowback) and normal operations were characterized and used in a guideline dispersion model (AERMOD) to assess impact on air quality levels at nearby receptors. Emissions and impacts of nitrogen oxides (NO_X as nitrogen dioxide or NO_2), particulate matter less than 10-microns in aerodynamic diameter (PM_{10}), fine particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), and selected organic compounds (Benzene, toluene, ethylbenzene, and xylenes, or BTEX) are provided in this report.

The results describe the impacts of project emissions at receptors near the well pads in comparison to the ambient air quality standards as regulated by the Colorado Department of Public Health and Environment (CDPHE) and the U. S. Environmental Protection Agency (USEPA). The results also compare impacts of emissions of benzene, toluene, ethyl-benzene, and xylenes (BTEX) to established human health risk assessment threshold concentration for inhalation. Maximum impacts are provided in tabular form, and spatial impacts are depicted for the areas around each of the well pads. Results show that impacts are below the standards and risk thresholds.

1. INTRODUCTION

Extraction Oil & Gas (Extraction) plans to develop two separate multi-well pads in Broomfield, Colorado. The phases of development will include drilling, well completions with "flowback," and normal operations, each of which would cause air emissions and lead to potential impacts on ambient air quality at nearby receptors. To address the concerns of the community, Extraction, with the approval of the Broomfield Oil and Gas Subcommittee, has retained SLR International Corporation (SLR) to conduct a dispersion modeling analysis that will quantify emissions and resulting ambient air quality impacts from each of these phases. The modeling effort follows the approach and detailed data that were included in a Dispersion Modeling Protocol that was provided to Extraction and other interested parties on June 12, 2017.

1.1 PURPOSE

The purpose of the dispersion modeling focuses on assessing air quality impacts on a receptor grid that includes nearby residences in and around the City and County of Broomfield, Colorado. This document provides a review of the techniques, input data, dispersion modeling approach and results for that dispersion modeling effort. The technical approach includes a description of the characterization of air emissions and an assessment of impacts using a guideline air dispersion model, AERMOD, which is supported by the U.S. Environmental Protection Agency and the Colorado Air Pollution Control Division (APCD) to asses such impacts from proposed sources.

1.2 OBJECTIVES

The objectives associated with each step of the process in assessing the air quality impacts are as follows:

- Prepare a detailed project description for the three critical phases of the well pad development, at each of the well pad sites including temporary drilling and well completions with flowback, and normal operation.
- Develop estimates of air emissions on a daily or hourly basis, as well as on an annual basis for input to AERMOD.
- Conduct dispersion modeling in accordance with established EPA and APCD modeling guidelines
- Present the impacts in a format for comparison to ambient standards and other thresholds of concern, including the combined impacts of the Sheridan and Lowell Well Pads.

There is no required air quality regulatory permitting or approval for this proposed operation, and the document is not intended to support a formal regulatory application. As shown below the operational emissions from the proposed stationary source are expected to be below the thresholds that require submittal of an Air Pollution Emissions Notice or a construction permit under Colorado Air Quality Regulation 3, Part B. While the modeling protocol and the resulting modeling approach may mirror the

requirements of the APCD, there is no formal regulatory requirement to conform or receive approval from the APCD.

The dispersion modeling analysis is designed to assess representative impacts from the proposed well development activities. This is an important consideration when characterizing dynamic and transient activities into a dispersion model. Using information provided by Extraction, and approved by the Broomfield Oil and Gas Subcommittee, and prior modeling experience with these activities, representative scenarios and model inputs (e.g., emissions, layout of sources and structures on the pad site) have been developed for each phase of the pad development. This approach is intended to provide a reasonable, yet robust and conservative approach, to estimating ambient air quality impacts.

2. PROJECT DESCRIPTION

The proposed project consists of three phases of concern, conducted sequentially, each with separate characterizations and subcategories of operations and emissions. Each project phase and associated activities that may cause air pollutants to be emitted are described in this chapter.

2.1 LOCATION AND PAD LAYOUT

Modeling focused on the proposed Lowell and Sheridan multi-well pads located in Broomfield County along the Northwest Parkway corridor at the intersections with Lowell Boulevard and Sheridan Parkway, as shown in Figure 1, which also depicts the current location of residences, highways, and other local features. The pads are located approximately ¾-mile apart. Each well pad will be enclosed by a 32' high sound and visual barrier during drilling and well completion activities. A total of 29 separate wells will be drilled at the Lowell Well Pad and 19 separate wells will be drilled at the Sheridan Well Pad. The following describes each of the three sequential operations to be conducted at each pad.

2.2 DRILLING

Well drilling operations will be conducted using electric-powered drill rigs connected to the existing power grid. A single electric drilling rig will be erected on each site and used to "spud" each well (begin drilling) and drill each well in sequence until drilling is completed for all of the planned wells. Two casing strings will be run and cemented during the drilling phase: surface casing; and production casing. Once the target depth is reached for surface casing and production casing, respectively, drilling will be interrupted to run and cement casing. Drilling resumes once the cement has cured (8 to 12 hours). Once all wells on site are cased, cemented in and the well heads capped, the rig will be moved offsite. A general layout of operations related to drilling is depicted in Figure 2; actual site configurations for each pad are under development.

It is expected that each lateral horizontal well, approximately 2-miles in length, will be drilled and cemented over a period of approximately 8 days per well. Wells will be drilled sequentially at each site and for purposes of modeling it is assumed that drilling will occur on both pads at the same time. Figure 2 depicts the general equipment and layout of drilling operations.

Air pollutant emitting activities during drilling include evaporative losses from drilling fluid systems and operation of nonroad engines during cementing, as described in the following subsections.

2.2.1 DRILLING FLUID SYSTEMS

During drilling operations, drilling fluid, also known as drilling "mud," is continuously circulated down-hole through the drill pipe, out the drill bit nozzles and up through the annulus to "shale shakers" used to remove drill cuttings. At the surface the drilling fluid is cooled and fluid properties may be adjusted by adding solid or liquid materials. The fluid is recirculated to the drill pipe and down-hole. The non-aqueous "external phase" of the drilling fluid will be oil, generally distillate (diesel). Tanks containing the

circulating drilling fluid at the surface are covered and operated at atmospheric pressure conditions. Evaporative losses, if any from the low-vapor pressure oil, are captured and routed to an enclosed combustion device (ECD) to oxidize organic compounds. The ECD will be equipped with a continuous pilot fueled by propane. The ECD will emit products of combustion, which may include carbon dioxide (CO_2), water vapor and a fraction of NOx, particulate matter (PM) as PM_{10} and fine particulate matter ($PM_{2.5}$). The ECD will destroy organic compounds, including BTEX to the extent such compounds are present in the vapor within the drilling fluid system, with a destruction removal efficiency (DRE) of >99 percent. Uncontrolled emissions from the drilling fluid system will be negligible because the tanks will be operated at constant or near-constant level conditions, which precludes liquid displacement of vapors, and the tanks are operated at atmospheric pressure conditions. Emissions are discussed in Chapter 3.

2.2.2 WELL CEMENTING

Once drilling has reached the appropriate depth and well below the depth of any aquifer, drilling stops and surface casing is run and cemented from that depth to the surface. Casing and stabilizers/centralizers are run down hole and cement is pumped through the casing and up around the annulus to secure the casing in place. Cementing surface casing can be completed in one day. Drilling resumes once the cement has cured, which typically takes 8 to 12 hours. Once total depth is reached, drilling again stops and another casing string is run and cemented from total depth to surface. Production casing cementing can be completed in approximately seven days.

During cementing, the contractor uses compression-ignition internal combustion engine (CI-ICE) driven equipment to mix cement and water at the surface, drive auxiliary equipment and pump the cement down-hole. The CI-ICE will be fueled with No. 2 ultralow sulfur diesel (ULSD). The CI-ICE are portable nonroad engines, as defined in Colorado Air Quality Control Commission[1] and federal regulations, that are not “stationary sources” and not subject to air quality permitting. Surface casing can be cemented in approximately one hour per well. The 5-1/2” casing string can be cemented over a period of 7 hours per well. Products of USLD combustion emissions include, or may include: Nitric oxide (NO) and a small fraction of nitrogen dioxide (NO_2), collectively NOx. Fine particulate matter (PM_{10}/$PM_{2.5}$) and BTEX may also be emitted at low concentrations from USLD-fired equipment. Emissions are discussed in Chapter 3.

2.3 WELL COMPLETIONS

Well completions include four separate operations conducted in sequence for each well:

1. Hydraulic fracturing (“frac”) – up to six days per well;
2. Coil Tubing Unit (CTU) cleanout – up to five days per well;
3. Workover – up to two days per well; and
4. Flowback – up to three days per well.

[1] See Colorado Department of Public Health and Environment Air Quality Control Commission Regulation 3 – Stationary Source Permitting and Air Pollutant Emission Notice Requirements, 5 CCR 1001-5, Part A, I.B.31

In total, well completion operations, during which time air pollutant emitting activities (combustion and flowback) may occur, will be completed in up to 16 days per well. A general layout of operations related to completions is depicted in Figure 3; actual site configurations for each pad are under development.

2.3.1 HYDRAULIC FRACTURING

Hydraulic fracturing ("frac" or "fracking") is a well treatment performed in shale or other low-permeability reservoirs to stimulate production of reservoir fluids. Hydraulic fracturing fluids, primarily comprised of water with lesser fractions of additives, are pumped at a high pressure and flowrate into the reservoir interval to be treated, causing vertical fractures to open in the horizontal wellbore. The fractures extend away from the wellbore in opposing directions according to the natural stresses within the formation. Sand "proppant" is mixed with the hydraulic fracturing fluid to keep the fractures open when the pressure is relieved and the treatment is complete to allow reservoir fluids to flow to the wellbore – see flowback phase.

An oilfield services contractor rigs up pumps, sand conveyance systems, frac fluid mixing equipment and ancillary equipment on site. Typically, two to four fracturing operations can be completed per day per well, at a rate of up to four wells simultaneously, including time to rig up, pump, and rig down. This process requires multiple, high-pressure, truck mounted pumps (14 for this project) and the associated portable equipment. Once the process is complete, the wells are shut in and all associated equipment is moved offsite.

Mechanical drive pumps and other equipment powered by ULSD-fired CI-ICEs are used in the frac operation. Products of USLD combustion include, or may include: NO, NO_2, PM_{10}/$PM_{2.5}$ and BTEX. Emissions are discussed in Chapter 3.

2.3.2 CTU CLEANOUT

After all wells at the pad have been fracked and wells shut-in in sequence, the frac equipment is moved off site and a CTU is moved onto the pad. The CTU is used to cleanout sand and debris from each well. Coil tubing is reeled out into the wellbore and water- or oil-based fluids are pumped downhole and through nozzles to clean the well. CTU cleanout is conducted for each well in sequence until the CTU cleanout phase in completed.

The CTU contractor operates mechanical drive pumps and other equipment powered by ULSD-fired nonroad engines. Products of USLD combustion include, or may include: NO, NO_2, PM_{10}/$PM_{2.5}$ and BTEX. Emissions are discussed in Chapter 3.

2.3.3 WORKOVER

After CTU cleanout, a workover contractor begins preparation of each well for flowback and production. Production tubing is installed in each well to provide a conduit for producing reservoir fluids to the surface.

The workover contractor operates mechanical drive equipment powered by diesel-fired nonroad engines. Products of USLD combustion include, or may include: NO, NO_2, PM_{10}/$PM_{2.5}$ and BTEX. Emissions are discussed in Chapter 3.

2.3.4 FLOWBACK

The last phase of the well completion is flowback. Extraction will use Reduced Emission Completion (REC) known as "green completion" practices for flowback operations. REC operations at the Lowell and Sheridan pads will perform better that required by EPA standards of performance for new stationary sources (NSPS) that regulate certain well completion operations.[2] EPA Best Standards of Emission Reduction (BSER) and NSPS for well completions are summarized in Table 1 for the "initial flowback" and "separation flowback" stages, as defined by EPA[3] and described below.

In the preamble to the promulgated standards, EPA defines the flowback period of a well completion as consisting of two distinct stages, the "initial flowback stage" and the "separation flowback stage." The initial flowback stage begins with the onset of flowback and ends when the flowback is routed to a separator. Once the separator is placed into service, the gas, produced water and oil from the separator will be sent to a remote processing facility via three separate underground pipelines.

"Routing of the flowback to a separator is required as soon as a separator is able to function (i.e., the operator must route the flowback to a separator unless it is technically infeasible for a separator to function). Any gas in the flowback prior to the point at which a separator begins functioning is not subject to control."

Extraction will route flowback to closed frac tanks during the initial flowback stage. The frac tanks will be connected to an ECD, which controls emissions at a rate that exceeds federal standards.

As described by EPA, the point at which the separator can function marks the beginning of the separation flowback stage. The separation flowback stage ends when the well is shut in and the flowback equipment is permanently disconnected from the well or on startup of production. This also marks the end of the flowback period.

"During [the separation flowback] stage, the operator must do the following, unless technically infeasible to do so as discussed below: (1) Route all salable quality gas from the separator to a gas flow line or collection system; (2) re-inject the gas into the well or another well; (3) use the gas as an onsite fuel source; or (4) use the gas for another useful purpose that a purchased fuel or raw material would serve. . . . No direct venting of gas is allowed during the separation flowback stage unless combustion creates a fire or safety hazard or can damage tundra, permafrost or waterways."

Extraction will meet option (1) above – Route all salable quality gas from the separator to a gas flow line or collection system. Extraction will also maximize resource recovery and minimize releases to the atmosphere over the duration of the flowback period.

[2] Code of Federal Regulations (CFR), Title 40: Protection of Environment, Part 60 Standards of Performance for New Stationary Sources (40 C.F.R. 60) Subpart OOOOa—Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced After September 18, 2015.
[3] See 81 Fed. Reg. p. 35845, June 3, 2006.

Table 1 Summary of EPA BSER and NSPS Standards and REC Procedures for Subcategory 1 Well Completion Flowback4

BSER	NSPS	SHERIDAN AND LOWELL REC
Combination of REC and the use of a completion combustion device	REC in combination with a completion combustion device; venting in lieu of combustion where combustion would present safety hazards. Initial flowback stage: Route to a storage vessel or completion vessel (frac tank, lined pit, or other vessel) and separator. Separation flowback stage: Route all salable gas from the separator to a flow line or collection system, re-inject the gas into the well or another well, use the gas as an onsite fuel source or use for another useful purpose that a purchased fuel or raw material would serve. If technically infeasible to route recovered gas as specified above, recovered gas must be combusted. All liquids must be routed to a storage vessel or well completion vessel, collection system, or be re-injected into the well or another well. The operator is required to have a separator onsite during the entire flowback period.	REC in combination with a completion combustion device – no venting. Initial flowback stage: Route to covered frac tanks controlled by an ECD (99% DRE). Separation flowback stage: Route all salable gas from the three-phase separator to a flow line or collection system. Liquid phases (oil and water) will be routed from the three-phase separator to a collection system and transferred offsite. A separator will be onsite during the entire flowback period.

Flowback may be conducted for each well individually or two or more wells may undergo flowback concurrently. An ECD is located on site to burn hydrocarbon gas/vapor in the event of any interruption of flow from the separator for any reason. For purposes of modeling, it is assumed that the ECD will be operating with a continuous burning pilot during flowback operations. No produced hydrocarbon gas from flowback will be burned in the ECD during normal flowback.

2.4 PRODUCTION

Produced multi-phase fluids from each well will be routed to a three-phase separator. Gas phase from the separator will be combined with gas from the other wells/separators, compressed by electric-driven compressors and transferred offsite via gas pipeline. Similarly, crude oil will be collected and transferred to a Lease Automated Custody Transfer (LACT) unit and transported off site via oil pipeline. Water phase streams will also be gathered from each well/separator and transported offsite via water pipeline. The scope of this modeling effort does not include the modeling of emissions from remote off-site processing facilities that receive the gas, water and oil transported by the pipelines.

Primary surface equipment at each pad may include wellheads, piping and fittings, valves, flanges, connectors, pressure vessels, compressors and pumps (electric-driven), air-actuated pneumatic controllers and other ancillary equipment. Where feasible, welded connections will be used in lieu of threaded or flanged connections to reduce the potential for equipment leaks. Other than the three-phase separators (pressure vessels) there will be no additional separation, treating or processing equipment on site.

[4] Non-wildcat and non-delineation wells

Each separator will be equipped with a single natural gas-fired burner with a maximum heat input capacity of 0.75 million British thermal units per hour (MMBtu/hr). The burners will only be operated during winter months. Each gas-fired burner may emit or has the potential to emit NO, NO_2, PM_{10}/$PM_{2.5}$ and BTEX.

There will be no atmospheric above-ground storage tanks, no process vents, no stationary or nonroad engines and no continuously operating fuel-burning equipment. The only air pollutant emitting units to be operated at each pad during normal operations are combustion emissions from the natural gas-fired separator burners and equipment leaks (fugitive emissions). Emissions are discussed in Chapter 3.

2.4.1 PLUNGER LIFT

The gas-to-oil ratio (GOR) of the produced fluids will be sufficiently high to allow for plunger lift systems as an alternative to other artificial lift solutions. Over the life of each well and at such time as the well pressure and gas velocity decreases and artificial lift becomes necessary, plunger lift systems will be installed to produce liquids to the surface. Liquids produced via plunger lift will be routed to the three-phase separator with no venting.

2.4.2 MAINTENANCE

One or more pressure vessels will be installed at each pad to accommodate planned and unplanned maintenance activities. If maintenance or repair is required for a well, separator, LACT, etc., fluids can be blown down to the maintenance vessel(s). One or more ECDs will be installed to combust gas/vapor relieved from the maintenance vessel(s) during maintenance blowdown. Each ECD will be equipped with continuous natural gas-fired pilot burners (two pilot burners per ECD) and an auto-ignitor. During normal production operations the maintenance vessels and ECD, including pilots, will not be operated (no combustion emissions). If a maintenance event occurs, the ECD pilots will be fired.

Figure 1 Well Site Area

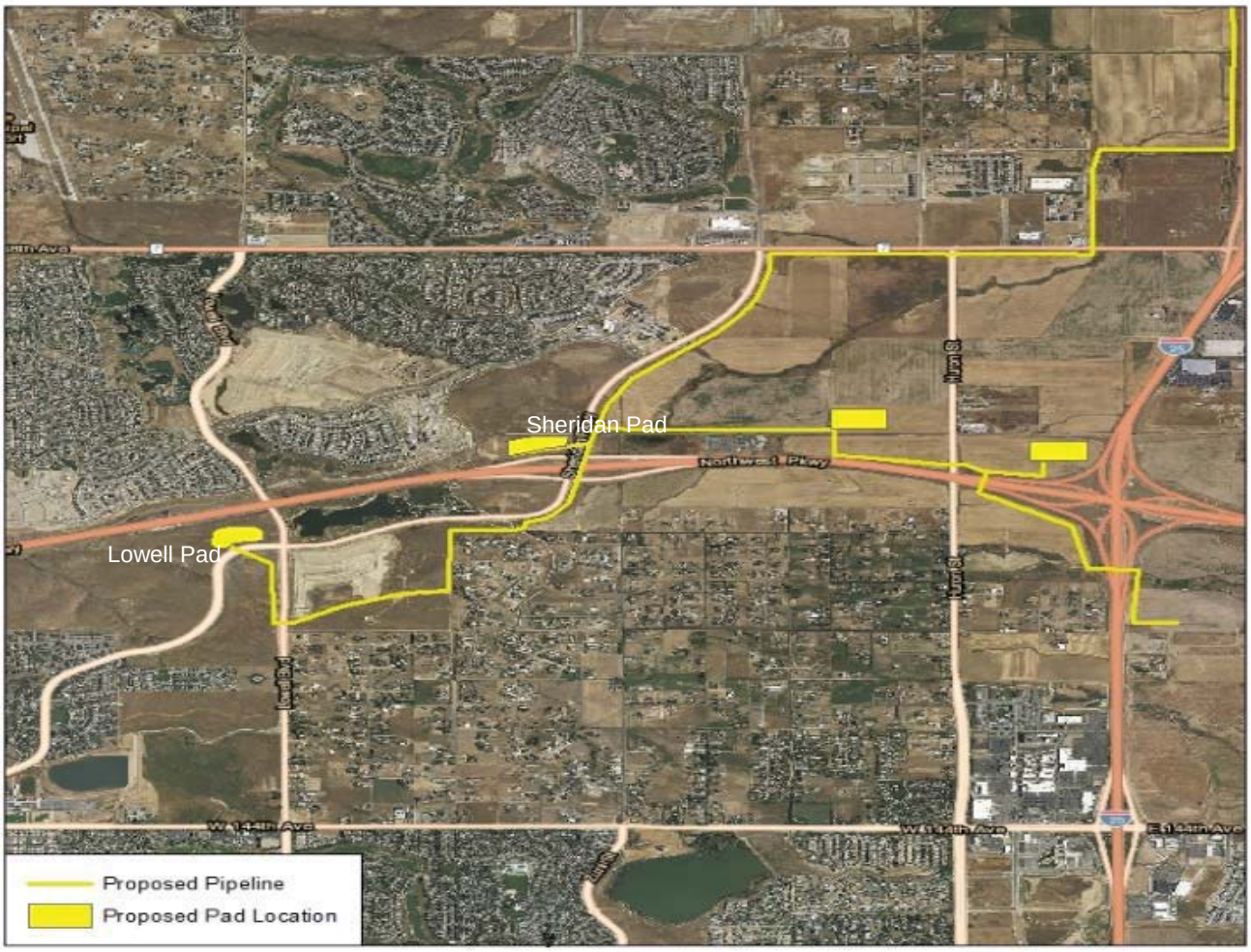


Figure 2 Schematic of Drilling Operations

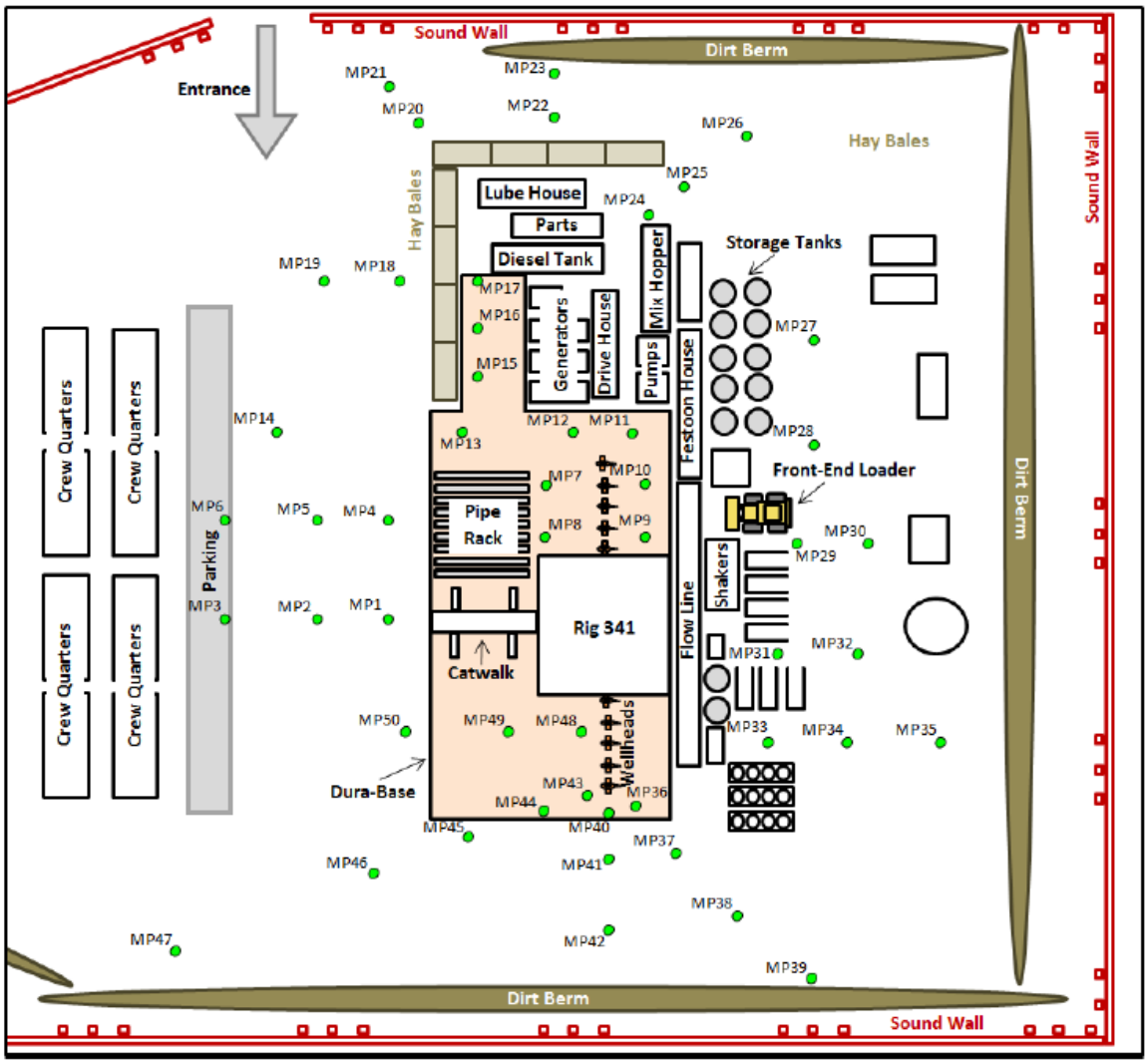
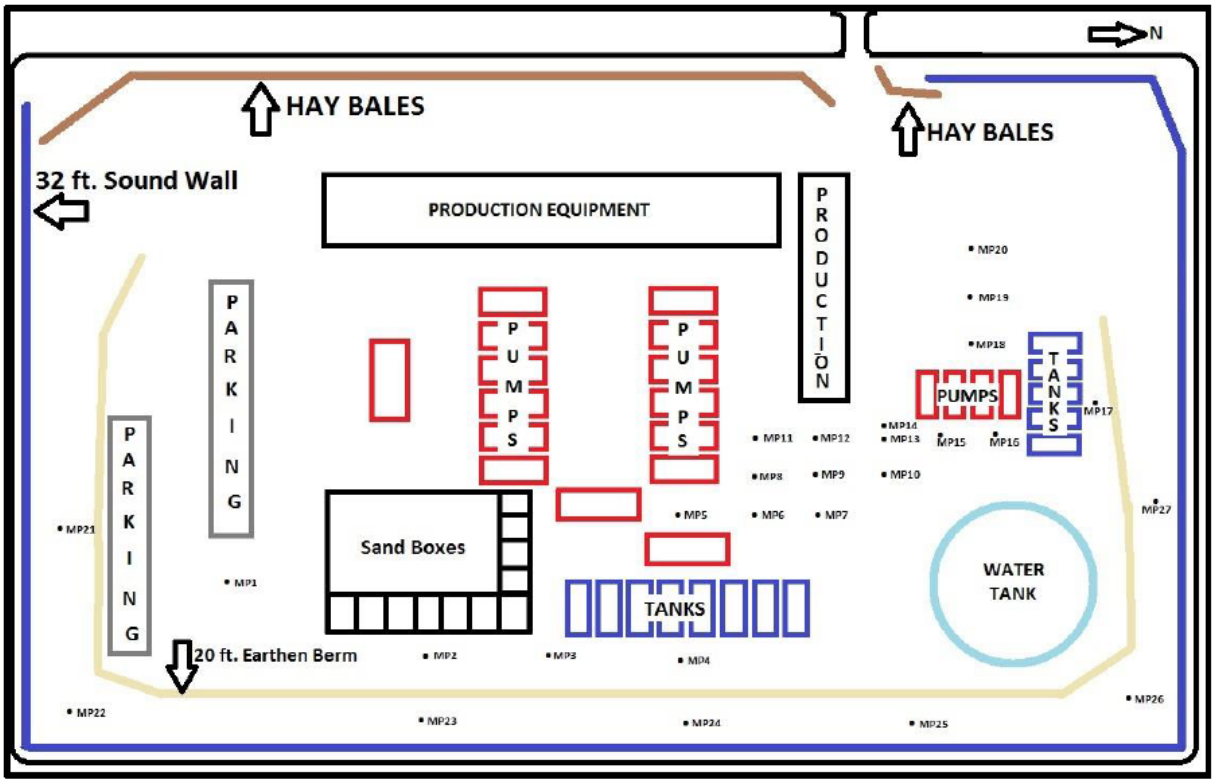


Figure 3 Schematic of Frack Completion Operations



3. EMISSIONS

During each phase of the development of these resources, there are emissions associated with drilling, completions and flowback, and normal operation. Emission estimates are based on project design, on vendor specifications and from standard emission factors that are used by the USEPA in permitting stationary sources. [5] Emission factors include the criteria air pollutants as well as factors for BTEX from combustion sources and equipment leaks (fugitive emissions). Estimates of equipment leaks related to the operation phase are based on counts of components in gas and crude oil service and standard emission factors for valves, flanges, compressors and pump seals, using the constituents of BTEX in the produced fluids.

3.1 AIR POLLUTANT EMITTING UNIT INVENTORY

Table 2 provides a list of equipment for each of the phases discussed above, including operational and design data that are associated with developing emissions estimates. Hourly and annual emissions were calculated using available emission factors and the indicated load factor and "duration" data that are included in this table.

3.2 NONROAD ENGINES

Federal Tier 1, Tier 2, Tier 3 or Tier 4 exhaust emission standards for Nonroad CI-ICE based on Model year and rated power of each engine were used as emission factors for each engine model within the drilling and well completion fleets. Emission standards for NOx, NMHC+NOx, and PM are set out in terms of grams per brake kilowatt-hour (g/kW-hr). Where NMHC+NOx standards apply, the standard was assumed to be NOx. Emissions of benzene, toluene, ethylbenzene and xylenes were estimated for nonroad CI-ICE using emission factors published in EPA's Publication AP-42 for large uncontrolled stationary diesel engines. Emission factors for BTEX compounds are provided in terms of pounds emitted per million Btu per hour heat input (lb/MMBtu). There is no emission factor for ethylbenzene.

Emission test data for NOx shows that emissions from diesel engines are primarily composed of NO, with a small fraction represented by NO_2. As allowed by EPA modeling guidelines, an appropriate and defensible in-stack NO_2 to NOx ratio was used to properly assess NOx impacts for comparison with the NO_2 NAAQS (See Section 4.6 for details).

For the fracking phase, Extraction will use dual-fuel fracking pump engines. The dual fuel engines, when fired primarily on natural gas, have achieved greatly reduced emissions of NO_X and $PM_{10}/PM_{2.5}$. An emission factor for $PM_{10}/PM_{2.5}$ was developed from a recent study[6] that directly compared emissions for dual fuel engines with diesel only firing and for firing on natural gas above a 75% total fuel feed. An adjustment of the $PM_{10}/PM_{2.5}$ emission factor of 0.1 was applied to the Tier 2 engine $PM_{10}/PM_{2.5}$

[5] https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors
[6] Papagiannakis, R.G. etl al, 2010: Emission characteristics of high speed, dual fuel, compression ignition engines operating in a wide range of natural gas/diesel fuel proportions. *Fuel* ***89*** (2010) 1397-1406.

emission rates and an adjustment of the NO_X emission factor of 0.46 was applied to accommodate this reduction in emissions.

3.3 EQUIPMENT LEAKS

Table 3 provides a list of operational "equipment counts" related to potential fugitive emissions of produced gas and other streams associated with operation at the Lowell Well site. (Identical data were developed for the Sheridan well site based on a total of 19 wells.) Component estimates are based on counts for each wellhead, with a separate additional estimate of counts for the integrated handling of these streams for the facility as a whole.

3.4 ECD AND SEPARATOR BURNERS

The Questor Q5000 ECDs are assumed to be operated with a continuous pilot each day of cementing and hydraulic fracturing flowback operations. Operation with a continuous pilot ensures availability for activation in the event of a malfunction or event requiring waste gas to be routed to the ECD. Emissions of NOx from the Questor Q5000 ECDs are estimated using an emission factor published by the manufacturer (Questor) in terms of 0.066 lb/MMBtu. Each Questor Q5000 is equipped with two pilot burners, each with a heat input capacity of 0.06 MMBtu/hr for a total of 0.12 MMBtu/hr. Emissions of PM_{10} and BTEX compound from ECDs and natural gas-fired separator burners are estimated using AP-42 emission factors.

In the production phase, each separator is equipped with a natural gas-fired burner to be used in winter months only. Emissions from combustion of natural gas are estimated using AP-42 emission factors.

An appropriate and defensible in-stack NO_2/NOx ratio has been applied for modeling of external combustion sources.

3.5 EMISSIONS

Table 4 provides a maximum 1-hour emission rate for the target pollutants for each equipment component for each well, and the same emission rate would be applied to well operations at both sites. Note that only one well would be drilled or completed at any one time. As a result the maximum 1-hour or daily rate during each phase would be based on the data in Table 4.

Tables 5 and 6 provide a summary of annual emissions from both well pads during the three phases, including the equipment or emission source. Detailed daily and annual emission calculations for each of these operations and sources are provided in Appendix A.

Table 2 Equipment Inventory

DRAFT Sheridan and Lowell Well Pad Development - Emission Unit Inventory

				Engine Data									
Phase	**Activity**	**Emission Unit (EU) Type**	**EU Make/Model**	**EPA Emissions**	**Max. Rating (bhp)**	**BSFC (lb/hp-hr) [LHV]**	**BSFC (Btu/hp-hr) [LHV]**	**Max. Heat Input (MMBtu/hr) [LHV]**	**Max. Heat Input (MMBtu/hr) [HHV]**	**Quantity per Well**	**Normal Load**	**Duration (Days/Year/Well)**	**Duration (Hours/Day/Well)**
Drilling	Drilling Mud	ECD (Pilot Only)	Questor Q5000	*N/A*	*N/A*	*N/A*	*N/A*		0.12	1	75%	8	24
	Cementing: HCR Elite® Trailer Deck Engines	CI-ICE	Caterpillar C11 ACERT™	Tier 3	420	0.353	6,501	2.7	2.9	1	60%	8	1
	Cementing: Auxiliary Engine	CI-ICE	Cummins QSB6.7	Tier 3	173		7,081	1.2	1.3	1	60%	8	1
Completions	Frac: Hydration Unit	CI-ICE	Cummins QSK 15L	Tier 2	598		7,000	4.2	4.5	1	60%	6	24
	Frac: Blender Units	CI-ICE	Cummins QSK 19L	Tier 2	798	0.348	6,409	5.1	5.5	1	60%	6	24
	Frac: Pumps	CI-ICE	Cummins QSK 50L Dual Fuel	Tier 2	2,250	0.352	6,483	14.6	15.7	14	60%	6	24
	Coil Tubing Units1: Cleanout	CI-ICE	Cummins 550 ISX	Tier 1	550		7,000	3.9	4.1	1	60%	5	24
	Coil Tubing Units2: Cleanout	CI-ICE	Caterpillar C18	Tier 1	800		7,000	5.6	6.0	1	60%	5	24
	Coil Tubing Units3: Cleanout	CI-ICE	Cummins	Tier 4	475		7,000	3.3	3.6	1	60%	5	24
	Workover: Rig Engine	CI-ICE	Detroit Diesel 60	Tier 3	425		7,000	3.0	3.2	1	60%	2	24
	Workover: Pump Engine	CI-ICE	Detroit Diesel 60	Tier 3	375		7,000	2.6	2.8	1	60%	2	24
	Workover: Snubbing Hydraulics	CI-ICE	Cummins ISX	Tier 1	475		7,000	3.3	3.6	1	60%	2	24
	Flowback	ECD (Pilot Only)	Questor Q5000	*N/A*	*N/A*	*N/A*	*N/A*		0.12	1	75%	3	24
Operation	Production	Fugitive emissions (Equipment Leaks)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*		*N/A*	1	N/A	365	24
	Production	Separator Burners (Gas-Fired)	TBD	*N/A*	*N/A*	*N/A*	*N/A*		0.75	1	75%	180	24

ECD - Enclosed Combustion Device

CI-ICE - Compression Ignition Internal Combustion Engine

BSFC - Brake Specific Fuel Consumption

Technical Approach and Assumptions:

1) Engine data obtained from Cummins and Caterpillar, if available
2) NOx and PM (PM10 and PM2.5) determined using EPA Tier 2 or Tier 3 limits
3) BTEX emissions based on AP-42 emission factors
4) Questor Q5000 ECDs operating on pilot only (normal operations)
5) Questor Q5000 NOx emissions based on mfg-published emission factor
6) Fugitive emissions based on EPA Protocol for Equipment Leak Emission Estimates, November 1995 (EPA-453/R-95-017). Table 2-8, Page 2-22.

Table 3 Process Equipment Counts for Lowell Well Site

Actual Equipment Counts		Number of Wells/Pad		29
Source: Extraction Oil & Gas				
Equipment Type	**Service**	**Per Wellhead**	**Additional**	**Total Pad**
Valves	Gas	48	262.5	1,655
	Heavy Oil			-
	Light Oil	55	70	1,665
	Water/Oil	6	17.5	192
Pump Seals	Gas			-
	Heavy Oil			-
	Light Oil			-
	Water/Oil			-
Others	Gas			-
	Heavy Oil			-
	Light Oil			-
	Water/Oil			-
Connectors	Gas	200	750	6,550
	Heavy Oil			-
	Light Oil	275	200	8,175
	Water/Oil	33	50	1,007
Flanges	Gas	17	375	868
	Heavy Oil			-
	Light Oil	31	100	999
	Water/Oil	3	25	112
Open-Ended Lines	Gas			-
	Heavy Oil			-
	Light Oil			-
	Water/Oil			-
Total				**21,222**

Components in Addition to Wellheads		Allocation by Service		
Type	Total Count	Gas	Oil	Water
Threaded Joints	1000	75%	20%	5%
Flanged Joints	500	75%	20%	5%
Valves	350	75%	20%	5%

Table 4 Hourly Emission Rates for Each Phase and Activity Per Well

			EMISSIONS (LB/HOUR) FOR EACH WELL					
Phase	Activity	Unit	**NO_x**	**PM_{10}**	Benzene	Toluene	E-Benzene	Xylenes
Drilling	Drilling Mud	ECD on Tank	0.006	0.0008	1.9E-07	3.0E-07	No EF	No EF
	Cementing	CI-ICE	1.667	0.083	1.4E-03	4.9E-04	No EF	3.4E-04
	Cementing-Aux	CI-ICE	0.687	0.050	6.1E-04	2.2E-04	No EF	1.5E-04
Completion	Frac Hydration	CI-ICE	3.797	0.119	2.1E-03	7.6E-04	No EF	5.2E-04
	Frac Blender	CI-ICE	5.067	0.158	2.6E-03	9.3E-04	No EF	6.4E-04
	Frac Pumps	CI-ICE	91.67	0.625	1.0E-01	3.7E-02	No EF	2.5E-02
	Coil Tubing Cleanout	CI-ICE	5.020	0.291	1.9E-03	7.0E-04	No EF	4.8E-04
		CI-ICE	7.302	0.423	2.8E-03	1.0E-03	No EF	7.0E-04
		CI-ICE	0.188	0.009	1.7E-03	6.0E-04	No EF	4.1E-04
	Workover Rig	CI-ICE	1.687	0.084	1.5E-03	5.4E-04	No EF	3.7E-04
	Workover Pump	CI-ICE	1.488	0.074	1.3E-03	4.8E-04	No EF	3.3E-04
	Workover Snub	CI-ICE	4.335	0.251	1.7E-03	6.0E-04	No EF	4.1E-04
	Flowback	CI-ICE	0.006	0.0007	1.9E-07	3.0E-07	No EF	No EF
Operation	Equipment	Leaks			3.5E-05	1.1E-04	2.0E-05	1.0E-04
	Separator	Burner (Gas)	0.037	0.004	1.2E-06	1.9E-06	No EF	No EF
Drilling	Maximum Hourly		2.353	0.134	0.002	0.001	0.000	0.001
Completion	Maximum Hourly		91.67	0.625	0.107	0.039	0.000	0.027
Operation	Maximum Hourly		0.037	0.004	3.7E-05	1.1E-04	2.0E-05	1.0E-04

Table 5 Total Annual Emissions for Lowell Pad (29 Wells)

			EMISSIONS (TON/YEAR)							
Phase	Activity	Unit	NO_X	PM_{10}	CO	VOC	Benzene	Toluene	E-Benzene	Xylenes
Drilling	Drilling Mud	ECD on Tank	0.017	0.002	0.013	0.001	5.2E-07	8.4E-07	0.0E+00	0.0E+00
	Cementing	CI-ICE	0.193	0.010	0.168	0.015	1.6E-04	5.7E-05	0.0E+00	3.9E-05
	Cementing-Aux	CI-ICE	0.080	0.006	0.098	0.006	7.1E-05	2.6E-05	0.0E+00	1.8E-05
Completion	Frac Hydration	CI-ICE	7.928	0.248	4.294	0.595	4.4E-03	1.6E-03	0.0E+00	1.1E-03
	Frac Blender	CI-ICE	10.579	0.331	5.731	0.794	5.3E-03	1.9E-03	0.0E+00	1.3E-03
	Frac Pumps	CI-ICE	191	1.3	226	209	2.1E-01	7.7E-02	0.0E+00	5.3E-02
	Coil Tubing Cleanout	CI-ICE	8.735	0.506	10.76	0.655	3.3E-03	1.2E-03	0.0E+00	8.3E-04
		CI-ICE	12.705	0.737	15.65	0.953	4.9E-03	1.8E-03	0.0E+00	1.2E-03
		CI-ICE	0.328	0.016	2.843	0.025	2.9E-03	1.0E-03	0.0E+00	7.2E-04
	Workover Rig	CI-ICE	1.174	0.059	1.017	0.088	1.0E-03	3.7E-04	0	2.6E-04
	Workover Pump	CI-ICE	1.036	0.052	0.898	0.078	9.1E-04	3.3E-04	0	2.3E-04
	Workover Snub	CI-ICE	3.017	0.175	3.717	0.226	1.2E-03	4.2E-04	0	2.9E-04
	Flowback	CI-ICE	0.006	0.001	0.005	0.001	1.9E-07	3.1E-07	0	0.0E+00
Operation	Equipment	Leaks	0.000	0.000	0.000	1.842	4.5E-03	1.4E-02	2.5E-03	1.3E-02
	Separator	Burner (Gas)	3.454	0.263	2.902	0.190	7.3E-05	1.2E-04	0	0.0E+00
Drilling	TOTAL		0.290	0.019	0.278	0.022	2.3E-04	8.4E-05	0.0E+00	5.7E-05
Completion	TOTAL		236.9	3.4	271.1	212.2	2.4E-01	8.6E-02	0.0E+00	5.9E-02
Operation	TOTAL		3.454	0.263	2.902	2.032	4.6E-03	1.4E-02	2.5E-03	1.3E-02

Table 6 Annual Emissions for Sheridan Pad (19 Wells)

			EMISSIONS (TON/YEAR)							
Phase	Activity	Unit	NO_x	PM_{10}	CO	VOC	Benzene	Toluene	E-Benzene	Xylenes
Drilling	Drilling Mud	ECD on Tank	0.011	0.001	0.008	0.001	3.4E-07	5.5E-07	0.0E+00	0.0E+00
	Cementing	CI-ICE	0.127	0.006	0.110	0.010	1.0E-04	3.8E-05	0.0E+00	2.6E-05
	Cementing-Aux	CI-ICE	0.052	0.004	0.064	0.004	4.7E-05	1.7E-05	0.0E+00	1.2E-05
Completion	Frac Hydration	CI-ICE	5.2	0.16	2.814	0.390	2.9E-03	1.0E-03	0	7.1E-04
	Frac Blender	CI-ICE	6.9	0.22	3.754	0.520	3.5E-03	1.3E-03	0	8.7E-04
	Frac Pumps	CI-ICE	125.4	0.86	148.2	136.7	1.4E-01	5.1E-02	0	3.5E-02
	Coil Tubing Cleanout	CI-ICE	5.7	0.33	7.050	0.429	2.2E-03	7.9E-04	0	5.5E-04
		CI-ICE	8.3	0.48	10.254	0.624	3.2E-03	1.2E-03	0	7.9E-04
		CI-ICE	0.21	0.011	1.862	0.016	1.9E-03	6.9E-04	0	4.7E-04
	Workover Rig	CI-ICE	0.77	0.038	0.667	0.058	6.8E-04	2.5E-04	0	1.7E-04
	Workover Pump	CI-ICE	0.68	0.034	0.588	0.051	6.0E-04	2.2E-04	0	1.5E-04
	Workover Snub	CI-ICE	2.0	0.115	2.435	0.148	7.6E-04	2.7E-04	0	1.9E-04
	Flowback	CI-ICE	0.004	4.59E-04	0.003	0.000	1.3E-07	2.1E-07	0	0.0E+00
Operation	Equipment	Leaks	0	0	0.000	1.207	2.9E-03	9.3E-03	1.6E-03	8.4E-03
	Separator	Burner (Gas)	1.52	0.17	1.901	0.124	4.8E-05	7.7E-05	0	0.0E+00
Drilling	TOTAL		0.190	0.012	0.182	0.014	1.5E-04	5.5E-05	0	3.7E-05
Completion	TOTAL		155.2	2.2	177.6	139.0	1.6E-01	5.6E-02	0	3.9E-02
Operation	TOTAL		2.263	0.172	1.901	1.332	3.0E-03	9.4E-03	0	8.4E-03

4. DISPERSION MODEL APPROACH

Overall guidance for preparing this modeling effort was based on guidance provided by the Colorado Air Pollution Control Division.[7] The modeling effort included separate analyses for the three phases (drilling, well completion/flowback, and normal operation) and separate activities within each phase. The modeling analyzed the combined impacts of concurrent operations and emissions from the Sheridan and Lowell well pads.

The aim of the modeling study described herein was to provide a realistic, yet representative analysis of the expected ambient air concentrations due to the well development activities at the proposed sites.

4.1 MODEL SELECTION

The most-recent versions of the AERMOD modeling system were used in the analysis:

- AERMOD version 16216r;
- AERSURFACE version 13016;
- AERMET version 16216;
- AERMAP version 11103; and
- BPIPPRM (04724) for barrier and wake effects.

AERMOD is the EPA-recommended model for nearfield (less than 50 km) impacts[8] that was formulated by the EPA and American Meteorological Society (AMS).[9] The model is a regulatory tool that is designed to quantify the expected air quality impacts from unbuilt sources, therefore it is designed to be protective of the National Ambient Air Quality Standards and other applicable standards (i.e., not under-predict the highest impacts from a source). The model has been extensively evaluated for various source types, averaging periods, climates, terrain conditions, urban and rural conditions, and with and without wake effects (downwash) by comparing to field studies and a wind tunnel evaluation.[10] A detailed review of AERMOD performance indicates that the model is generally conservative, especially for predicted high (maximum) impacts. AERMOD was found to provide predictions that were within a factor of 2 of the observations over 70% of the time for low level source characterized as area and volume sources.[11] Frost[12] reported performance of AERMOD at the higher (maximum predicted) concentrations when compared in time and space[13] concluding that "over-prediction of the design value, although within the accepted regulatory model performance limit of a factor of 2, presents major ramifications for … permitting …". The model is constantly undergoing additional development to address known

[7] Colorado Modeling Guideline for Air Quality Permits, updated May 20, 2011.
[8] 40 CFR Part 51 Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches To Address Ozone and Fine Particulate Matter, January 17, 2017.
[9] Cimorelli, A.J., et. al., 2005: AERMOD: A dispersion model for industrial source applications. Part I: General Model Formulation and Boundary Layer Characterization. *J. Appl. Meteor*. 44. 682-692
[10] Perry, S.G.,et al., 2005: AERMOD: A dispersion model for industrial source applications. Part II: Model performance against 17 field study databases. *J. Appl. Meteor*. 44. 694-708
[11] Ibid.
[12] Frost, K.D., 2014: AERMOD performance valuation for three coal-fired electrical generating units in southwest Indiana. *J. of the Air & Waste Management Association*, 64:3 280-290.
[13] Comparing model performance to monitored concentrations, when paired in time and space, is a stringent requirement. Air dispersion models have been shown to adequately recreate the magnitude of the concentrations at some receptor and at some time, but not necessarily at the time and location of the measured concentration.

formulation issues such as low wind speed adjustments, urban heat island effects, and other important factors.[14] Yet when run in its default model (as done for this analysis), the AERMOD modeling (maximum impact) results presented herein should be interpreted in the context of the known model biases and conservatisms.[15]

4.2 BACKGROUND AIR QUALITY DATA

The modeling effort focused on impacts of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). No background data have been developed that are representative of the well pad sites. The nearest data from the Welby site in urban Denver, would not be representative for these locations. Representative background data for BTEX were obtained from the 2012 monitoring study in nearby Erie[16]. No other nearby emission sources were explicitly included in the modeling analyses.

4.3 METEOROLOGICAL DATA

A high quality, pre-processed, meteorological dataset for the modeling analysis has been provided by the APCD from a site near Platteville, Colorado.[17] One year of data (2009) that includes monitors at 2-, 10-, 30-, and 60-m levels above the ground were used for this analysis. The meteorological data were collected 32 km from the proposed pad sites, but as noted by APCD, this data set contains higher quality and resolution data, which is critical for air dispersion modeling analyses. Review of the surface characteristics surrounding the collection site indicates a rural area surrounded by natural scrubland with some irrigated land in the distance. These surface characteristics are generally representative of the proposed pad sites, which are surround by natural scrubland and residential areas. It is expected that the heat fluxes, mixing heights and atmospheric stability generated by the meteorological dataset are representative of the proposed pad sites. The meteorological monitoring site and the well pad locations are both within shallow valleys surrounded by rolling terrain, with a predominant terrain features trending northeast/southwest. Therefore the modeling results are provided without any adjustment based on terrain features or topographic differences between the Fort St. Vrain data at the Broomfield site. A wind rose is provided in Figure 4, which also depicts the site locations.

4.4 RECEPTORS AND TERRAIN

The model calculated air quality concentrations from the emission sources at model receptors. A nested Cartesian receptor grid was generated, centered around the Lowell and Sheridan sites. The resolution of the receptor grid was developed as follows:

- Pad boundaries – 25 meter resolution;
- Within 2.5 km (1.55 miles) – 50 meter resolution; and

[14] 40 CFR Part 51 Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches To Address Ozone and Fine Particulate Matter, January 17, 2017.
[15] It is noted that the beta LOWWIND options were not incorporated as default (as was proposed) into the most recent version of AERMOD because it was not sufficiently robust and conservative.
[16] *Air Emissions Case Study related to Oil and gas Development in Erie, Colorado*, Colorado Air Pollution Control Division, 2012.
[17] APCD provided two processed datasets: 1) data processed with the adjust u* option 2) data processed without the adjust u* option. The dataset that did not utilize the adjust u* option was used the modeling analysis.

- Within 5.0 km (3.1 miles) – 100 meter resolution.[18]

This grid resulted in assessing impacts at 25,325 receptors. The modeling results confirm that the magnitude of the impacts from the sources rapidly decrease with distance from the source, and no additional modeling was required to assess "hot spots" that are evident due to terrain or other features. An illustration of the modeling receptor grid is provided in Figure 5.

The AERMAP processor was run with the above receptor grid and terrain data downloaded from the 1/3 arc-second National Elevation Dataset (NED) quadrants[19]. The elevations for all sources, structures, and receptors were obtained from this NED data. An illustration of the nearby terrain data for the area that was used in AERMAP is provided in Figure 6.

All receptor and source locations were modeled in the coordinate system of UTM 13, NAD 83.

[18] It is noted that the CDPHE modeling guideline recommends 50 to 100 m spacing along the boundary; 100 m spacing out 1 km; and 250 m spacing out to 3 km. Therefore, the proposed receptor grid for this analysis is more refined than the guidance requires.
[19] https://viewer.nationalmap.gov

Figure 4 2009 Annual Wind Rose for Fort Saint Vrain and Site Locations

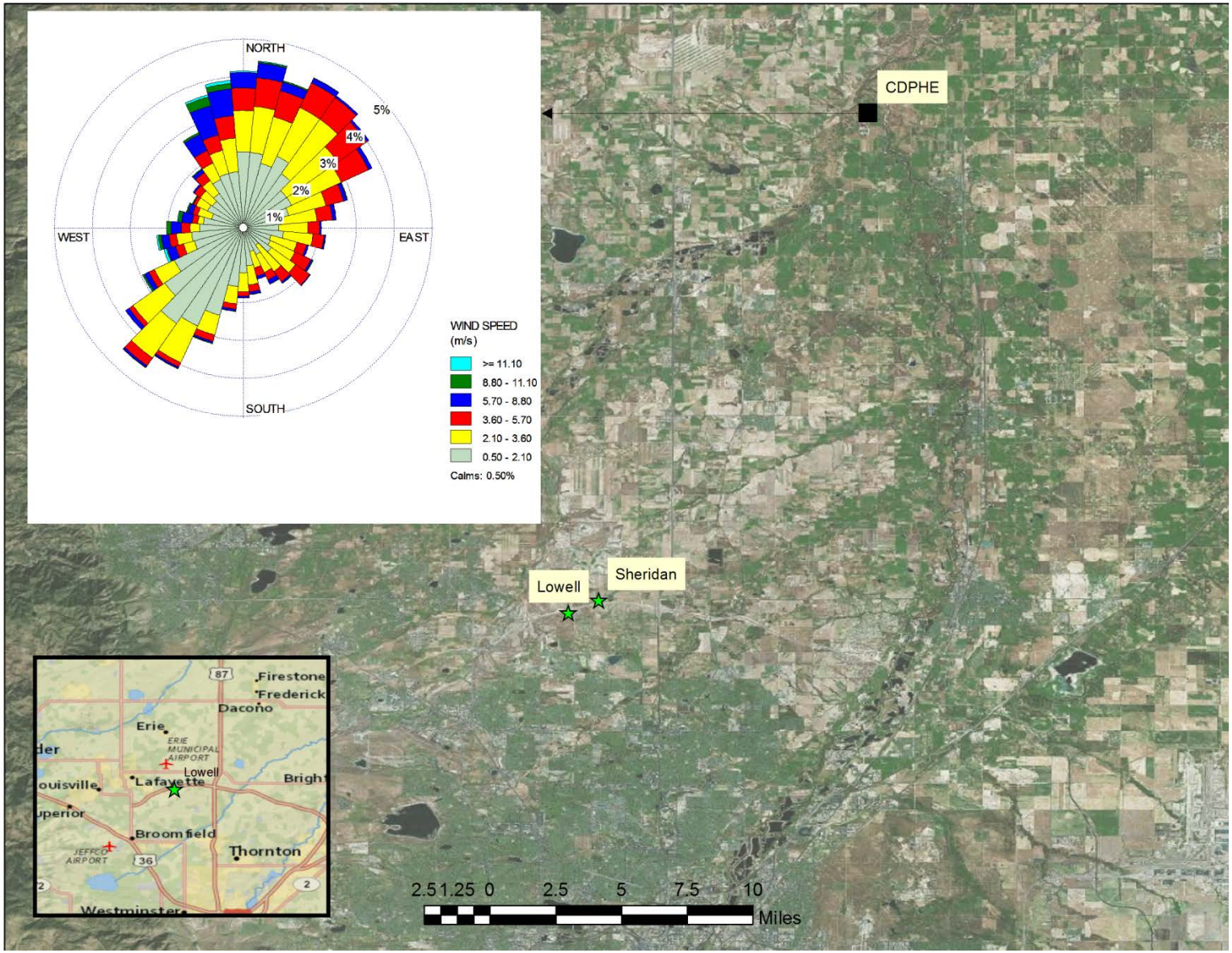
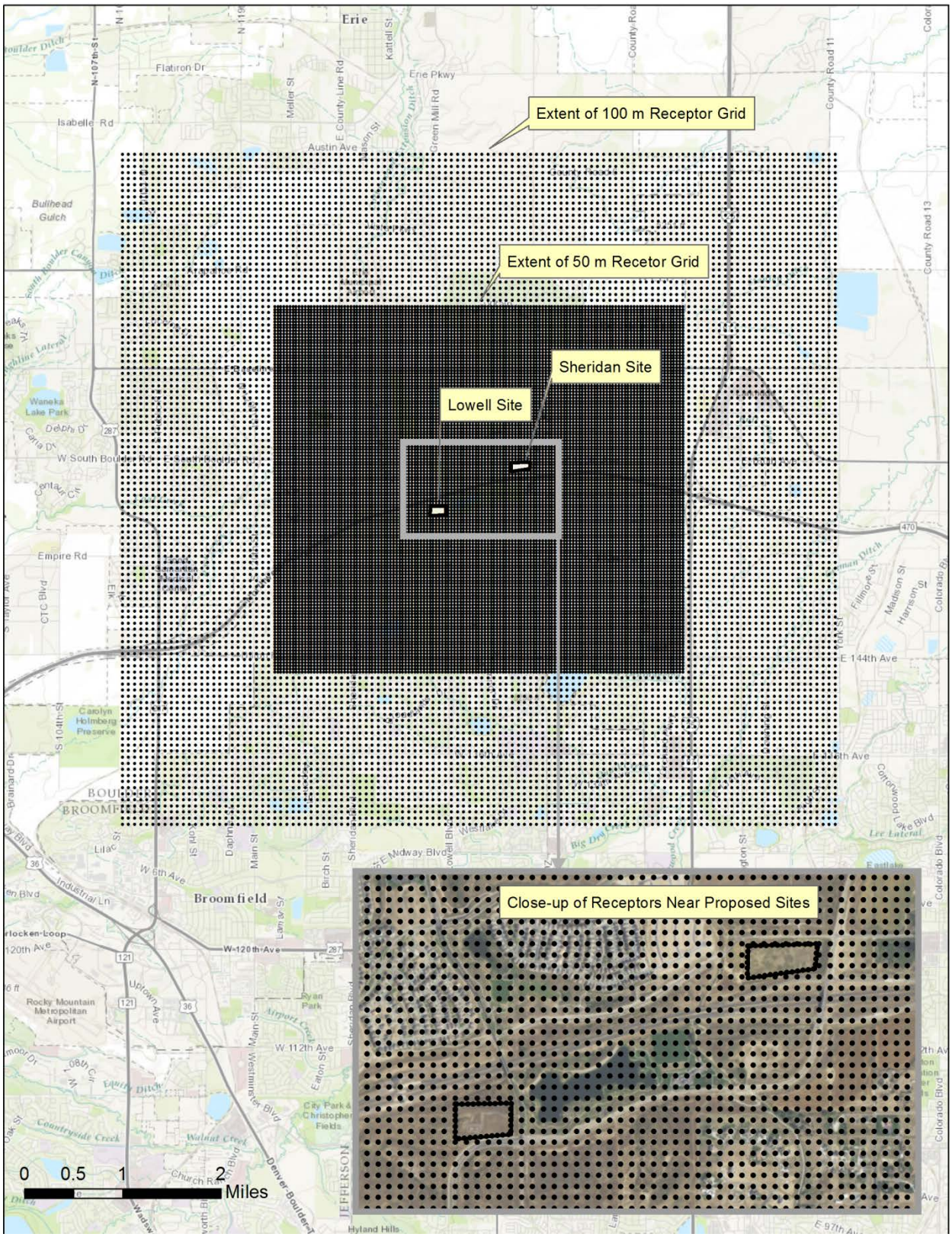


Figure 5 Modeling Receptor Grid



4.5 BUILDING OR WAKE EFFECTS

Schematics of the pads during drilling and completing the wells are provided in Figures 2 and 3. During these activities, 32 foot sound barriers surrounding each pad will be constructed. In addition, various support equipment and structures will also be present onsite. Both the sound barriers and support equipment/structures can impede the airflow within and around the well pad. This approach results in cavity zone recirculation and downwash of source emissions.[20] The USEPA program designed to account for such effects is the Building Profile and Input Program (BPIP), which takes into account the relative proximity and height of each point source and structure. If a point source is within the area of influence of a structure, then BPIP generates direction-specific AERMOD inputs for that source.

SLR digitized the input into BPIP each proposed site with a 32 foot sound barrier and representative support equipment/structures for drilling and well completion in order to address cavity zone recirculation and downwash.[21] No point sources, sound barriers, or large structures will be onsite during the production phase; therefore these sources were not assessed in BPIP. Illustrations of the digitized site layout are provided in Figures 6 and 7.

[20] AERMOD only explicitly incorporates downwash effects for point sources.
[21] It is noted that BPIP was designed to address downwash for industrial facilities and more complicated structures like sound barriers. Nevertheless, it is proposed to use readily-available tools in order to conduct the analysis.

Figure 6 Digitized Layout for Fracking Scenario

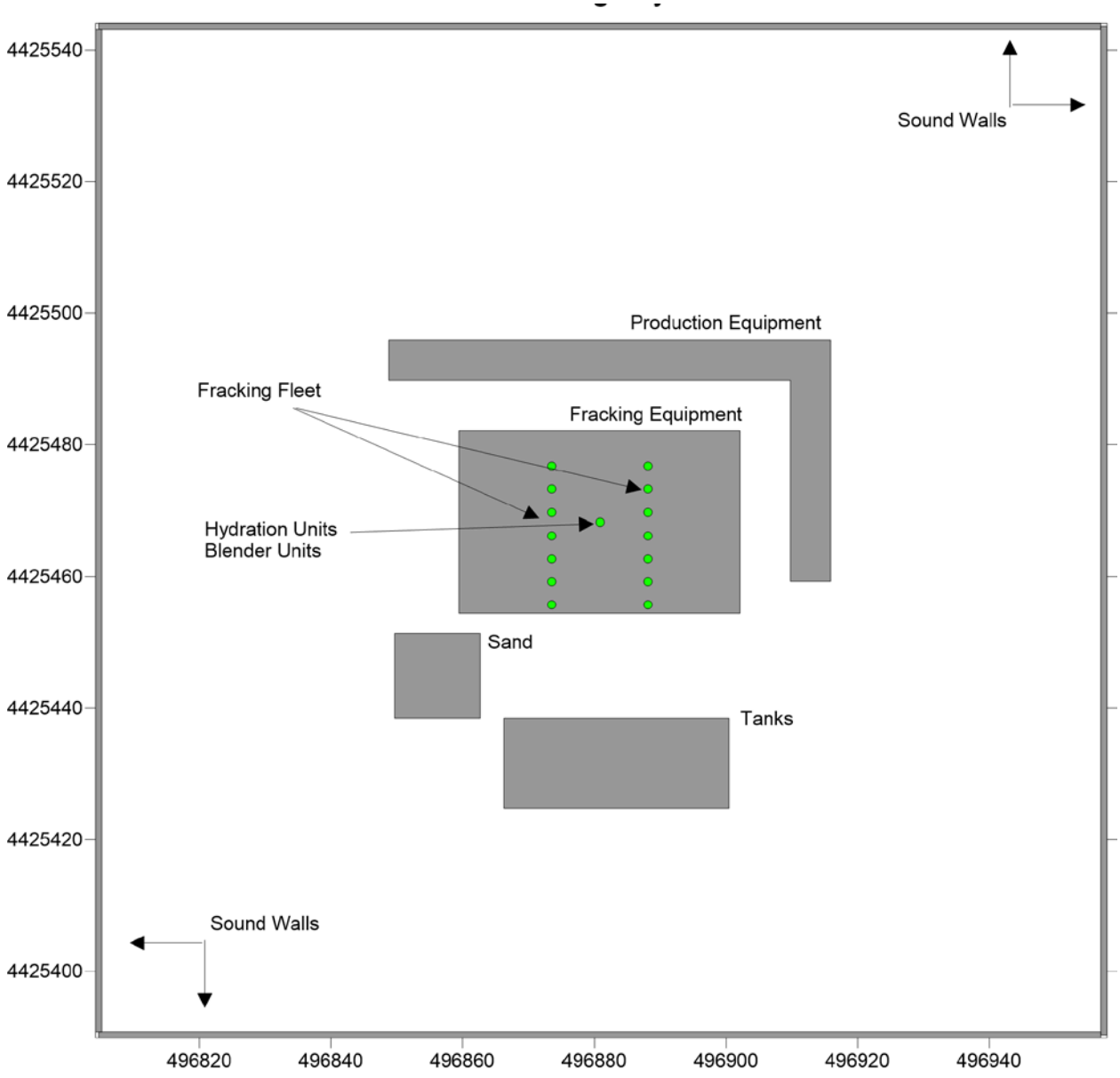
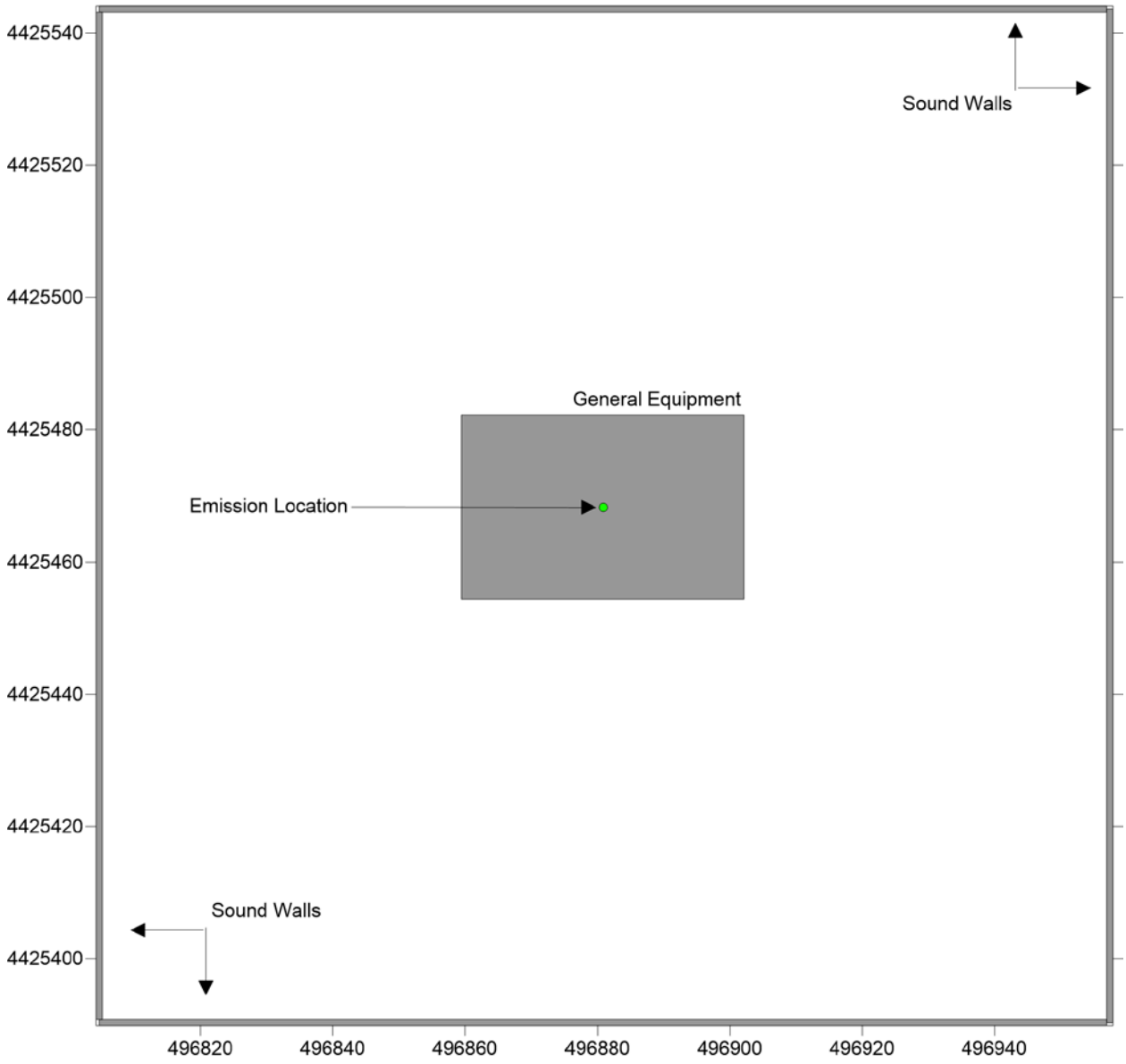


Figure 7 Digitized Layout for Drilling and Other Completion Activities



4.6 SOURCE INPUTS

The AERMOD dispersion model can characterize source emissions with three main source types – point, volume, and area. As is typical of such efforts, the emission sources associated with drilling, well completion and production were characterized by point sources (e.g., stationary combustion sources) and volume or area sources (e.g., fugitive, non-point, or miscellaneous sources). Final source

characterization considered the specific site layouts, proximity to receptors (i.e., volume sources cannot be too close to receptors), and other project-specific information.

For modeling purposes in determining annual impacts, it was assumed that each phase of each pad's development would occur separately over a single year. As discussed in Sections 2 and 3, the operating plan is to sequentially drill each well, remove all drilling equipment, then sequentially complete each well before production commences. Based on the development plan and expected operating schedule:

- the Sheridan site will have:
  - drilling operations for 152 days
  - completion operations for 247 days
- The Lowell site will have:
  - drilling operations for 232 days
  - completion operations for 377 days
- Each site will be in the production phase thereafter.

Therefore, the modeling consisted of:

- Drilling Phase – concurrent at Sheridan and Lowell sites:
  - Emissions associated with electrified drilling including engines associated with cementing
  - Emissions for cementing were pro-rated to account for the fact that they only occur for 12 hours over an 8 day period. Cementing operations occur for one well at a time. Any other emissions associated with drilling were assumed to be in continuous operation.
  - The sources were held stationary for the duration of the modeled activity.
- Well completions – concurrent at Sheridan and Lowell sites:
  - Emissions associated with each phase of the completion process were modeled separately, including:
    - The fracturing operation
    - Coil tubing units cleanout
    - Workovers
    - Flowback
    - These activities do not occur concurrently, therefore, each activity was modeled individually.
    - The sources were assumed to be stationary and to be in constant operation for the duration of the modeled activity.
- Production emission – concurrent at the Sheridan and Lowell sites:
  - Emissions associated with production were assumed to be stationary and to be in constant operation for the duration of the modeled activity.
  - Fugitive equipment leaks were modeled as a volume source consistent with the size of the overall equipment.

The modeling used a Tier 3 (ozone limiting method) approach for refined NO_2 impacts and included data on the in-stack ratio of NO_2 to NO_X. For the fracking engines an in-stack NO_2 to NO_X ratio of 0.5 % was

used, and for other engine combustion sources, a NO_2/NO_X ratio of 10% was used[22]. The PM_{10} and $PM_{2.5}$ emission rates were based on the filterable portion only since the formation of secondary pollutants such as sulfates and nitrates would be minimal given the relative short distance and short atmospheric residence time from source to nearby receptors.

The final modeling analysis incorporated available vendor and typical stack inputs for each source and activity, including: source type, modeled emission rate, and source parameters (height, diameter, flow rate, emission temperature). Table 7 lists each unit type in the emissions inventory for all phases of the development, including the number of separate units at each well pad, along with make and model of the units that are planned for development.

[22] Performance test of Cummins Model QSK60-G6 (Tier 1) compression-ignition (diesel) engine conducted February 4, 2003, Northstar Production Facility, BP Exploration (Alaska) Inc., The RETEC Group, Inc. report date: March 1, 2003.

Table 7 Emission Unit Source Parameters Used in Modeling

ACTIVITY – EMISSION UNIT	MAKE/MODEL	MODELED EXIT STACK PARAMETERS			
		Height (m)	Temperature (Degrees K)	Velocity (m/s)	Diameter (m)
Drilling Mud	Questor Q5000	3.66	533	1.52	0.152
Cementing: HCR Elite® Trailer Deck Engines	#N/A	6.10	641	45.83	0.234
Cementing: Auxiliary Engine	Cummins QSB6.7	6.10	641	45.83	0.234
Frac: Hydration Unit	Cummins QSK 15L	4.11	766	34.98	0.254
Frac: Blender Units	Cummins QSK 19L	4.11	766	34.98	0.254
Frac: Pumps (14 separate Units)	Cummins QSK 50L	4.11	766	34.98	0.254
Coil Tubing Cleanout (3 Separate Units)	Cummins 550 ISX	6.10	687	57.36	0.226
Workover: Rig Engine	Detroit Diesel 60	6.10	757	82.05	0.127
Workover: Pump Engine	Detroit Diesel 60	6.10	757	82.05	0.127
Workover: Snubbing Hydraulics	Cummins ISX	6.10	757	82.05	0.127
Flowback	Questor Q5000	3.66	533	1.52	0.152
Production	N/A	0.91	ambient	0.03	0.003
Production	TBD	3.66	533	1.52	0.152

5. MODEL RESULTS

The results of the modeling analysis summarize the 1-hour and annual NO_2 impacts; 24-hour PM_{10} impacts; 24-hour and annual $PM_{2.5}$ impacts, and short-term and annual BTEX impacts. The applicable National Ambient Air Quality Standards (NAAQS) are provided in Table 8 below. Results are provided separately for each phase and activity expected for well development. As noted in Table 8, several pollutants have standards that are based on a 3-year average of the design concentrations[23]; this includes 1-hour NO_2 and 24-hour and annual $PM_{2.5}$. All results have been provided in the context of the expected sequence of activities; for example the calculation of the 3-year values are based on one year of drilling, one year of fracking, and one year of production.

Table 8 Applicable Ambient Air Quality Standards

POLLUTANT	NAAQS		
Pollutant	1-hour	24-hour	Annual
NO_2	188 µg/m^3 (a)	--	100 µg/m^3 (b)
PM_{10}	--	150 µg/m^3 (c)	--
$PM_{2.5}$	--	35 µg/m^3 (d)	12 µg/m^3

a) 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
b) Maximum annual mean.
c) Not to be exceeded more than once per year on average over 3 years.
d) 98th percentile of daily 24-hour average concentrations, averaged over 3 years.

5.1 NO_2 IMPACTS

Nitrogen oxides are emitted from combustion operations, specifically including any engines that operate on-site, process heaters, and the ECD. As noted in Section 4, the NO_2 impacts were evaluated using the ozone limiting method and an in-stack NO_2/NO_X ratio for individual sources. Table 8 provides the results of the modeling for the 1-hour standard for each modeled activity. As noted in section 4, it was assumed that each phase of development would occur separately over a single year and sequentially (drilling, then completions, then operations) over three years. Therefore, the model result that is appropriate to compare to the standard is a 3-year average of the design value concentrations based on impacts from drilling, completions (the CTU cleanout activity with the highest impacts), and operations.

[23] "Design" concentrations or value refers to the rank or distribution of concentrations that is compared to the ambient standard. For instance, the design value for 1-hour NO_2 is the 98th percentile of 1-hour daily maximum concentrations; the design value for annual $PM_{2.5}$ is the maximum annual concentration at any receptor, etc.

Table 9 Combined 1-hour NO_2 Impacts by Phase and Activity (results in µg/m^3)[1]

PHASE	ACTIVITY	YEAR 1	YEAR 2	YEAR 3	PERCENT OF STANDARD
Drilling	Drilling	***107.4***			
Completions	Fracking		160.4		
	CTU Cleanout		***170.2***		
	Workover		160.8		
	Flowback		4.4		
Operation	Operation			***17.1***	
Three-year average		(107.4 + 170.2+ 17.1)/3 = 98.2			98.2/188 = 52%

[1]The NAAQS for the 3-year average of the 98th percentile daily 1-hour maximum impact is 188 µg/m^3. The results presented in this table represent the combined impacts from both Lowell and Sheridan operating concurrently. The provided results are the design value for 1-hour NO_2 reported for each phase/activity.

Figure 8 depicts the 3-year averaged results as a percent of the 1-hour NO_2 design value for the three phases of well development (drilling, CTU cleanout, and production), from the concurrent development and operation of the two well pads. The modeled impacts indicate that for the three-year period that includes concurrent well development at both sites, the impacts from the on-site equipment would comply with the 1-hour NO_2 air quality standard (188 µg/m^3). The well development is a temporary activity and thereafter, only production equipment will be on-site. Figure 9 illustrates the expected air quality impacts from production operations as a percent of the 1-hour NO_2 design value.

Table 10 provides the annual average NO_2 impacts for each phase of development and related activities. As shown in the table all projected impacts for any scenario or activity are less than the annual NO_2 NAAQS.

Table 10 Annual NO_2 Impacts by Phase and Activity (results in µg/m^3)[1]

PHASE	ACTIVITY	MAXIMUM IMPACT	PERCENT OF STANDARD
Drilling	Drilling	0.2	0.2/100 = 0.2%
Completions	Fracking	21.8	21.8/100 = 22%
	CTU Cleanout	4.6	
	Workover	2.4	
	Flowback	0.0	
Operation	Operation	3.7	3.7/100 = 3.7%

[1]The NAAQS for annual NO_2 is 100 µg/m^3 for each year. The results presented in this table represent the combined impacts from both Lowell and Sheridan operating concurrently. The results provided are the design value for annual NO_2.

Figure 8 1-hour NO_2 Impacts from Drilling, CTU Cleanout, and Operations (Three-Year Average)

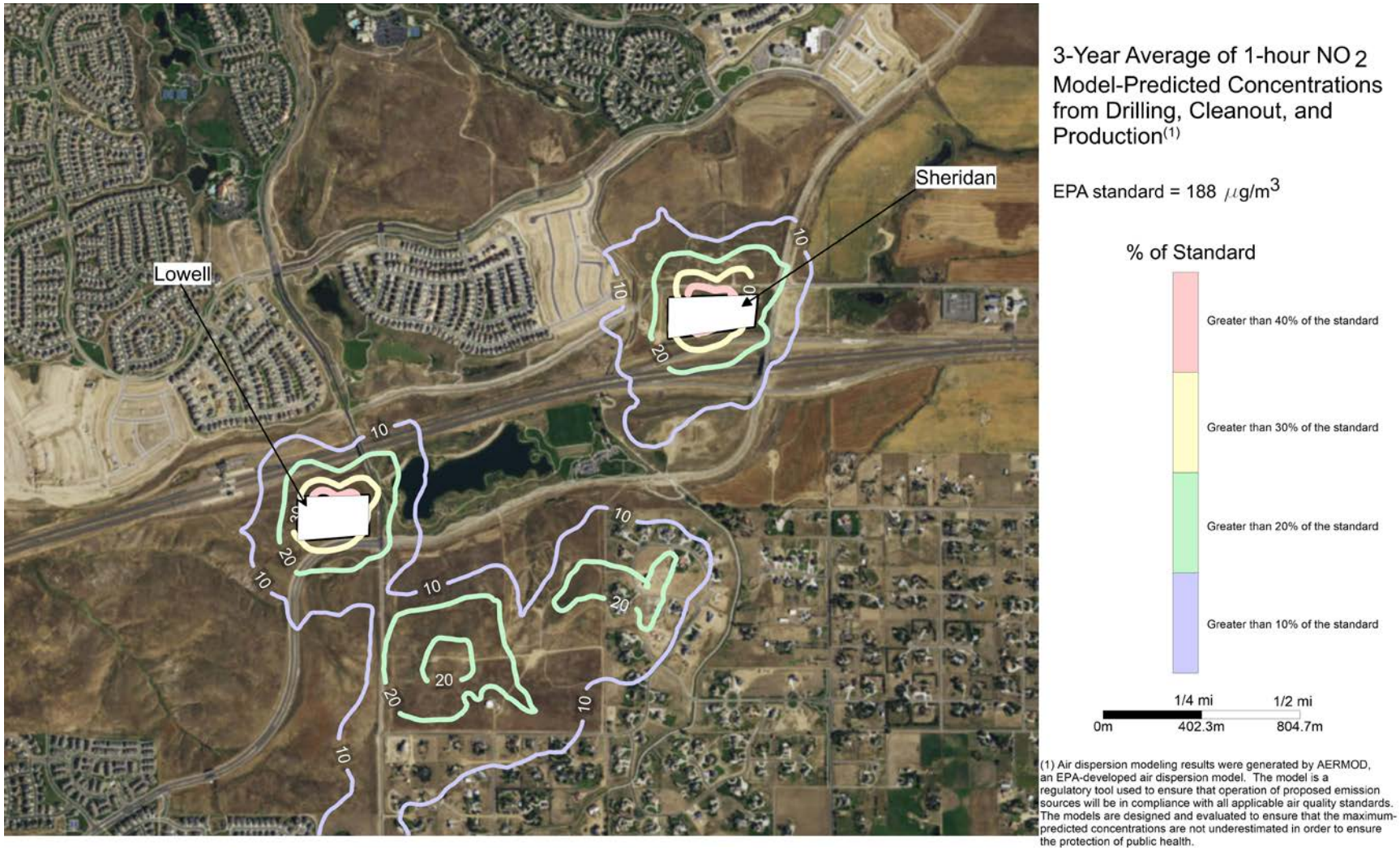
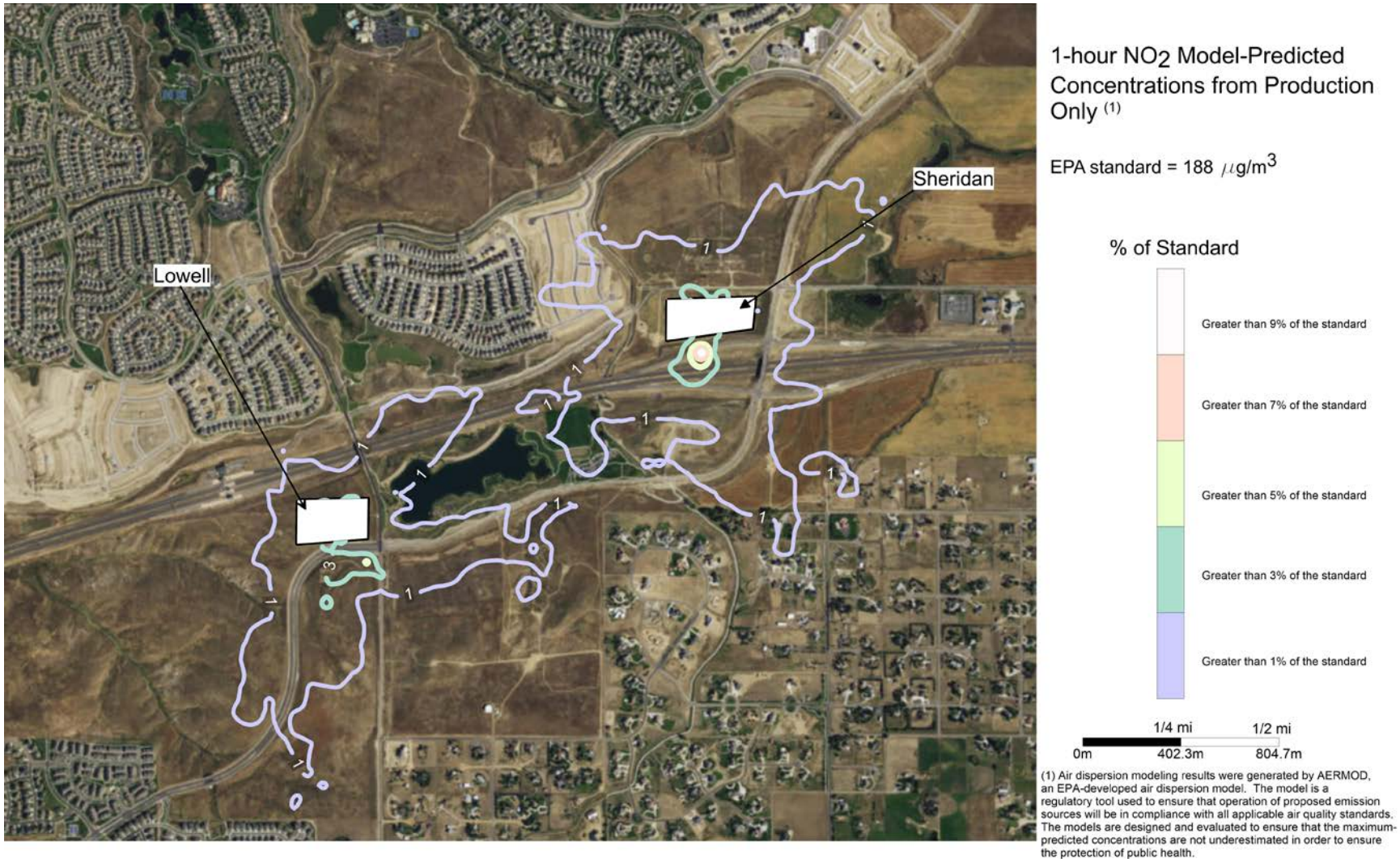


Figure 9 1-hour NO_2 Impacts from Production Equipment Only



5.2 PARTICULATE MATTER IMPACTS

Particulate matter as PM_{10} and $PM_{2.5}$ are emitted from fugitive sources as well as from combustion equipment and other processes. Table 11 provides the design value of the 24-hour PM_{10} impacts for each phase of development and related activities. As shown in the table all projected impacts for any scenario or activity are less than 24-hour PM_{10} NAAQS.

Table 11 24-hour PM_{10} Impacts by Phase and Activity (results in µg/m^3)[1]

PHASE	ACTIVITY	MAXIMUM IMPACT	PERCENT OF STANDARD
Drilling	Drilling	2.0	2/150 = 1.3%
Completions	Fracking	21.9	21.9/150 = 15%
	CTU Cleanout	12.6	
	Workover	8.3	
	Flowback	0.2	
Operation	Operation	0.2	0.2/150 = .13%

[1] The NAAQS for 24-hour PM_{10} is 150 µg/m^3. The results presented in this table represent the combined impacts from both Lowell and Sheridan operating concurrently. The results are the design value for 24-hour PM_{10}.

Table 12 shows the design value of the daily $PM_{2.5}$ impacts at the maximum receptor for each phase and activity. Similar to 1-hour NO_2, the table also includes a calculation of the maximum impact, with a 3-year value based on the expected sequence of well development, i.e., drilling, completion, and normal operations would occur over a 3-year period. Once operations are underway, the maximum impacts would be represented by the 0.2 µg/m^3 value for operations alone.

Figure 10 depicts the 3-year averaged results of the 24-hour $PM_{2.5}$ as a percent of the design value for the three phases of well development (drilling, fracking, and production), from the concurrent development and operation of the two well pads. The modeled impacts indicate that for the three-year period that includes concurrent well development at both sites, the impacts from the on-site equipment would comply with the 24-hour $PM_{2.5}$ air quality standard (35 µg/m^3). The well development is a temporary activity and thereafter, only production equipment will be on-site. Figure 11 illustrates the expected air quality impacts due to the production phase equipment once well development is complete.

Compliance with the annual average $PM_{2.5}$ NAAQS is based on a 3-year average at the maximum receptor. Table 13 shows the maximum annual impact for each of the modeled phases and activities.

Table 12 24-hour $PM_{2.5}$ Impacts by Phase and Activity (results in µg/m^3)[1]

PHASE	ACTIVITY	YEAR 1	YEAR 2	YEAR 3	PERCENT OF STANDARD
Drilling	Drilling	***1.5***			
Completions	Fracking		***16.5***		
	CTU Cleanout		9.3		
	Workover		6.5		
	Flowback		0.1		
Operation	Operation			***0.2***	
Three-year average		(1.5 + 16.5 + 0.2)/3 = 6.0			6.0/35 = 17%

[1]The NAAQS for 24-hour $PM_{2.5}$ is 35 µg/m^3. The results presented in this table represent the combined impacts from both Lowell and Sheridan operating concurrently. The results are the design value for 24-hour $PM_{2.5}$ reported for each phase/activity.

Table 13 Annual $PM_{2.5}$ Impacts by Phase and Activity (results in µg/m^3)[1]

PHASE	ACTIVITY	YEAR 1	YEAR 2	YEAR 3	PERCENT OF STANDARD
Drilling	Drilling	***0.0***			
Completions	Fracking		***1.6***		
	CTU Cleanout		0.3		
	Workover		0.1		
	Flowback		0.0		
Operation	Operation			***0.5***	
Three-year average		(0.0 + 1.6 + 0.5)/3 = 0.7			0.7/12 = 5.8%

[1]The NAAQS for annual PM2.5 is 12 µg/m^3. The results presented in this table represent the combined impacts from both Lowell and Sheridan operating concurrently. The results are the design value for annual $PM_{2.5}$ reported for each phase/activity.

Figure 12 depicts the 3-year averaged results of the annual $PM_{2.5}$ design value for the three phases of well development (drilling, fracking, and production), from the concurrent development and operation of the two well pads. The modeled impacts indicate that for the three-year period that includes concurrent well development at both sites, the impacts from the on-site equipment would comply with the 24-hour $PM_{2.5}$ air quality standard (35 µg/m^3). The well development is a temporary activity and thereafter, only production equipment will be on-site. Figure 13 illustrates the expected air quality impacts for the annual $PM_{2.5}$ design value due to the production equipment once well development is complete.

Figure 10 24-hour $PM_{2.5}$ Impacts from Drilling, Fracking, and Operations (Three-Year Average)

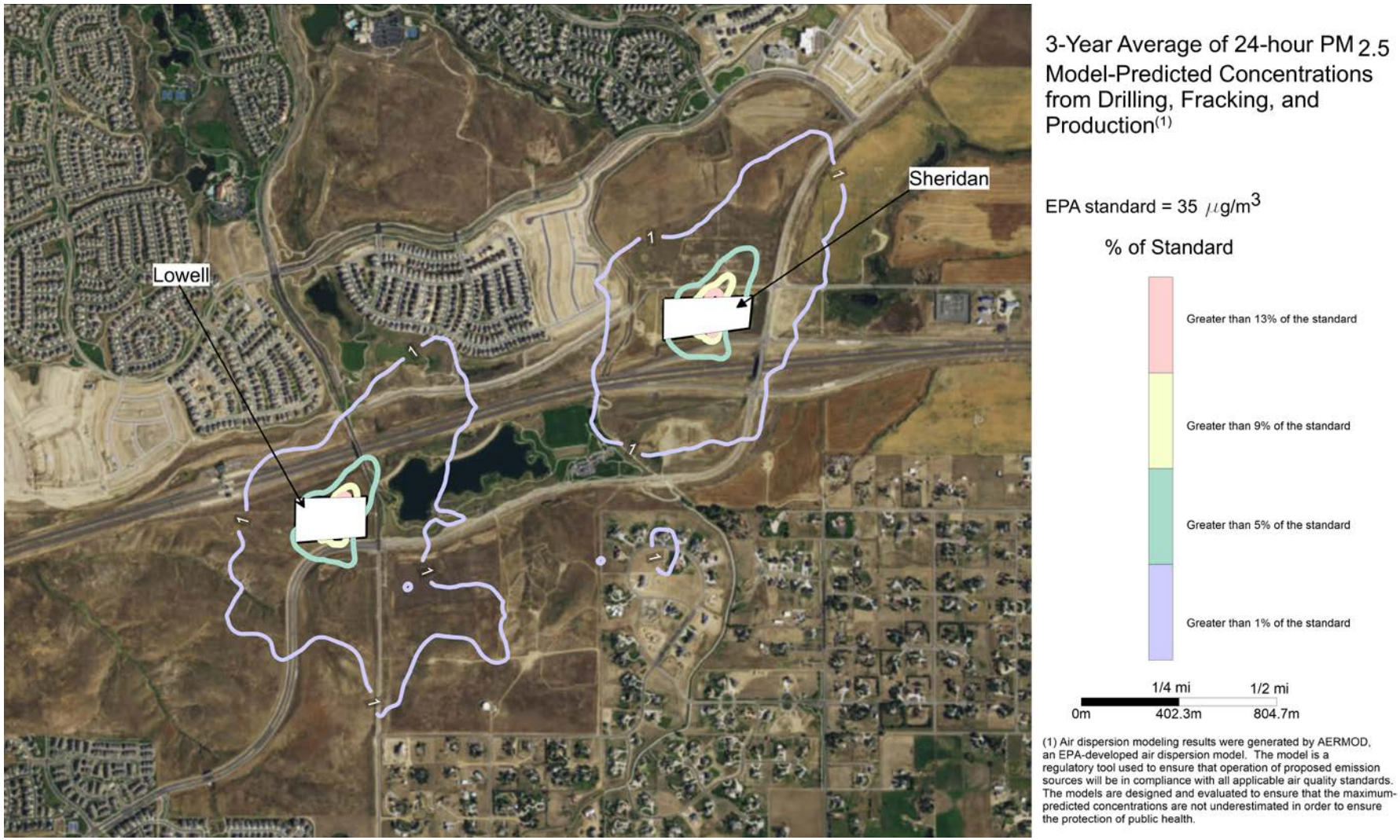


Figure 11 24-hour $PM_{2.5}$ Impacts from Production Equipment Only

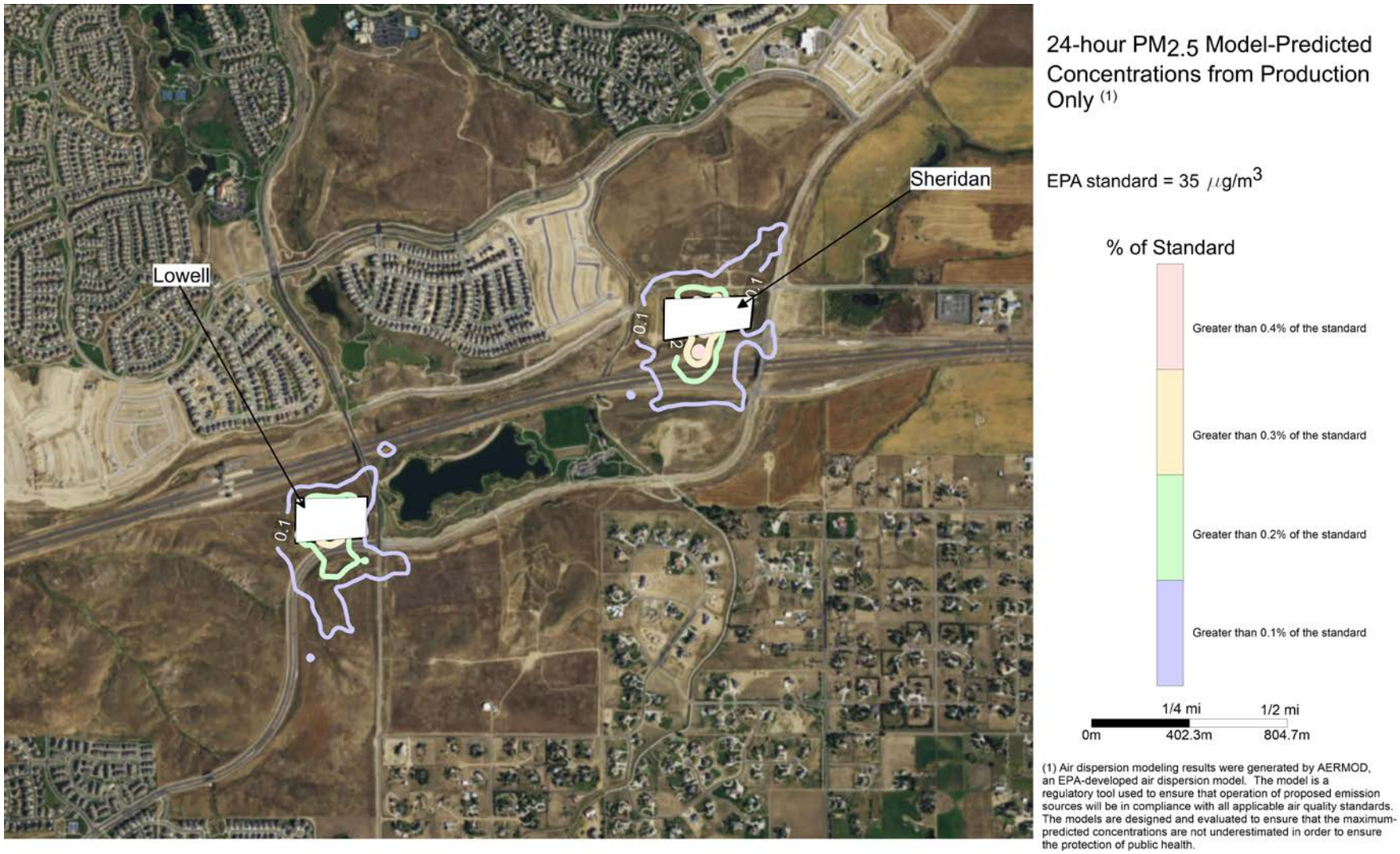


Figure 12 Annual $PM_{2.5}$ Impacts from Drilling, Fracking, and Operations (Three-Year Average)

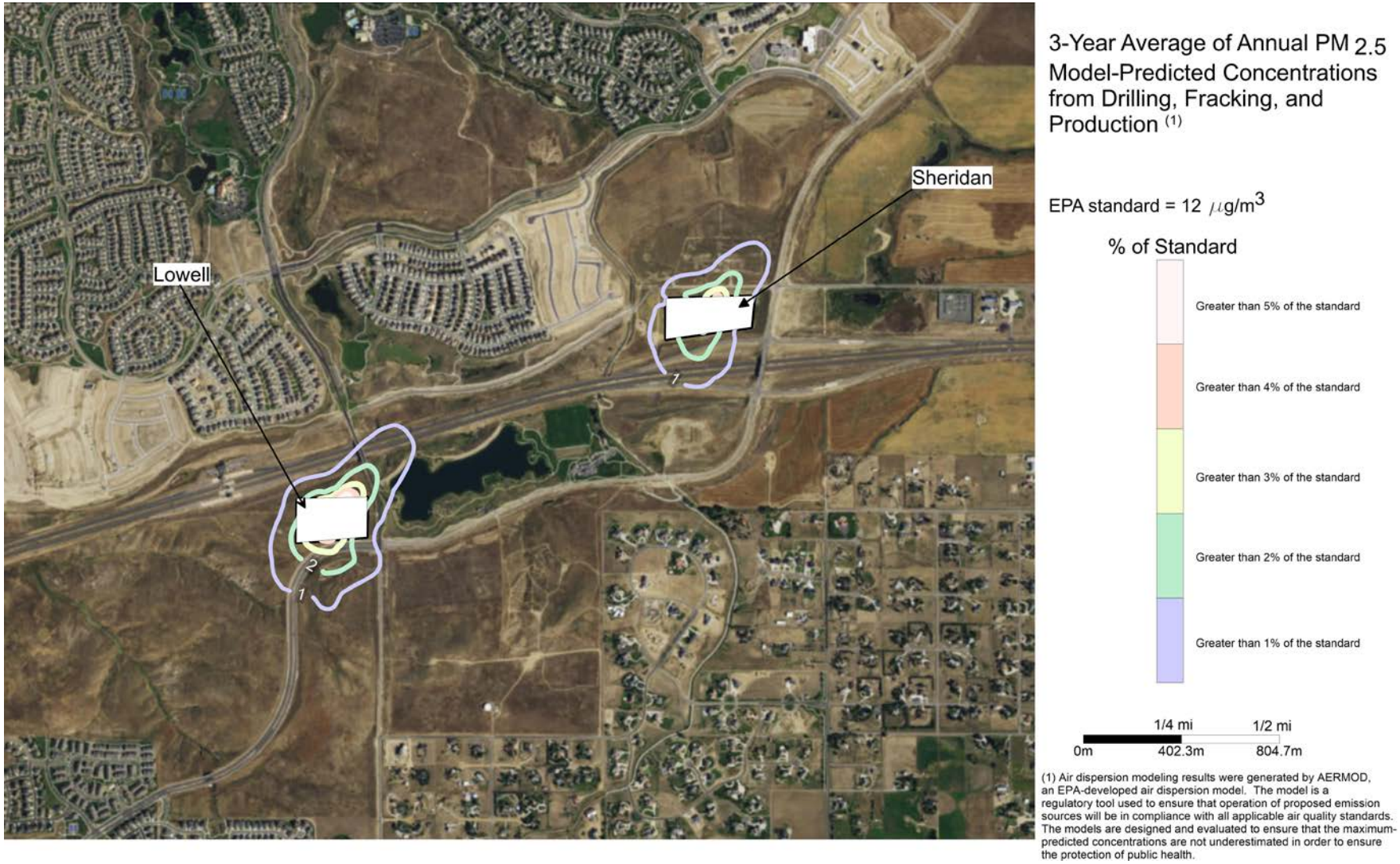
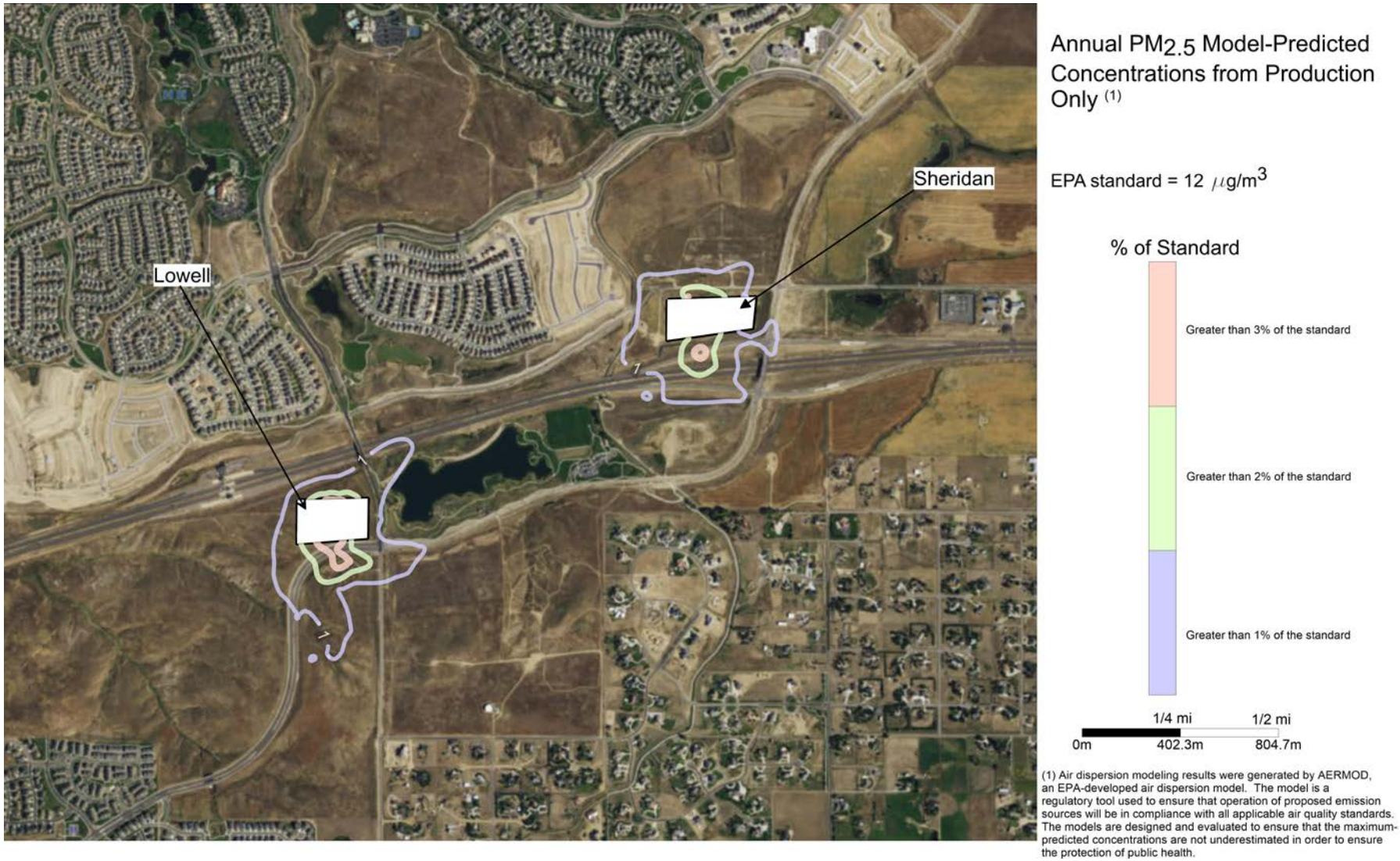


Figure 13 Annual $PM_{2.5}$ Impacts from Production Equipment Only



5.3 BTEX IMPACTS

Organic gases, including BTEX, are emitted from many sources including engines, combustion units, and fugitive emissions from handling of organic liquids. The combustion point sources were characterized as discussed in Section 4; and fugitive emissions were characterized as a low-level point source representative of the volume of the liquids and gas processing equipment, including the valves, flanges, connectors, etc. Note from Section 3 that there were no emission factors for ethylbenzene for internal combustion diesel engines.

Results are compared to relevant acute and chronic thresholds as provided in Table 14. Table 15 provides the impacts of emissions from the proposed project for each activity, averaging period, and comparison to the relevant thresholds.

Table 14 Relevant Acute and Chronic Thresholds

CONSTITUENT	ACUTE	CHRONIC
Benzene	29 µg/m^3 (a)	30 µg/m^3 (for noncancer) – (b)
Toluene	3,800 µg/m^3 (a)	5,000 µg/m^3 (for noncancer) – (b)
Ethylbenzene	22,000 µg/m^3	1,000 µg/m^3 (for noncancer) – (b)
Xylenes	8,700 µg/m^3 (a)	100 µg/m^3 (for noncancer) -- (b)

a) ASTDR Minimum Risk Level, Acute Response Assessment for Assessing Health Risks Associated with Exposure to Hazardous Air Pollutants (2014) https://www.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazaroud-air -pollutants

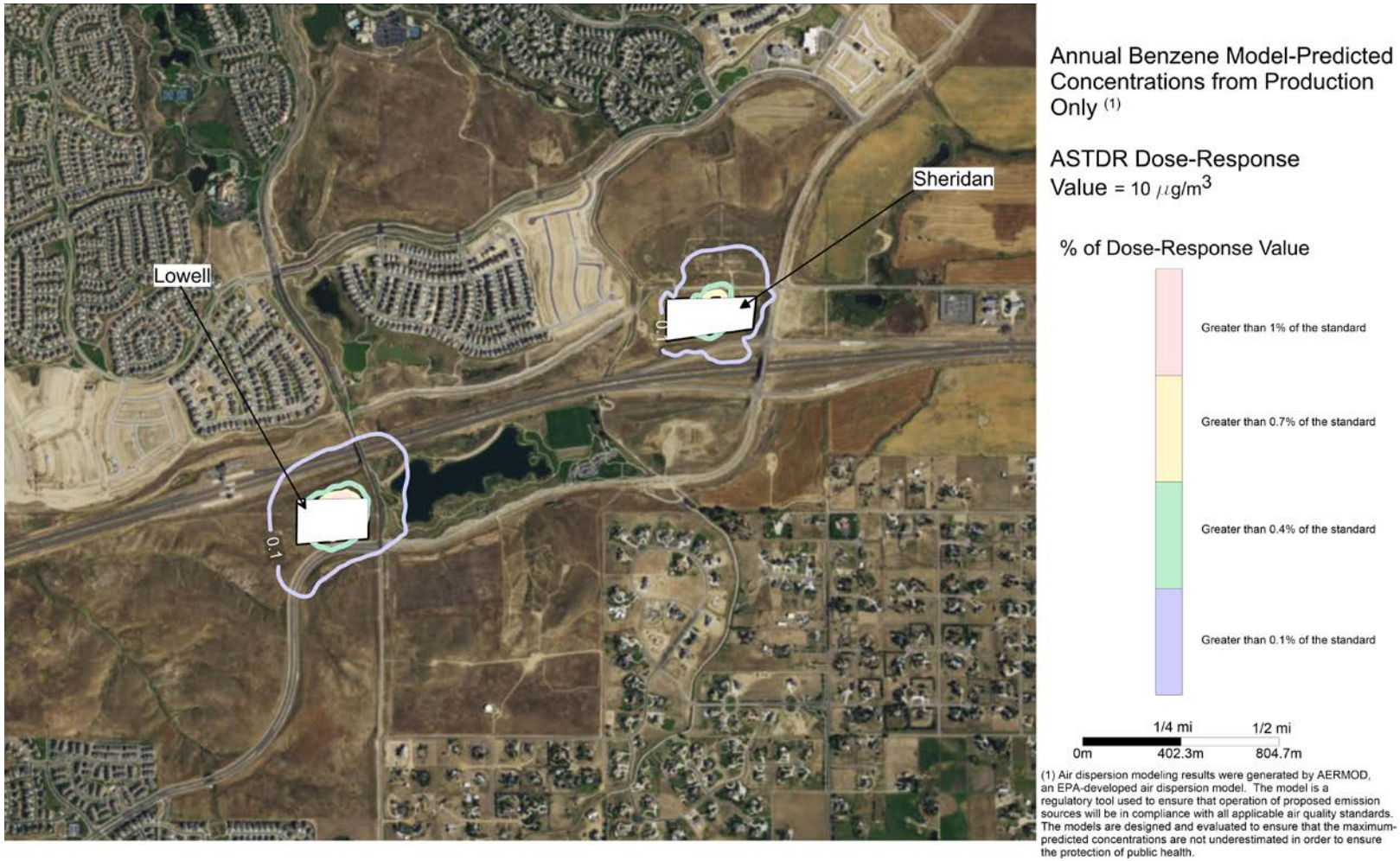
b) https://www.epa.gov/sites/production/files/2014-05/documents/table1.pdf ALSO https://www.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazaroud-air -pollutants

Table 15 Modeled Impacts of BTEX Compared to Relevant Thresholds (results in µg/m^3)

ACTIVITY	POLLUTANT	AVERAGING PERIOD	MAXIMUM IMPACT	BACK-GROUND	REL	PERCENT OF REL
Drilling	Benzene	1-hour	0.13	0.73	29	3.0
		Annual	0.00	0.73	39	2.4
	Toluene	1-hour	0.05	2.73	3,800	0.1
		Annual	0.00	2.73	5,000	0.1
	Xylenes	1-hour	0.03	1.26	8,700	0.0
		Annual	0.00	1.26	100	1.3
Fracking	Benzene	1-hour	9.44	0.73	29	35.1
		Annual	0.18	0.73	39	3.0
	Toluene	1-hour	3.42	2.73	3,800	0.2
		Annual	0.07	2.73	5,000	0.1
	Xylenes	1-hour	2.35	1.26	8,700	0.0
		Annual	0.05	1.26	100	1.3
CTU Cleanout	Benzene	1-hour	0.37	0.73	29	3.8
		Annual	0.00	0.73	39	2.4
	Toluene	1-hour	0.14	2.73	3,800	0.1
		Annual	0.00	2.73	5,000	0.1
	Xylenes	1-hour	0.09	1.26	8,700	0.0
		Annual	0.00	1.26	100	1.3
Workover	Benzene	1-hour	0.37	0.73	29	3.8
		Annual	0.00	0.73	39	2.4
	Toluene	1-hour	0.13	2.73	3,800	0.1
		Annual	0.00	2.73	5,000	0.1
	Xylenes	1-hour	0.09	1.26	8,700	0.0
		Annual	0.00	1.26	100	1.3
Flowback	Benzene	1-hour	0.00	0.73	29	2.5
		Annual	0.00	0.73	39	2.4
	Toluene	1-hour	0.00	2.73	3,800	0.1
		Annual	0.00	2.73	5,000	0.1
	Xylenes	1-hour	0.00	1.26	8,700	0.0
		Annual	0.00	1.26	100	1.3
Production	Benzene	1-hour	0.23	0.73	29	3.3
		Annual	0.12	0.73	30	2.8
	Ethyl-benzene	1-hour	0.13	0.25	22,000	0.0
		Annual	0.07	0.25	1,000	0.0
	Toluene	1-hour	0.73	2.73	3,800	0.1
		Annual	0.38	2.73	5,000	0.1
	Xylenes	1-hour	0.66	1.26	8,700	0.0
		Annual	0.34	1.26	100	1.6

The modeled results show that incremental impacts from the proposed project are well below the acute and chronic Relative Exposure Level thresholds. The background concentrations are provided mainly for informational purposes to demonstrate the very low comparative existing concentrations.

Figure 14 Annual Benzene Concentrations as a Percent of Chronic REL for the Production Scenario



6. CONCLUSIONS

Based on the emission data, operations and design data, and impact analysis the following conclusions are drawn from this analysis, for the development of the Extraction Oil & Gas Broomfield Development Project.

1. Overall emissions from regulated stationary sources are below a threshold that requires a formal permit from the regulatory agency (CDPHE). Emissions from fugitive sources and from non-stationary sources, including non-road engines, are excluded from determining the applicability of a permitting requirement.

2. The study does not include the incorporation of "background" levels of air quality for criteria pollutants, which could be added to the impacts to account for existing, non-modeled sources. More representative background levels may be developed for this specific site, leading to an adjustment in the total impacts presented herein.

3. The modeling followed CDPHE guidance and standard modeling practices. The intent was to develop a reasonable and generally representative analysis of the expected well development activities and resultant downwind air quality impacts. The analysis conservatively assumed identical and concurrent well development activities at both the Lowell and Sheridan sites.

4. Project-only ambient air quality impacts are shown to be below the applicable ambient air quality standards.

5. The highest impacts occur near the immediate boundary of the well pads and are reduced dramatically at receptors beyond that boundary. At any residential receptors, impacts are well below the NAAQS.

6. A human health risk assessment shows that risks associated with BTEX are below the chronic and acute RELs.

LIMITATIONS

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