

# SITE-SPECIFIC QUALITY ASSURANCE & QUALITY CONTROL AUDIT

## Permit Closure Type – Final



## PERMIT CLOSURE REPORT – RANGELAND

Location ID 331380

Location Name DOW/23-28 PAD

### Report Date

31 May 2023

Soil Sage has conducted a thorough data audit as part of our Quality Assurance and Quality Control (QA/QC) protocols. The audit revealed this site has gone through a land use change.

### Initial Job Assignment

Client	CIVITAS Resources
Work Assignment	CPW Centennial Valley Wildlife Area Reclamation Report
Date	April 26, 2023

### Quality Assurance & Quality Control Audit

Auditor	Soil Sage
Audit Date	05/05/2023

### Audit Methodology

The following source materials were consulted during the QA and QC audit process:

- ✓ Site Permit Closures provided by CIVITAS Resources
- ✓ Colorado Oil & Gas Information System – COGIS Database
- ✓ On-site Evaluation and Proprietary Soil Sage Drone Imagery data collection
- ✓ Review of legacy imagery for site location and facility parameters

All pertinent data, imagery, and materials are included at the end of this report.

## Site Description

<b>Name</b>	DOW/23-28 PAD		
<b>Location ID</b>	<a href="#">331380</a>		
<b>Operator / #</b>	BONANZA CREEK ENERGY OPERATING COMPANY LLC / 8960		
<b>Field</b>	WATTENBERG 90750		
<b>County, State</b>	WELD		
<b>Lat/Long</b>	40.368690 / -104.444000		
	Planned Location	X	As Drilled
<b>Facility Status</b>	CL	<b>Location</b>	NESW 28 5N63W
<b>Facility Status Date</b>	02/11/2019	<b>Access Road</b>	Oil & Gas Access
<b>Facility Entities</b>	X	Tank Battery	Pits
	X	Wells	X Off-Location Flowlines ( <b>Form 44</b> )
		Domestic Taps	X On-Location Flowlines ( <b>Form 42</b> )
<b>Equipment Remaining on Site</b>	X	None	Debris or Non-Oil & Gas
	List of Equipment:		
<b>Environment Incidents &amp; Remediation</b>	X	None	Spill or Release ( <b>Form 19</b> )
	Remediation ( <b>Form 27/27A</b> )		
<b>Inspection Corrective Actions (CA)s</b>	<p><b>Corrective Actions (CA)s were detected during the QA &amp; QC Audit.</b></p> <p><b>CA Overall Status:</b> 1 of 1 CAs has not been completed</p> <p><b>Originating Field Inspection Doc # &amp; Date:</b> <a href="#">697504623</a> &amp; 04/28/2023</p> <ul style="list-style-type: none"> <li>See "Field Inspection Form" section of this report below for details.</li> </ul> <p><b>Complete COGCC Inspection Search Results:</b> <a href="#">Link</a></p>		
<b>Sundry Notice (Form 4)</b>	<b>Form 4s exist for Related Facilities</b> – See individual scout card data for report details.		
<b>On Location Flowlines (Form 42)</b>	<b>Form 42s exist for Related Facilities</b> – See individual scout card data for report details.		
<b>Off-Location Flowlines (Form 44)</b>	<b>No Form 44s were detected during the QA &amp; QC Audit.</b>		
<b>Field Inspection Form (Form INSP)</b>	<p><b>Form INSP Doc # &amp; Date:</b> &amp; 04/28/2023</p> <ul style="list-style-type: none"> <li><b>Status Summary:</b> Follow Up Inspection Required, Corrective Action Response Requested</li> <li><b>Inspected Facilities:</b> <a href="#">Well DOW 23-28</a>, access road, and Off-Site Tank Battery (assigned COGCC Location ID <a href="#">447280</a>)</li> <li><b>Inspection Status:</b> RI – Reclamation Inspection (Final)</li> </ul>		



	<ul style="list-style-type: none"> <li>○ <b>Inspection Date &amp; Inspector:</b> 04/20/2023 by Chris Binschus</li> <li>○ <b>Complaint #:</b> <a href="#">403379491</a></li> <li>○ <b>Nature of Complaint:</b> CPW (landowner) had concerns about failed reclamation that was previously performed by BONANZA CREEK approximately three years ago.</li> <li>○ <b>Comments:</b> The well location, offsite tank battery and access road consisted mostly of weeds or bare soil that is not reflective of reference areas. Two drainage crosses need to be recontoured, as it appears water flow would be impacted. Refer to the attached photos. Due to the lack of desirable vegetation establishment, COGCC is requiring soil sampling. Operator shall take samples along portions of the failed reclamation and background reference samples for comparison. Operator shall take discrete samples at six (6) inches intervals to a minimum depth of two (2) feet. See COGCC Comments Section for details on analytics. Note- Operator may need to install temporary fencing to facilitate on-going grazing operations</li> <li>○ <b>Corrective Action:</b> Comply with Rule 1004 to conduct additional reclamation. For soil samples, submit results via Form 4 Sundry Notice to the attention of Chris Binschus no later than two weeks after receiving results. Soil samples shall be overlaid on an aerial map depicting where soil sample locations and reference samples were taken.</li> <li>○ <b>CA Dates:</b> 04/20/2023</li> <li>○ <b>Overall Final Reclamation:</b> <b>Fail</b></li> <li>○ <b>Attachments:</b> Inspection Photos Doc # <a href="#">697504624</a></li> </ul>
<b>COGIS Tank Facilities Information</b> <b>(Scout Card)</b>	<p><b>Tank Battery Name:</b> DOW 23-28 RTB</p> <p><b>FACILITY ID:</b> <a href="#">447280</a></p> <ul style="list-style-type: none"> <li>○ <b>Status &amp; Date:</b> AC &amp; 05/16/2018</li> <li>○ <b>Lat/Long:</b> 40.367820 / -104.445060</li> <li>○ <b>COGCC documents:</b> No documents were detected during the QA &amp; QC Audit, however, this off-site Tank Battery for <a href="#">Well DOW #23-28</a> is referenced in the Final Reclamation Inspection listed above in the "Field Inspection Form" section of this report.</li> </ul>
	<p><b>Note:</b> This off-site Tank Battery is also the site of the produced water release (Spill/Release <a href="#">454242</a>) and associated Remediation Workplan (Remediation Project # <a href="#">11496</a>). Details follow:</p> <p><b>Site Investigation and Remediation Workplan</b></p>

	<p><b>Remediation Project #:</b> <a href="#">11496</a></p> <p><b>Form 27A Supplemental Docs # &amp; Date:</b> <a href="#">404047240</a> &amp; 05/17/2019</p> <ul style="list-style-type: none"> <li>○ <b>Purpose:</b> Closure of Remediation Project (resulting water issues from Spill/Release.</li> <li>○ <b>Final Resolution:</b> <b>Case Resolved</b></li> </ul> <p><b>Form 27 Supplemental Doc # &amp; Date:</b> <a href="#">401922581</a> &amp; 02/01/2019</p> <ul style="list-style-type: none"> <li>○ <b>Purpose:</b> Reclamation Planning Update</li> <li>○ <b>Operator Comments:</b> The facility was decommissioned, and all of the road base was removed. The pad sat on relatively level topography and was ripped, seeded, and crimped with straw. This constitutes Final reclamation of the location. The surface owner approved the seed mix. The first three quarterly (water) sampling events data results were also provided.</li> </ul> <p><b>Form 27 Initial Doc# &amp; Date:</b> <a href="#">401642858</a> &amp; 07/04/2018</p> <ul style="list-style-type: none"> <li>○ <b>Purpose:</b> Spill/Release remediation, Remediation of impacted ground water</li> <li>○ <b>Operator Comments:</b> The production tank load line separated at a 4" valve and released the tank contents inside the lined containment. However, upon removing the ballast from the containment, several large holes were discovered in the poly container liner. The tank battery was decommissioned, and all of the impacted soil was removed. Groundwater was encountered and impact was observed.</li> </ul>
	<p><b>Spill or Release</b></p> <p><b>FACILITY ID:</b> <a href="#">454242</a></p> <ul style="list-style-type: none"> <li>○ <b>Status &amp; Date:</b> CL &amp; 05/15/2018</li> <li>○ <b>Lat/Long:</b> 40.367885 / -104.445422</li> </ul> <p><b>Form 19 Resolving Doc # &amp; Date:</b> <a href="#">401642689</a> &amp; 07/04/2018</p> <ul style="list-style-type: none"> <li>○ <b>Date Closed:</b> 05/16/2018</li> <li>○ <b>Request for Closure:</b> Work is proceeding under an approved Form 27 Remediation Workplan</li> <li>○ <b>Remediation Project #:</b> <a href="#">11496</a></li> </ul> <p><b>Form 19 Initial Doc # &amp; Date:</b> <a href="#">401567017</a> &amp; 03/08/2018</p> <ul style="list-style-type: none"> <li>○ <b>Date of Discovery:</b> 03/07/2018</li> <li>○ <b>Spill Type:</b> Recent Spill</li> <li>○ <b>Reference Location Facility ID &amp; Type:</b> Tank Battery <a href="#">447280</a></li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>Operator:</b> BONANZA CREEK ENERGY OPERATING COMPANY LLC</li> <li>○ <b>Operator Comments:</b> The following are initial details in regards to a produced water and oil release at the DOW 23-28 remote tank battery discovered on 3/7/2018. The release was discovered during routine facility operations. The production tank load line separated at a 4" valve and released the tank contents (currently unknown amount of produced water and oil). Bonanza is currently reviewing production records to calculate a potential spill volume. The release was inside lined containment but there is evidence of some liquid passing through the plastic liner and metal containment berm. Equipment removal and remediation is already underway. Additional information will be submitted in a subsequent Form 19.</li> <li>○ <b>Note:</b> Additional spill and release details were provided one week later in a subsequent Form 19 Doc # <a href="#">401572608</a>.</li> <li>○ <b>Additional Operator Comments:</b> The facility is currently being decommissioned. Once tanks are removed, the liner and impacted ballast will be removed and the spill will be fully delineated and the impacted soil will be removed. Currently impacted depth is estimated to be four feet below ground surface.</li> </ul>
	<p><b>Well Name:</b> DOW #23-28</p> <p><b>API#:</b> <a href="#">05-123-20593</a></p> <p><b>FACILITY ID:</b> 261349</p> <ul style="list-style-type: none"> <li>○ <b>Status &amp; Date:</b> PA &amp; 01/14/2019</li> <li>○ <b>Lat/Long As Drilled:</b> 40.368690 / -104.444000</li> <li>○ <b>Form 6 Subsequent Doc # &amp; Date:</b> <a href="#">401914739</a> &amp; 11/05/2019</li> <li>○ <b>Form 42 Doc # &amp; Date:</b> <a href="#">401893624</a> &amp; 01/04/2019 <b>Purpose:</b> Start of Plugging Operations – 48 hour notice</li> <li>○ <b>Form 4 Doc # &amp; Date:</b> <a href="#">401941116</a> &amp; 03/04/2019 <b>Purpose:</b> Upload the Gyro</li> </ul>

**COGCC Abbreviations:** [Location & Facility Status Codes](#), [Inspection Types & Statuses](#) and [COGCC Help](#).

## Audit Key Findings – Designation Land Use Observations

PREVIOUS LAND USE	CURRENT LAND USE
<b>Reference Imagery for Infrastructure:</b> Landsat/Copernicus 2013	<b>Remotely Sensed Imagery:</b> 05/02/2023
<b>Designation:</b> Oil and Gas Facility	<b>Designation:</b> Rangeland

### The following imagery sources were reviewed during this audit:

EarthExplorer, DRCOG 2002 - 2014, NAIP Imagery 2011, 2013, 2015, 2017, 2019, 2021, ESRI Maxar and Remotely Sensed Imagery Sep 2022

## Closure Information

Landowner Colorado Parks and Wildlife (CPW) filed a complaint on 04/20/2023 stating concerns about failed reclamation activities at the Centennial Valley State Wildlife Area performed by operator BONANZA CREEK ENERGY OPERATING COMPANY LLC approximately three years ago. In response, COGCC Reclamation Specialist Chris Binschus performed a Reclamation Inspection of the area that failed and identified a Corrective Action (CA) requiring the operator to perform soil sampling.

The inspection for this Location (331380) includes plugged and abandoned Well DOW #23-28, access road, and off-site Tank Battery (447280). The inspection noted these areas consisted mostly of weeds or bare soil that is not reflective of reference areas. It also called attention to two drainage crosses that need to be recontoured as it appears water flow would be impacted.

Our post-inspection audit revealed a produced water and oil release at the off-site tank battery location on 03/07/2018. The release is reported under Location 447280, Spill or Release ID 454242 (release closed on 05/16/2018) and remediated under a Remediation Workplan RPN# 11496 (case resolved on 05/17/2019).

## Site Photos

### *Site Investigation and Photos Date*

05/02/2023

Cardinal directional photos of the site



North





East



South





West

## ATTACHMENTS

### Maps and Figures

#### *Location Maps*

CPW Overview Soil and Vegetation Locations  
CPW Overview Observation Locations  
CPW Overview Roads and Reclamation Extents  
CPW Overview Reference Extents  
CPW Overview of Gully Repair

#### *Area Maps*

Previous Infrastructure Overview  
Current Site Overview  
Elevation & Contours  
Slope  
Hydrology  
NDVI Composite  
NDVI

#### *Reports*

Reclamation Report  
Soil Analytics  
Reference Soil and Vegetation  
Observations

### Background Information

#### *Natural Resources Conservation Service (NRCS) Map Unit Description*

Reference Soil and Ecological Description



# SITE-SPECIFIC RECLAMATION PLAN



## Permit Closure Type – Final

Failed Reclamation Inspection

## Site Description

Name	DOW/23-28 PAD
Location ID	<a href="#">331380</a>
Operator / #	BONANZA CREEK ENERGY OPERATING COMPANY LLC / 8960
Field	WATTENBERG / 90750
County, State	WELD, CO

## Report Date

31 May 2023

## Site Evaluation

*Investigator:* Soil Sage

*Investigation Date:* 2-4 May 2023

*Reference Soil Information:* This site is comprised within one soil type, Map Unit 3 - Aquolls and Aquents, gravelly substratum, 0 to 3 percent slopes, variable texture surface and at depth. These soils are recent alluvium. Landform is stream terraces. Poorly drained with a moderate available water holding capacity. Depth ranges from 0 – 10 inches, the pH is 7.9 and the organic matter is 2.0%.

Soil chemical properties within the rooting zone to 50 inches is described in the Soil Properties – USDA Soil Properties section of this report.

*Current Land Use in Reference Area:* Range land

### Observations

The Southern section is intermixed leased grazing land and “native” ecosystem along the South Platte River. The reclaimed areas have residual gravel and excessive applications of manure, which have impacted the recovery of the sites.

Weed pressure has occurred along the roads and patchy areas at each site.

Debris remains along the roads and sites in the form of silt fencing, waddles and oil and gas operational equipment. Reference the observation document for specifics.

Stream crossings have not been recontoured, disruption of the stream flow and vehicle crossing has occurred.

## Site Soils

During the field investigation, Soil Sage collected soil samples every six inches from 0 – 24 inches within the site and reference locations within the map unit. These soils were analyzed to establish current soil physicochemical properties for reclamation planning. See spreadsheet attachment Table 1 for site specific soil characterizations and associated reference soils. Reference USDA Soils and Ecological Site Description for historical properties.

## Recommendations

### Data of Sampling – 2-4 May 2023

## Vegetation

Spring vegetation characteristics were present, newly emerging grasses and weeds are the primary vegetation during the site visit.

Ecological Site observations serve as the baseline vegetation cover.

Table represents the present cover observations.

Sample Number	Bare Ground	Grass	Forbs	Shrubs	Litter	Weeds	Field Notes
12	0	5	0	0	93	2	

## Weeds

### *Weed Summary Reference*

Common Name	Weed List Type	Percent Cover (%)
Tansy Mustard	Common	1
Curled Dock	Common	1

### *Weed Inventory Criteria*

- Each site is accessed for noxious weeds and common weeds
- Data are aggregated using point locations coupled with percent cover assessments and area measurements as needed
- Governance - Colorado Department of Agriculture - Colorado Noxious Weeds List, effective October 2020
- List A - Designated for eradication, List B - Designated to stop the continued spread, List C - Facilitate more integrated effective weed management, Watch List - Determined to pose a potential threat to ag and natural productivity.
- Common - designates weeds that do not fall within the Colorado Department of Agriculture lists
- Other - designates other identified weeds at the site

## Site Characteristics

### *Hydrology*

Hydrology – Stream Orders 1 – 6 are present - dominant streams are orders are 1, 2 and 3. Order 3 are present in locations that have the potential for soil erosion represented by gullying and riling that follow the elevation gradient from high to low within the current reclaim extent. These could be major runoff areas for gullying and soil erosion with heavy precipitation events.

Ponding - potential ponding can occur where water follows the elevation gradients in low lying area.

Reference Hydrology and Elevation and Contour Maps

### *Soil/Erosion*

Exposed soils have low susceptibility to water erosion and are in the low susceptible group for wind erosion due to ecosystem dynamics and vegetative cover.

## Summary Acreage Table

Description	Acres
<b>Total Disturbance Extent</b>	<b>0.20</b>
○ Reclaim Extent	0.13
○ Road	0.10
○ Reference Extent	*

Road Extents includes a Gully repair CPW 10. Extents from Location 447280.

\* Refer to this Site Overview map and the CPW Observation Overview map and Observation document for additional information on the gully area.

\*Reference areas are shared and are available in the South Reference Document and Site Overview Reference Map.

## Site Recommendation and Re-Evaluation

### North Side

Road: 12 inches remove and replace

Pad: 12 inches remove and replace

### Replacement Soil

Texture: Sandy Loam

Organic Matter: 1%

pH: 7.0 - 8.3

Nitrate N: less than 50 ppm

Sodium: less than 150 ppm

Chloride Cl: less than 100 ppm

Sulfate S: less than 100 ppm

Soil tests must be submitted to Luke Kelly ([lkelly@civiresources.com](mailto:lkelly@civiresources.com)) AND Sam Streeter ([sam@soilsage.com](mailto:sam@soilsage.com)) for approval prior to use on the project. Certified Weed Free Straw must be used, and evidence must be supplied to Luke Kelly and Sam Streeter. Soil Sage will be performing inspections during reclamation activities and after work is complete to ensure success. On-site access must be coordinated with Colorado Parks and Wildlife (CPW) before work commences. Schedule of reclamation activities (approximate) must be submitted before reclamation starts and any changes to the schedule must be communicated via email to Luke Kelly and Sam Streeter.

## Seed Mix

### Vegetation Seed Mix

*Additional reclamation procedures are recommended at this time.*

Sandy Bottomland - Salt Meadow Ecosystems CPW Mix

Common Name	Scientific Name	#PLS/Acre	% of Mix
Alkali Sacaton	<i>Puccinellia distans</i>	4	26.7
Western Wheatgrass	<i>Pascopyrum smithii</i>	4	26.7
Switchgrass	<i>Spartina pectinata</i>	3	20.0
Prairie Cordgrass	<i>Spartina pectinata</i>	2	13.3
Needle and Thread	<i>Hesperostipa comata ssp. comata</i>	2	13.3
<b>Total Mix</b>		<b>15</b>	<b>100.0</b>

**NOTE:** The seed mix is based on the soil type and landscape position. The surrounding area has similar soil properties, and this seed mix is subject to change based on land use type.

## Soil Amendments

New soil specifications are outlined above with NPK and OM recommendations.

## Pre-Reclamation Activities and Notes:

- There are active and abandoned midstream assets in both the northern and southern parts of the reclamation area.
- Remove silt fencing, waddles and remaining oil and gas operational equipment.

## Reclaim Area Protocol

Time Frame	Activity	Specifications	Site Totals
<b>Prior to Reclamation Activities</b>	Pre-Reclamation	Remove trash, silt fencing, waddles, and oil and gas operational equipment	Refer to the observation document for the area
<b>Recontour Ditches</b>	Pre-Reclamation	Recontour ditch crossings on the south side. 3 ditch crossings need to be converted to crossing points where vehicles can cross when dry and water can flow when wet. In the current condition vehicles cannot cross.	Refer to the observation document for the area
<b>Spring 2023</b>	Remove and Replace Soil	Texture: Sandy Loam Organic Matter: 1% pH: 7.0 - 8.3 Nitrate N: less than 50 ppm Sodium: less than 150 ppm Chloride Cl: less than 100 ppm Sulfate S: less than 100 ppm	0.13 Acres
	Rip	Deep rip to 18 inches, do not rip below 18 inches. Evidence of seasonably high-water table found as shallow as 18 inches. Do not interact with this layer	
	Disc	Disc the site to a depth of 6.0-inches using a disk and harrow, field cultivator, vibrashank, or another alternative suitable to site conditions	
	Seed	CPW Mix	15 LBS/acre
	Straw	Spread certified weed free straw	2 Tons/acre
	Crimp	Crimp Straw	
<b>Monitoring</b>	Continuous	Site should be monitored post reclamation to ensure success	
<b>Weed Management</b>		Due to the seed bank of cheatgrass, thistle and kochia monthly monitoring is recommended with appropriate herbicide control	

## Site Photos – Soil 14

Lat/Long: 40.368683 / -104.443993

Nearest Facility #: 331380

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

	
Soil Picture 1	Soil Picture 2 Vegetation at Soil Location






## Site Photos – Vegetation 12

Lat/Long: 40.368722 / -104.444104



Nearest Facility #: 331380

Date Range: 2-4 May 2023

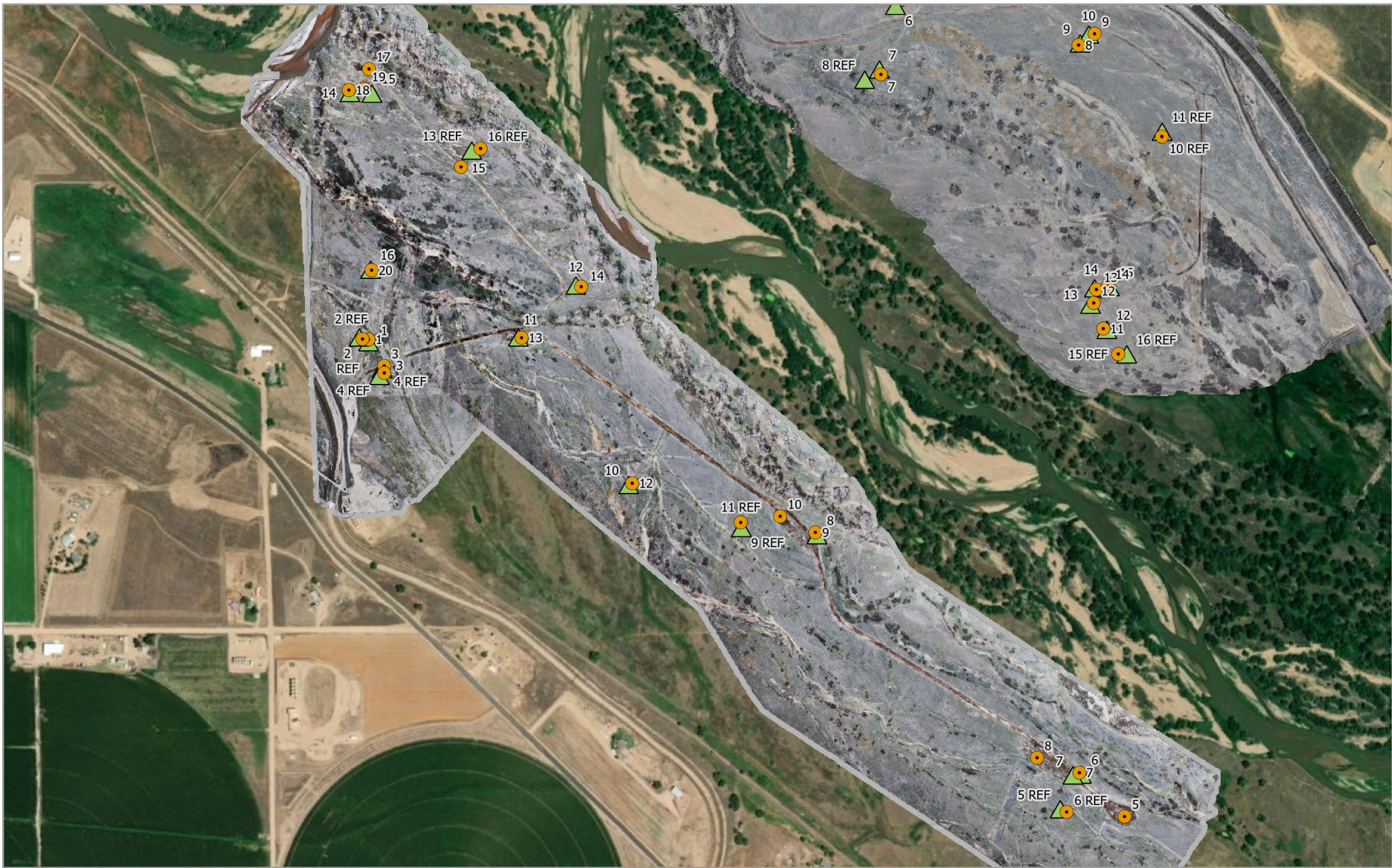
Photo locations correspond with the overview map and vegetation table.

	
Veg	Veg - North
	
Veg - East	Veg - South



	
<p>Veg – West</p>	<p>Tansy Mustard – <i>Descurainia pinata</i> – Common Weed</p>
	
<p>Curled Dock – <i>Rumex crispus</i> – Weed</p>	<p>Grass</p>





**CIV - CPW South Side**  
**Map Extent - Overview Soil & Veg Points**

Imagery: RS Orthomosaic & DSM  
 Imagery Date: 2 May 2023  
 Map Date: 29 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

**Legend**

- Soils
- ▲ Veg



Scale: 1:9,000



Service Credits - Maxar





# **CIV - CPW South Side** **Map Extent - Overview Soil & Veg Points**

Imagery: RS Orthomosaic & DSM  
 Imagery Date: 2 May 2023  
 Map Date: 29 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

## **Legend**

- ◆ Well
- Tank Battery
- Soils
- ▲ Veg

0 275 550 Meters

Scale: 1:9,000



Service Credits - Maxar





# **CIV - CPW South Side** **Map Extent - Overview Observation Points**

Imagery: RS Orthomosaic & DSM  
 Imagery Date: 2 May 2023  
 Map Date: 29 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

## **Legend**

- Well
- Tank Battery
- Observations

0 275 550 Meters

Scale: 1:9,000



Service Credits - Maxar



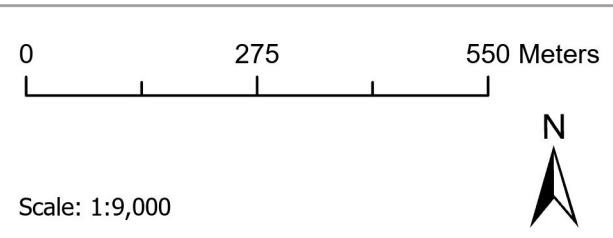


**CIV - CPW South Side**  
**Map Extent - Overview Observation**  
**Points**

Imagery: RS Orthomosaic & DSM  
Imagery Date: 2 May 2023  
Map Date: 29 May 2023  
Datum: WGS 1984 UTM Zone 13N  
POC: Soil Sage

**Legend**

 Observations



Service Credits - Maxar







# **CIV - CPW South Side** **Map Extent - Overview Reclaim & Road** **Reclaim Extent**

Imagery: RS Orthomosaic & DSM  
 Imagery Date: 2 May 2023  
 Map Date: 31 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

## **Legend**

- ◆ Well
- Tank Battery
- Reclaim Extent
- Road Reclaim

0 275 550 Meters

Reclaim Extent: 5.0 Surface Acres  
 Road: 6 Surface Acres including buffer  
 Scale: 1:9,000



Service Credits - Maxar












# **CIV - CPW South Side** **Map Extent - Overview Gully Reclaim**

Imagery: RS Orthomosaic & DSM  
 Imagery Date: 2 May 2023  
 Map Date: 31 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

## **Legend**

-  Well
-  Tank Battery
-  Observations

0 40 80 Meters

Scale: 1:1,510



Service Credits - Maxar, Microsoft





# **CIV - CPW South Side** **Map Extent - Overview Gully Reclaim**

Imagery: RS Orthomosaic & DSM  
 Imagery Date: 2 May 2023  
 Map Date: 31 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

## **Legend**

- ◆ Well
- Tank Battery
- 📷 Observations

0 40 80 Meters

Scale: 1:1,510



Service Credits - Maxar, Microsoft





Service Credits -

## CIV - 331380 - DOW 23-28 Map Extent - Landsat/Copernicus 2013

Imagery: Landsat/Copernicus  
 Imagery Date: 6 Sep 2013  
 Map Date: 30 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

- |                |                      |
|----------------|----------------------|
| ◆ Well         | 📷 Observation Points |
| 🛢 Tank Battery | 🟠 Disturbance Extent |
| ● Soils        | 🟢 Reclaim Extent     |
| ▲ Veg          | 🔴 Road               |

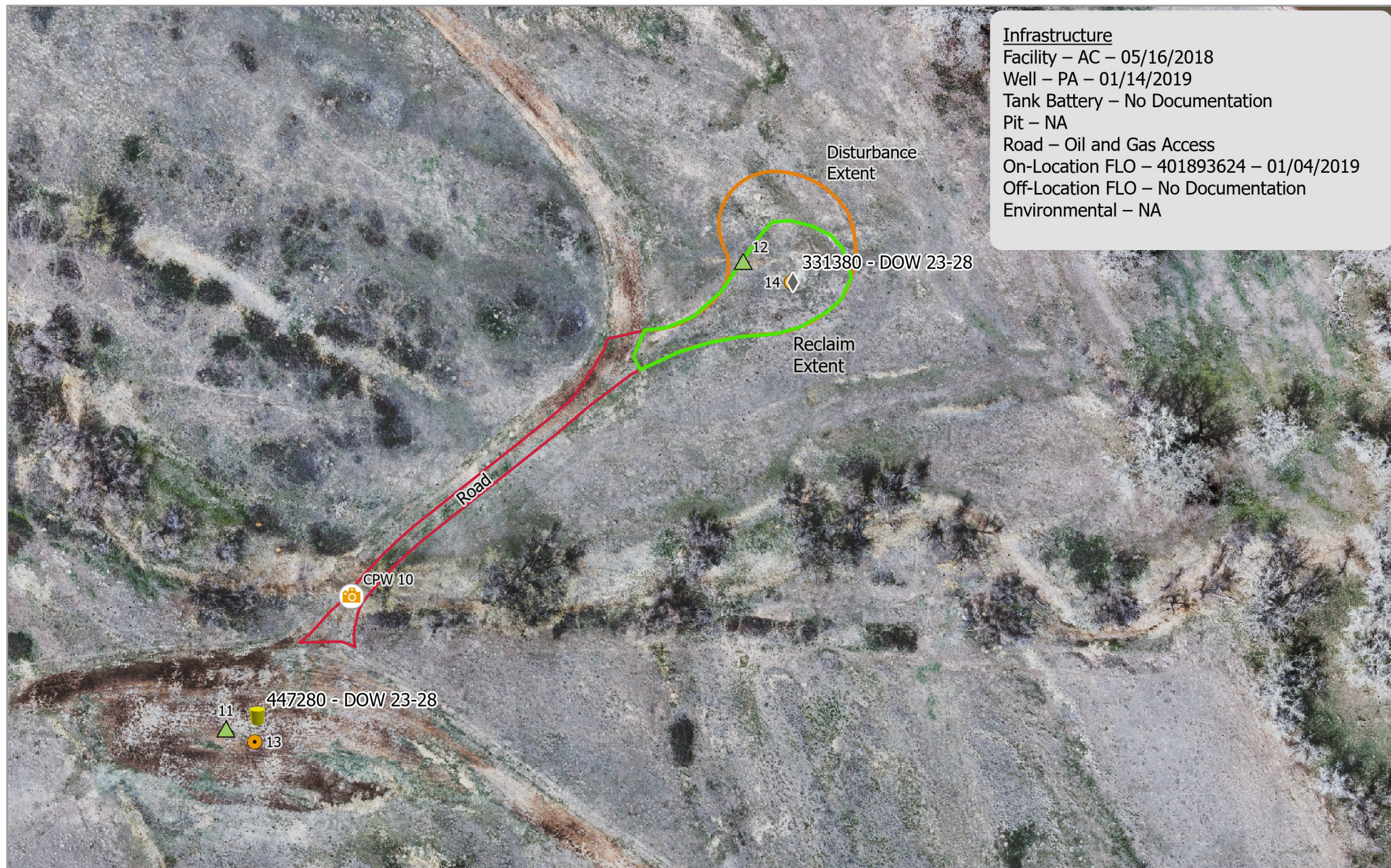
0 30 60 Meters

Scale: 1:1,000

Pad Location:  
 40.368690  
 -104.444000







## CIV - 331380 - DOW 23-28 Map Extent - Overview

Imagery: RS Orthomosaic & DSM  
 Imagery Date: 2 May 2023  
 Map Date: 30 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

### Legend

- ◆ Well
- Tank Battery
- Soils
- ▲ Veg
- 📷 Observation Points
- ▭ Disturbance Extent
- ▭ Reclaim Extent
- ▭ Road

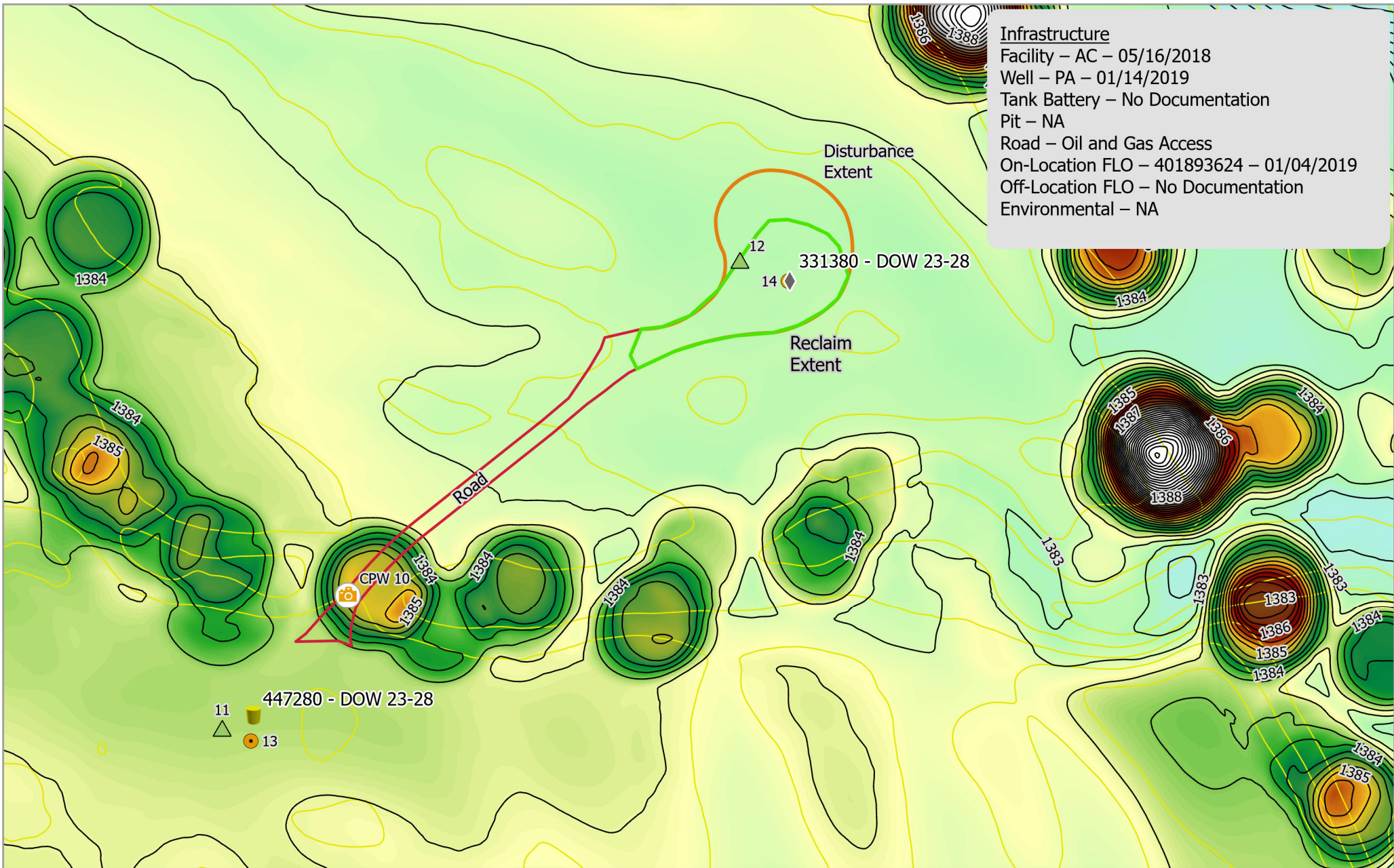
0 30 60 Meters

Reclaim Extent: 0.13 Acres  
 Road: 0.10 Acres  
 Scale: 1:1,000

Pad Location:  
 40.368690  
 -104.444000

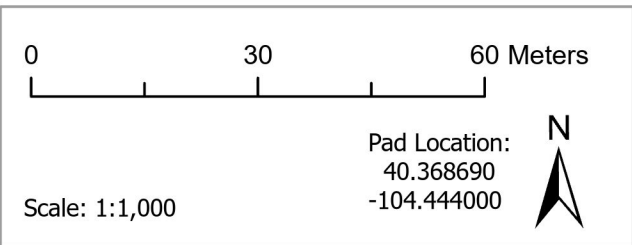
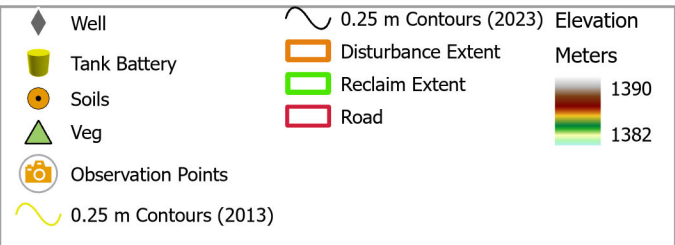


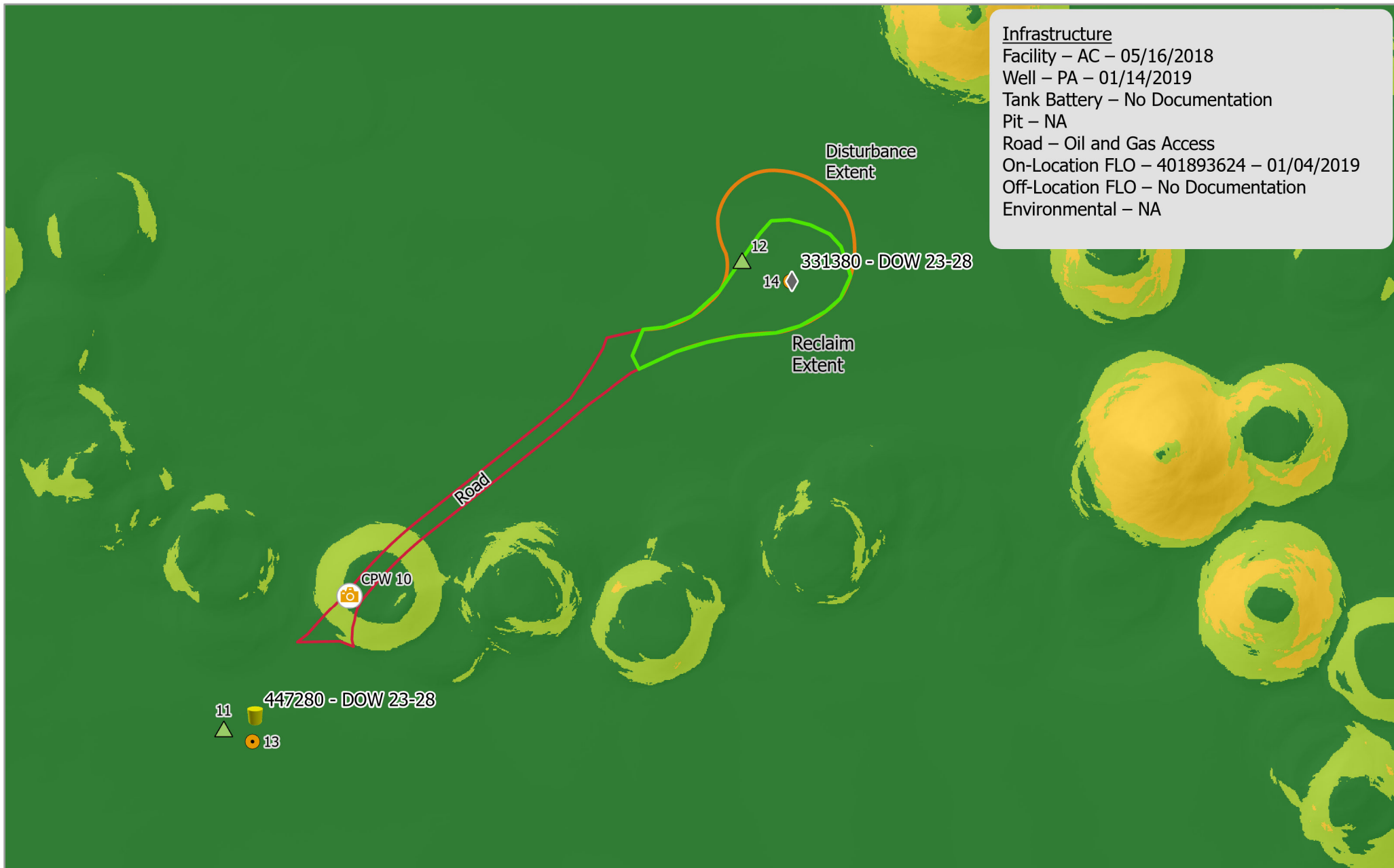




# **CIV - 331380 - DOW 23-28** **Map Extent - Elevation & Contours**

Imagery: RS DSM, USGS  
 Imagery Date: 2 May 2023, 2013  
 Map Date: 30 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage





**Infrastructure**  
 Facility – AC – 05/16/2018  
 Well – PA – 01/14/2019  
 Tank Battery – No Documentation  
 Pit – NA  
 Road – Oil and Gas Access  
 On-Location FLO – 401893624 – 01/04/2019  
 Off-Location FLO – No Documentation  
 Environmental – NA

**CIV - 331380 - DOW 23-28**  
**Map Extent - Slope**

Imagery: RS DSM  
 Imagery Date: 2 May 2023  
 Map Date: 30 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

<ul style="list-style-type: none"> <li>Well</li> <li>Tank Battery</li> <li>Soils</li> <li>Veg</li> </ul>	<ul style="list-style-type: none"> <li>Observation Points</li> <li>Disturbance Extent</li> <li>Reclaim Extent</li> <li>Road</li> </ul>	<b>Slope</b> <b>Percent</b> <ul style="list-style-type: none"> <li>&lt; 15</li> <li>15 - 30</li> <li>30 - 100</li> <li>&gt;100</li> </ul>
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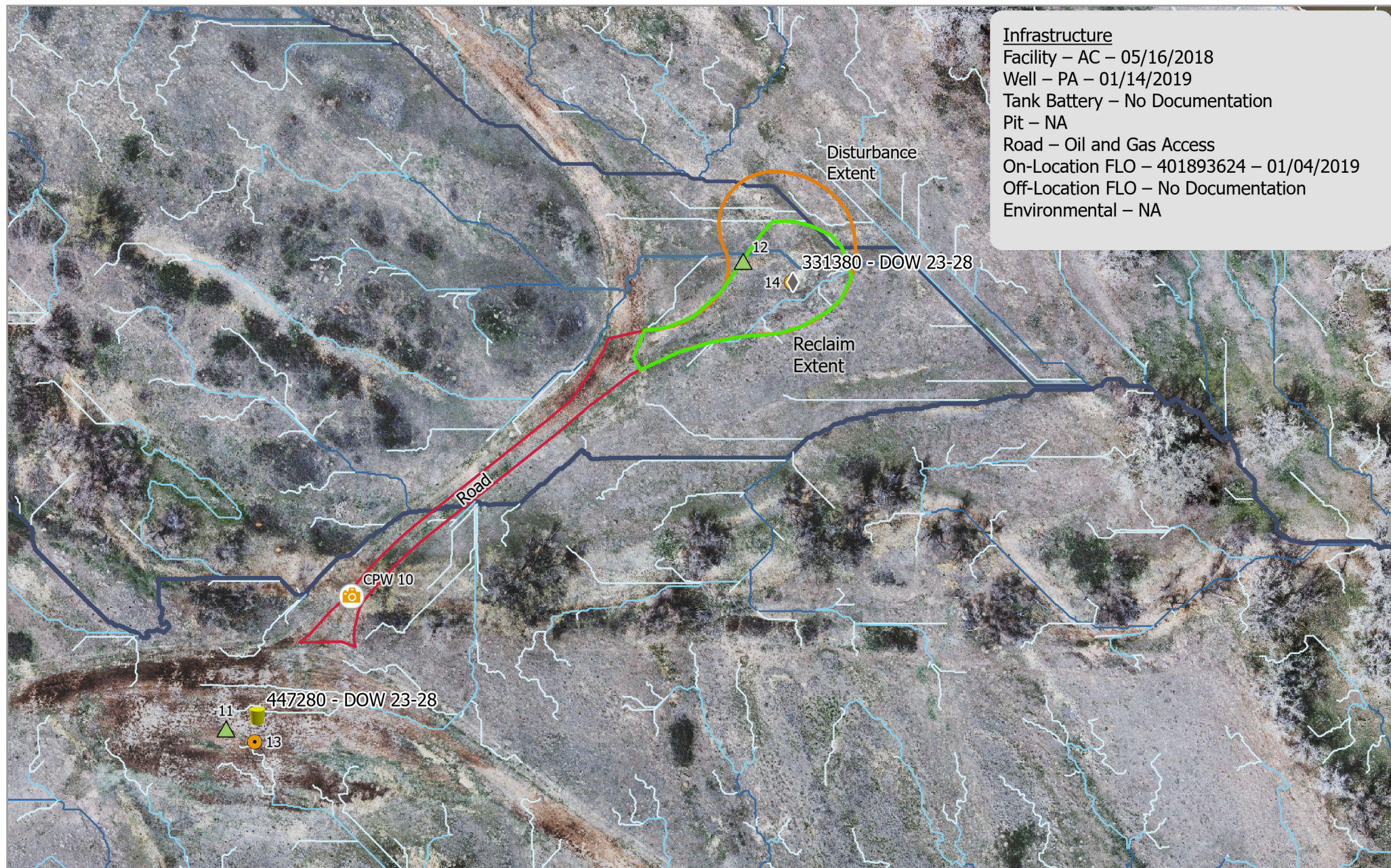
03060 Meters

Scale: 1:1,000

Pad Location:  
 40.368690  
 -104.444000



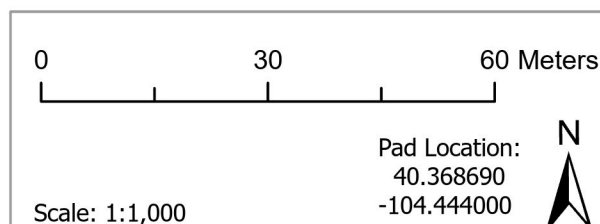




**Infrastructure**  
 Facility – AC – 05/16/2018  
 Well – PA – 01/14/2019  
 Tank Battery – No Documentation  
 Pit – NA  
 Road – Oil and Gas Access  
 On-Location FLO – 401893624 – 01/04/2019  
 Off-Location FLO – No Documentation  
 Environmental – NA

# **CIV - 331380 - DOW 23-28** **Map Extent - Hydrology**

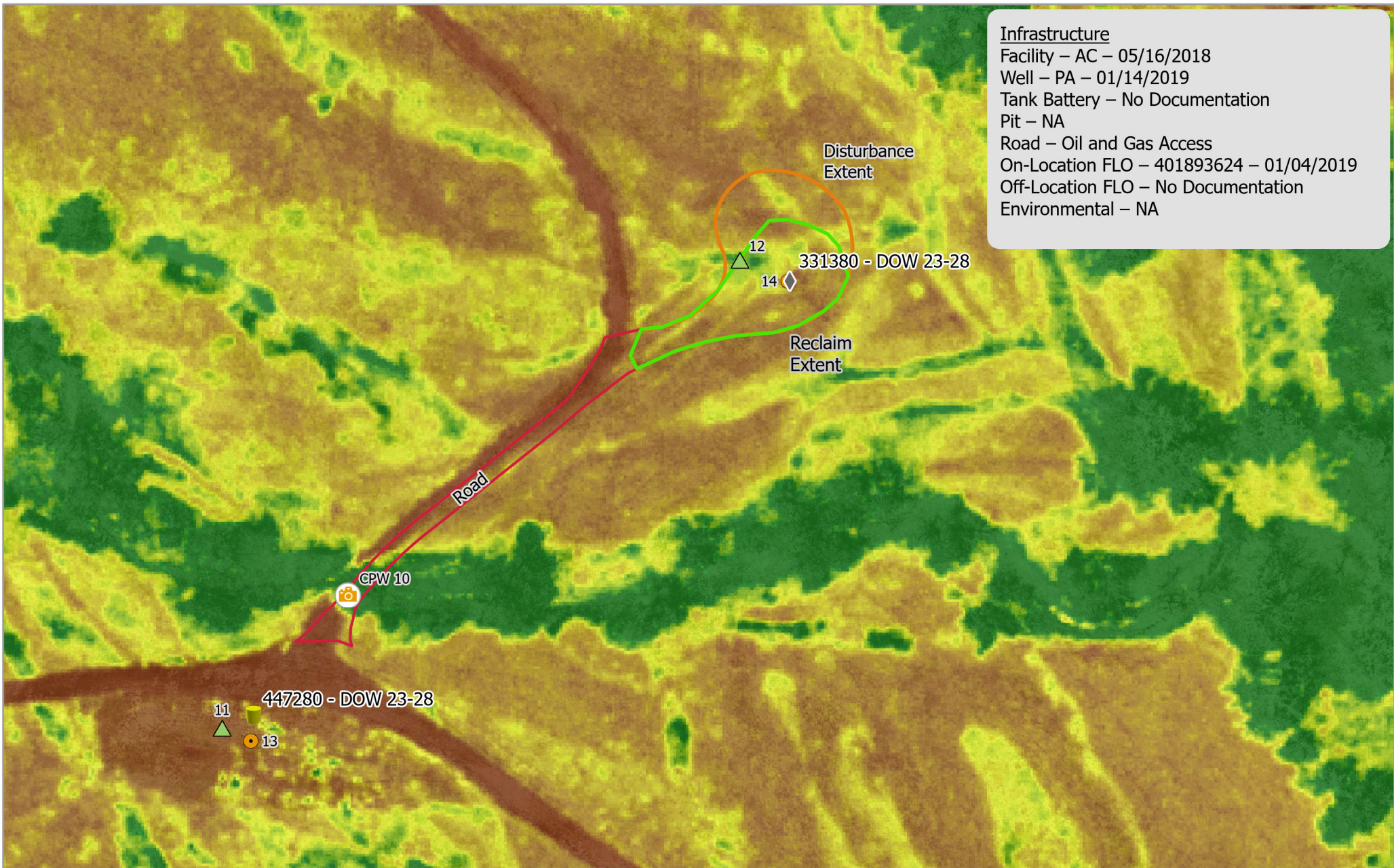
Imagery: RS Orthomosaic & DSM  
 Imagery Date: 2 May 2023  
 Map Date: 30 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage



Service Credits -







**CIV - 331380 - DOW 23-28**  
**Map Extent - NAIP NDVI Composite**

Imagery: USDA NAIP  
 Imagery Date: 2011-2021  
 Map Date: 30 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage

**Legend**

- ◆ Well
- Tank Battery
- Soils
- ▲ Veg
- 📷 Observation Points
- ▭ Disturbance Extent
- ▭ Reclaim Extent
- ▭ Road

0 30 60 Meters

Scale: 1:1,000

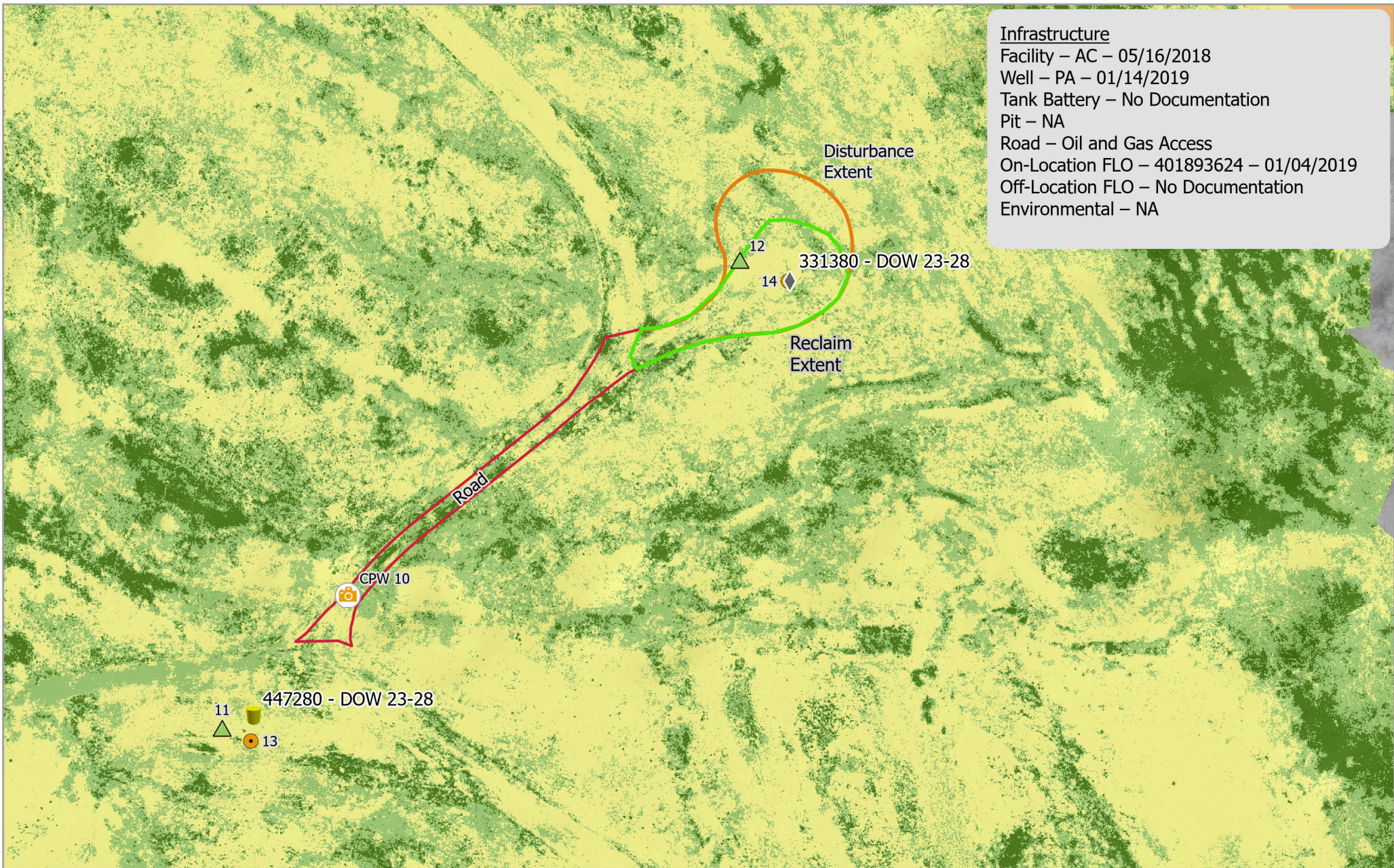
Pad Location:  
 40.368690  
 -104.444000



Service Credits - Esri, USDA Farm Service Agency



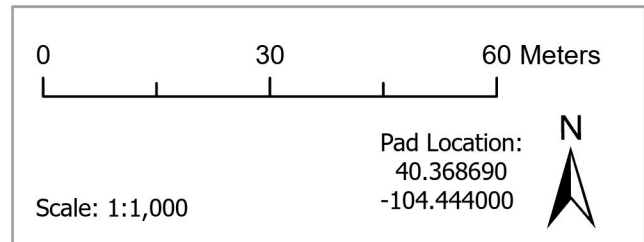
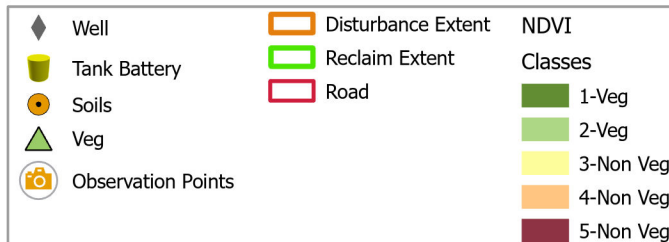




**Infrastructure**  
 Facility – AC – 05/16/2018  
 Well – PA – 01/14/2019  
 Tank Battery – No Documentation  
 Pit – NA  
 Road – Oil and Gas Access  
 On-Location FLO – 401893624 – 01/04/2019  
 Off-Location FLO – No Documentation  
 Environmental – NA

# **CIV - 331380 - DOW 23-28** **Map Extent - NDVI**

Imagery: RS Multispectral  
 Imagery Date: 2 May 2023  
 Map Date: 30 May 2023  
 Datum: WGS 1984 UTM Zone 13N  
 POC: Soil Sage



Service Credits -





# CPW Soil and Vegetation

## South Side Reference



### *Site Soils*

These soils were analyzed to establish current soil physicochemical properties.

Soil Analytical Spreadsheet

Map Unit(s) – 3

The CPW\_South\_SoilData\_17MAY2023 - contains 5 soil references.

Overview of the 0-12 inch

- Soil texture is a Sandy Loam / Loamy Sand with Sandy Clay Loam intermixed
- pH 7.4
- ECe 4.5
- Organic Matter % - 3.1
- SAR 11
- N-P-K – 25-52-279
- Nitrate-N Lbs/A = 46
- Sodium – 743 ppm
- Chloride – 218 ppm
- Sulfate – 208 ppm

**NOTE:** The native soils have elevated sodium levels in 4 of the 5 samples in the top 12 inches which has a direct correlation to the higher ECe and SAR values.

### *Vegetation Analysis*

Ecological Site observations serve as the baseline vegetation cover.

Table represents the present cover observations.

During the time of sampling the site contained bare ground no vegetation analysis performed.

Sample Number	Bare Ground	Grass	Forbs	Shrubs	Litter	Weeds	Field Notes
2	0	10	5	0	85	0	
4	0	0	1	0	99	0	
5	30	0	0	0	50	20	
9	0	0	15	0	85	0	
13	3	95	0	0	2	0	
15	0	80	0	0	20	0	



Site Average for Vegetative Cover and Total Percent Cover based on field sampling.

Grasses	Forbs	Total Percent Cover	Site Target Recovery (80%)
31	4	35	20

## Weeds

### *Weed Summary Reference based on 2-4 May 2023 Monitoring*

Common Name	Weed List Type	Percent Cover (%)
Field Bindweed	List C Noxious	20



## Site Photos – Soil 2

Lat/Long: 40.367876 / -104.448531

Nearest Facility #: 415157

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

	
Soil Picture 1	Soil Picture 2 Vegetation at Soil Location

## Site Photos – Soil 4

Lat/Long: 40.367339 / -104.448087

Nearest Facility #: 447280

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

 A close-up photograph showing a soil profile. A metal rod is visible on the left, partially buried in dark, moist soil. The soil is surrounded by dry, yellowish-brown grass and straw.	 A wide-angle photograph of a grassy field. The field is covered in dry, yellowish-brown grass. In the background, there are some buildings and a fence under a blue sky with scattered clouds.
Soil Picture 1	Soil Picture 2 Vegetation at Soil Location



## Site Photos – Soil 6

Lat/Long: 40.360312 / -104.434017

Nearest Facility #: 331805 and 423850

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.



Soil Picture 1



Soil Picture 2 Vegetation at Soil Location


## Site Photos – Soil 11

Lat/Long: 40.364939 / -104.440725

Nearest Facility #: 331414

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

	
Soil Picture 1	Soil Picture 2 Vegetation at Soil Location





## Site Photos – Soil 16

Lat/Long: 40.370877 / -104.446062

Nearest Facility #: 332761 and 331380

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

	
Soil Picture 1	Soil Picture 2 Vegetation at Soil Location
	
Soil Picture 3	



## Site Photos – Vegetation 2

Lat/Long: 40.367921 / -104.448596

Nearest Facility #: 415157

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

					
Veg				Veg - North	
					
Veg - East				Veg - South	

		
Veg – West		






## Site Photos – Vegetation 4

Lat/Long: 40.367312 / -104.448183

Nearest Facility #: 415157 and 447280

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

	
Veg	Veg - North
	
Veg - East	Veg - South



# CPW Site Observations



## South

Reference the Observation overview map

### *Observation 1 - South*

40.367494 / -104.447921



Ditch repair is required after the culvert was removed. Gravel, steep slopes, and contouring.

**Observation 2 - South**

40.360507 / -104.432604



Oil field equipment remaining on site



Oil field equipment remaining on site



**Observation 3 - South**

40.360864 / -104.43337



Silt Fence



**Observation 4 - South**

40.360525 / -104.433728



Silt Fence

**Observation 5 – ROAD - South**

40.36087 / -104.433771



Road observation point - 18 inches to sand – top 6 inches cow manure, gravel, sand, no vegetative growth or weeds



Manure

Depth example



**Observation 6 – ROAD - South**

40.362706 / -104.437297



Road observation - 12 in of manure that has mold during anaerobic processes – compaction layer



White mold and unincorporated manure



**Observation 7 – ROAD - South**

40.36405 / -104.439013



Road observation - 9 inches of manure



***Observation 8 – Adjacent to Riparian - South***

40.365264 / -104.439799



Straw waddles



**Observation 9 – ROAD - South**

40.367241 / -104.443627



Road observation - 6 in manure – no vegetative growth or weeds



**Observation 10 – GULLY - South**

40.368137 / -104.44501



Ditch repair is required after the culvert was removed. Gravel, steep slopes, and contouring.

Steep slopes



Steep slopes



**Observation 11 – DEBRIS - South**

40.372252 / -104.448623



Silt waddles and trash



Silt waddles



Silt waddles



Trash



**Observation 24 – GULLY - South**

Location Well Pad 415157

40.3679748 / -104.4486290



Ditch repair is required after the culvert was removed. Gravel, steep slopes, and contouring.



**Observation 25 – TANK BATTERY - South**

40.3722154 / -104.4484291





Silt and waddles



Silt and waddle



	
Veg – West	Grass ssp.







## Site Photos – Vegetation 5

Lat/Long: 40.360376 / -104.434149

Nearest Facility #: 331805 and 423850

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

					
Veg				Veg - North	
					
Veg - East				Veg - South	



	
Veg – West	Mullein – <i>Verbascum</i> spp. – Native
	
Grass ssp.	



## Site Photos – Vegetation 9

Lat/Long: 40.364869 / -104.44071


Nearest Facility #: 331414

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

	
Veg	Veg - North
	
Veg - East	Veg - South



	
<p>Veg – West</p>	<p>Brome ssp.</p>
	
<p>Field Bindweed – <i>Convolvulus arvensis</i> – Colorado List C Noxious Weed</p>	



## Site Photos – Vegetation 13

Lat/Long: 40.370867 / -104.446245

Nearest Facility #: 332761

Date Range: 2-4 May 2023

Photo locations correspond with the overview map and vegetation table.

	
Veg	Veg - North
	
Veg - East	Veg - South





Veg – West



Grass ssp.



# Soil Properties

## USDA Soil Description

### Reference Soil Information

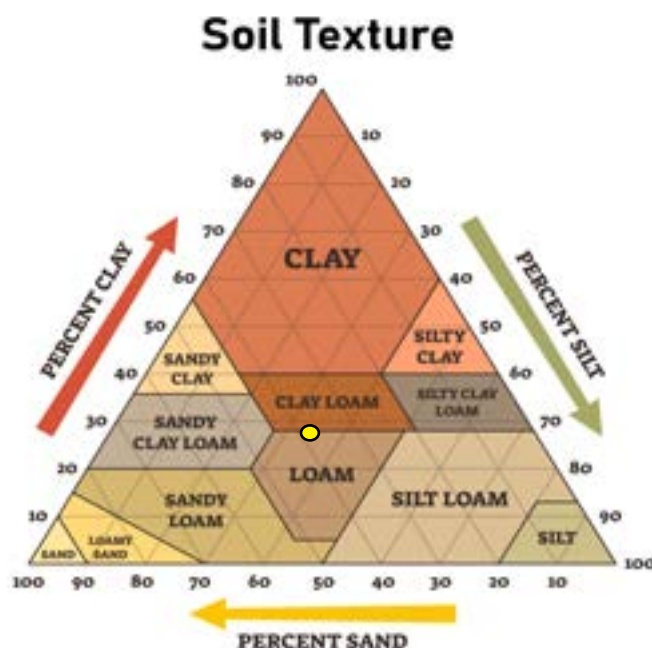
The location of the site is contained within one soil type, Aquolls and Aquent, gravelley substratum.

### Map Unit 3 Reference Soil information - Aquolls and Aquent, gravelley substratum

This soil is formed from recent alluvium. Landform is stream terraces, with the Salt Meadow Ecological Site. Soils are poorly drained with a moderate water holding capacity, and slope 0-3 percent.

Depth (in)	Physical			Chemical			
	Texture	Bulk Density	Partical Size Percent sand, silt, clay	pH	EC	SAR	OM%
0-10	Variable	1.28	39-35-26	7.9	2.0	0.0	2.00
10-20	Variable	1.28	39-35-26	7.9	2.0	0.0	2.00
20-30	Variable	1.28	39-35-26	7.9	2.0	0.0	2.00
30-40	Variable	1.28	39-35-26	7.9	2.0	0.0	2.00
40-50	Variable	1.35	51-29-21	7.9	2.0	0.0	1.70
50 +	Very Gravelly Sand	1.62	97-2-2	7.9	2.0	0.0	0.50

### Soil Texture Triangle reflect the 0-10 in depth



### Erosion Potential (10 inches)

- K Factor, Whole soil - .24. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.
- Wind Erodibility Group – 8. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.



## Soil Reference Information

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There is a general relationship of soil bulk density to root growth based on soil texture. Bulk densities ideal for root growth are less than 1.60 g/cc for sandy textures, less than 1.40 g/cc for loamy textures, and less than 1.10 g/cc for clayey textures. Bulk densities that restrict root growth are greater than 1.80 g/cc for sandy textures, 1.65 g/cc for loamy textures, and 1.47 g/cc for clayey textures.



# Vegetation

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## Reference vegetation – Salt Meadow Ecology

### Climate

Average Annual Precipitation 14 to 17 inches annually

Average Annual Air Temperature 50 degrees F

Drought conditions in effect

Long-term effects of these latest drought events have yet to be determined. Growth of native cool-season plants begin about April 1 and continue to mid-June. Native warm-season plants begin growth about May 1 and continue to about August 15. Regrowth of cool-season plants occur in September in most years, depending on moisture.

### Reference dynamics

The Reference State is characterized by warm-season bunchgrass (alkali sacaton, switchgrass), cool-season midgrass (western wheatgrass), warm-season tall rhizomatous grass, and a minor component of cool-season grasslike (Nebraska sedge). The Warm-Season Shortgrass State is characterized by a warm-season short rhizomatous grass (inland saltgrass). The Increased Bare Ground State is characterized by early successional cool-season grass (foxtail barley), annual grasses, and annual forbs.

Drought has increased mortality of blue grama in some locations

The major grasses in the Reference Plant Community include tall and mid warm and cool-season grasses. Major grasses include alkali sacaton, switchgrass, prairie cordgrass and western wheatgrass. Other grasses and grass-like occurring on the community include big bluestem, little bluestem, alkali cordgrass, Nebraska sedge, and Baltic rush. Key forbs and shrubs include American licorice, prairie gentian, rag sumpweed, and fourwing saltbush.

Well suited for carbon sequestration



# Vegetation

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## Reference Vegetation – Salt Meadow Ecology

### At Risk Plant Community

Key species from the Reference Plant Community, Alkali sacaton, prairie cordgrass, switchgrass, Indiangrass, little bluestem, Canada wildrye and Nebraska sedge have decreased. Western wheatgrass may initially increase or decrease depending upon the season of use. Forbs and shrubs are still present in reduced amounts. This plant community is at risk of losing warm-season tall grasses, palatable forbs and shrubs.

This community has decreased in plant frequency and production. Less litter can be expected however, the soil remains stable and can become very resistant to change depending on the degree to which the inland saltgrass has increased.

## Salt Meadow Ecosystem Vegetative Community Composition

Common Name	Scientific Name
Alkali Sacaton	<i>Sporobolus airoides</i>
Western Wheatgrass	<i>Pascopyrum smithii</i>
Switchgrass	<i>Panicum virgatum</i>
Prairie Cordgrass	<i>Spartina pectinata</i>
Big Bluestem	<i>Andropogon gerardii</i>
Little Bluestem	<i>Schizachyrium scoparium</i>
Indiangrass	<i>Sorghastrum nutans</i>
Slender Wheatgrass	<i>Elymus trachycaulus</i>
Saltgrass	<i>Distichlis spicata</i>
Foxtail Barley	<i>Hordeum jubatum</i>
American Licorice	<i>Glycyrrhiza lepidota</i>
Showy Prairie Gentian	<i>Eustoma exaltatum</i> ssp. <i>russellianum</i>
Leafy False Goldenweed	<i>Oenopsis foliosa</i> var. <i>foliosa</i>
Illinois Bundleflower	<i>Desmanthus illinoensis</i>



# Change Detection

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## **Normalized Difference Vegetation (NDVI)**

Section will primarily focus on the NDVI imagery for vegetation reference and current analytics.

The composite NAIP NDVI imagery from 2010-2020, this data set does not contain the NDVI values to perform statistical analysis. The imagery foot print encompasses the site extent and a vegetation reference extent for vegetative analysis.

Remotely sensed data was gathered on 2 - 4 May 2023, which reflects the current vegetative cover statistics.

NDVI calculations used the Near Infrared from the multispectral sensors. The NDVI reflects the measurements from the plant's topmost layer of leaves, typically used during spring emergence into mid-season growth.