

# Restoration of Sagebrush Landscapes Jonah Field

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Jonah Field



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# PROJECT PURPOSE

Restore native vegetation to land that has been disturbed by the development of Gas in the Jonah Field to meet objectives outlined in the Record of Decision for the Jonah Field.

# RESTORATION vs RECLAMATION

**Land Reclamation** -- is repairing damaged lands to a more natural state. I. e blow out sand areas to stable vegetation, saline lands to more productive land or deserts to irrigated land.

**Restoration Ecology** --is repairing damaged lands to a state that is replicable to the landscape in scope and value prior to a disturbance.

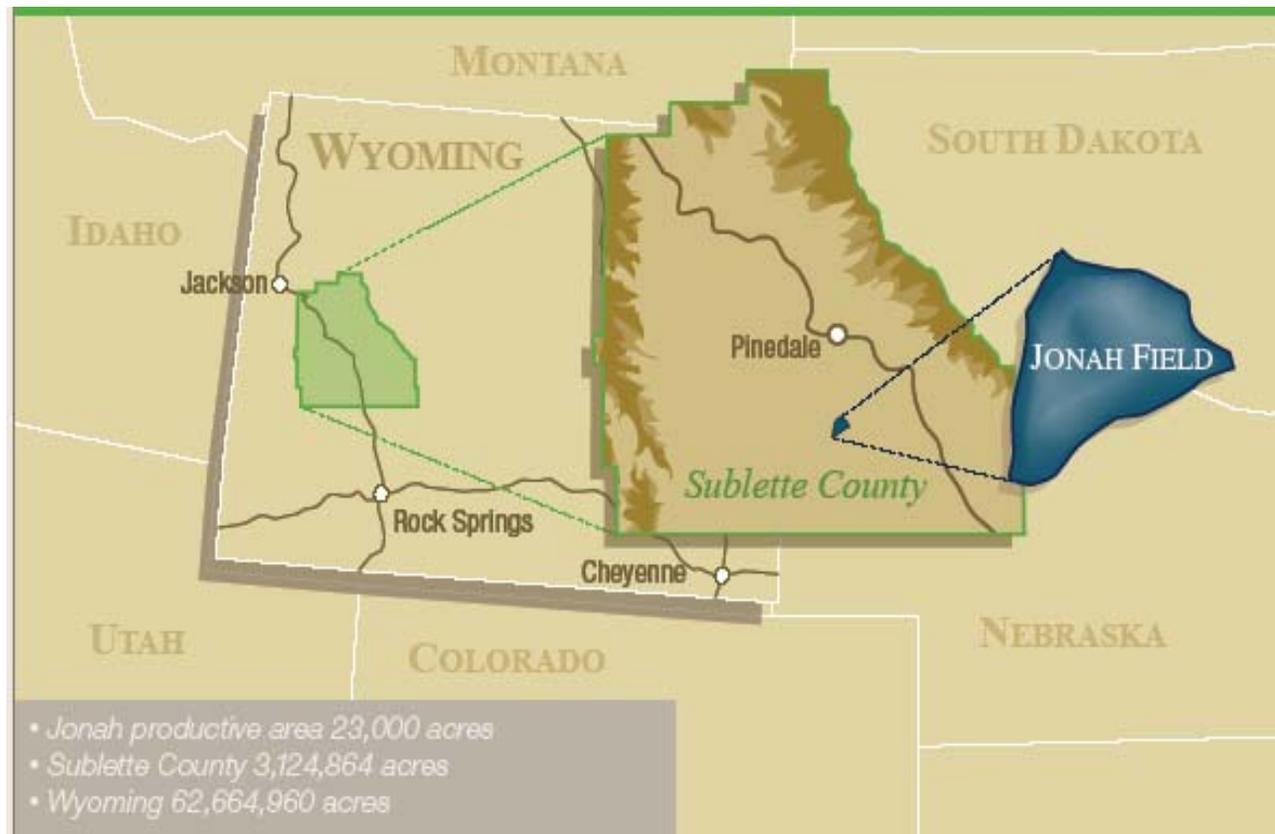


# Jonah Field Restoration Drivers

- The Jonah ROD
- A social license to operate
- Multiple tools in the toolbox-paradigm shifts
- Need for more understanding and science



# Jonah Field Location







# PHYSICAL CHARACTERISTICS

- Average annual precipitation 7-9 inches
- Land Cover type is for the most part Wyoming Sage/Rhizomatous wheat grass
- Soils are Loamy, Loamy Slightly Alkaline, and Sandy Clay Loam
- Two major Ecological Sites are Wind River Loamy 7-9, and Clayey 7-9



## JONAH FIELD

Total Field is approximately 30,000 Ac

- ❖ Encana lease approximately 17,400 Ac
- ❖ Total disturbance allowed all operators 20,000 Ac
- ❖ Never to exceed 14,000 Ac
- ❖ Encana 7,300 acres of the 14,000 Ac
- ❖ Current Disturbance 5,130 Ac
- ❖ Average annual Disturbance 500 Ac

# PRE and POST GAS FIELD DEVELOPMENT

## MAJOR LAND USES --- WILDLIFE HABITAT AND CATTLE GRAZING

- Wildlife in the field are numerous migratory birds (sage thrasher, sage sparrow, burrowing owl, horned lark, etc), sage grouse and antelope
- Three allotments are present in the field. Two are spring and one fall (North Spring Allotments deferred grazing for 5 years beginning in 2008)
- Prior to Jonah Field development the vegetation was in mid seral to late seral stage
- Post Development should find 1/3 in early seral stage 1/3 mid seral and 1/3 late seral

# CURRENT RESTORATION EFFORTS

- CONVENTIONAL EARTH LOCATION
- MAT LOCATION
  - **735 Conventional Earth Locations**
  - **105 Mat Locations**



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# Restoration Goals

Land under restoration = to land being disturbed annually

Restoration of land use values = or greater than pre-disturbance



# ECOLOGICAL GOALS

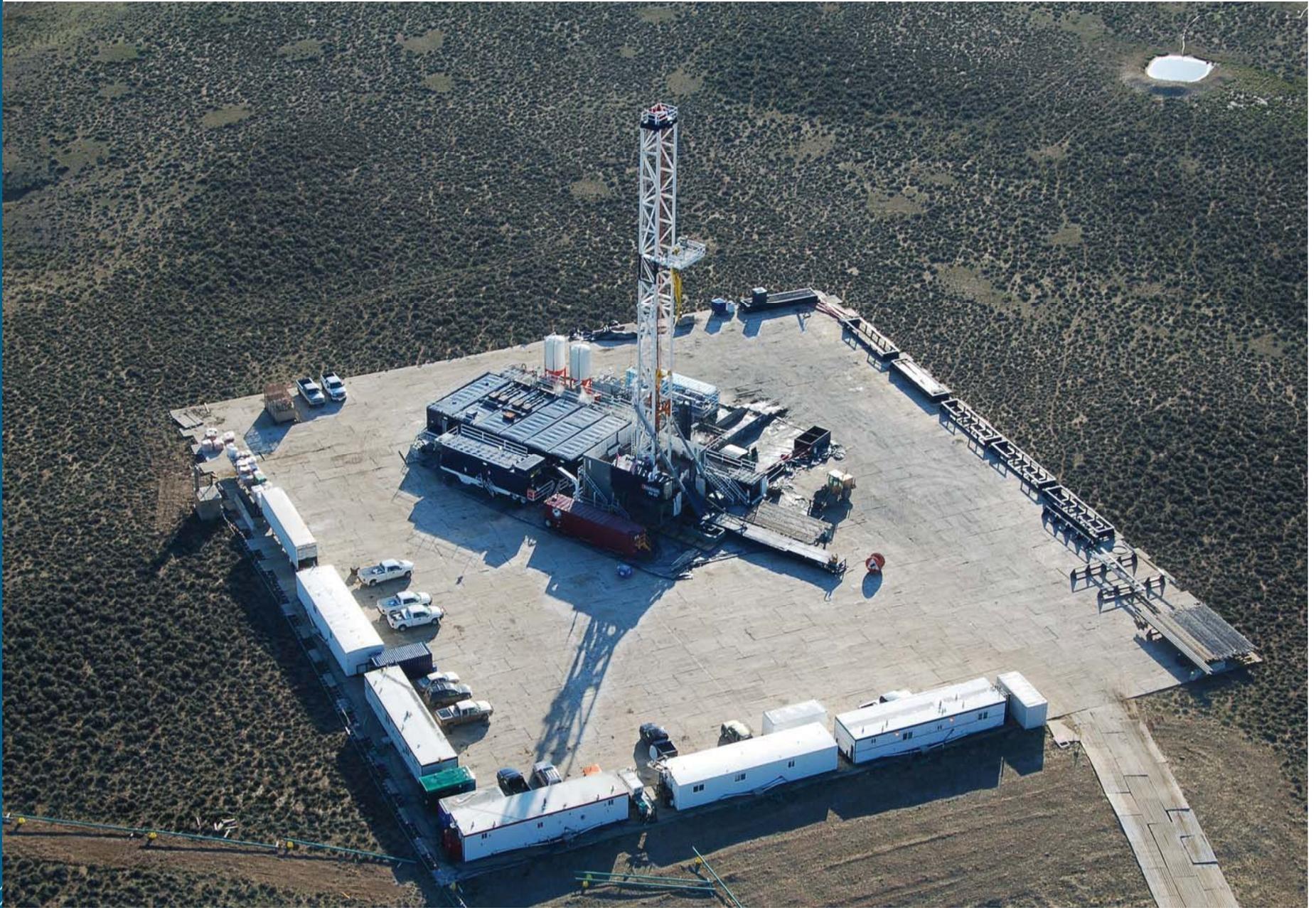
## **Restoration of Disturbance Sage Brush Steppe Landscapes to meet Roll Over Criteria established by Jonah Interagency Office**

- Bare Ground equal to or less than
- Stable Soil
- Forbs Frequency 75%
- Forbs Diversity equal
- Shrubs Frequency 50%
- Shrubs Diversity equal
- Dominant Shrub 15%
- Grass three species two bunch grasses
- Forbs, Shrubs and Grasses in a reproductive state

# CONVENTIONAL EARTH PAD WITH RESERVE PIT



# MAT PAD DRILLING LOCATION





# CONVENTIONAL LOCATION RESTORATION GOALS

- HAVE CONVENTIONAL LOCATION MEET ROLL OVER CRITERIA WITHIN 5-7 YEARS



# CONVENTIONAL LOCATION RESTORATION

- EARTH WORK
- SEEDBED PREPARTION
- SEED
- SEEDING







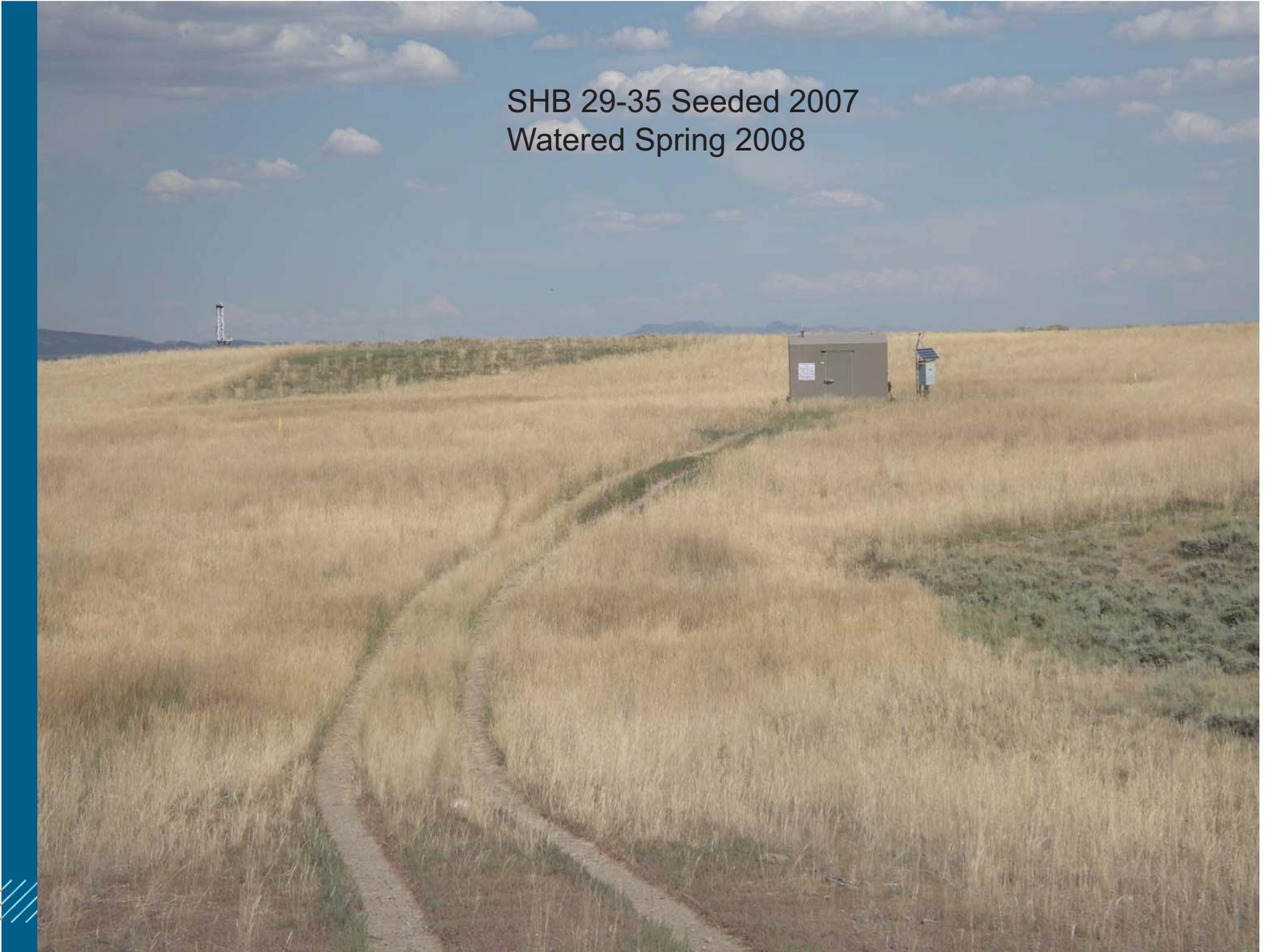


# RESTORATION PROGRESS

- TOTAL PADS DISTURBED 3550 AC
- 105 MATS OR 200 AC OF THE 3550
- PADS UNDER RESTORATION 2545 ACRES



SHB 29-35 Seeded 2007  
Watered Spring 2008





# RESTORATION of CONVENTIONAL LOCATIONS

- Keys
  - Analyze and Handle Cover Soil
  - Quick Turn Around
  - Improve plant materials for Native Forbs and Shrubs













## TRUAX RANGELAND DRILL WITH 12 INCH ROW SPACING



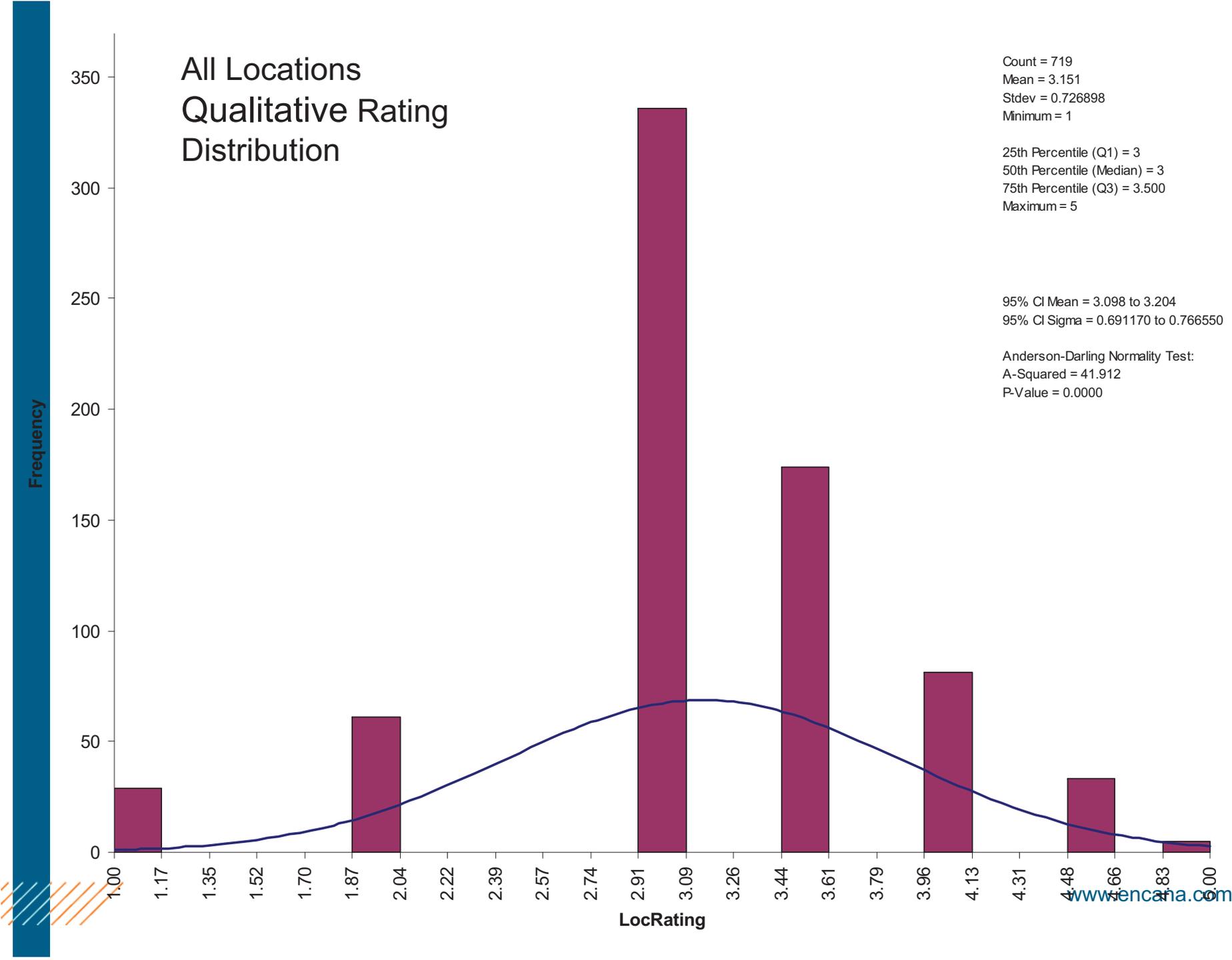
# MONITORING PROGRESS

- ❖ Qualitative monitoring of disturbance required yearly
- ❖ Quantitative every other year
- ❖ Both sets of Data housed in USGS data base
- ❖ <http://data.fort.usgs.gov/jio/home>

# Qualitative Ranking Criteria used to give locations and qualitative rating in 2010

- **1.** Majority of location lacks a minimum of two species of grass and needs remediation seeding.
- **2.** Location has some cover on over 50% of location with 3 grass species and a least some perennial forbs but needs watching for additional seeding work
- **3.** Location is stable throughout has three or more grass species has forbs and shrubs scatted over location but lacks sagebrush seedlings.
- **3.5.** Location is stable throughout and has three or more grass species, has forbs and shrubs scatted over location and has some sagebrush seedlings.
- **4.** Location is stable throughout and has three or more grass species, has a variety forbs and shrubs scatted over location and has good population of sagebrush seedlings.
- **5.** Meets roll over criteria

# All Locations Qualitative Rating Distribution



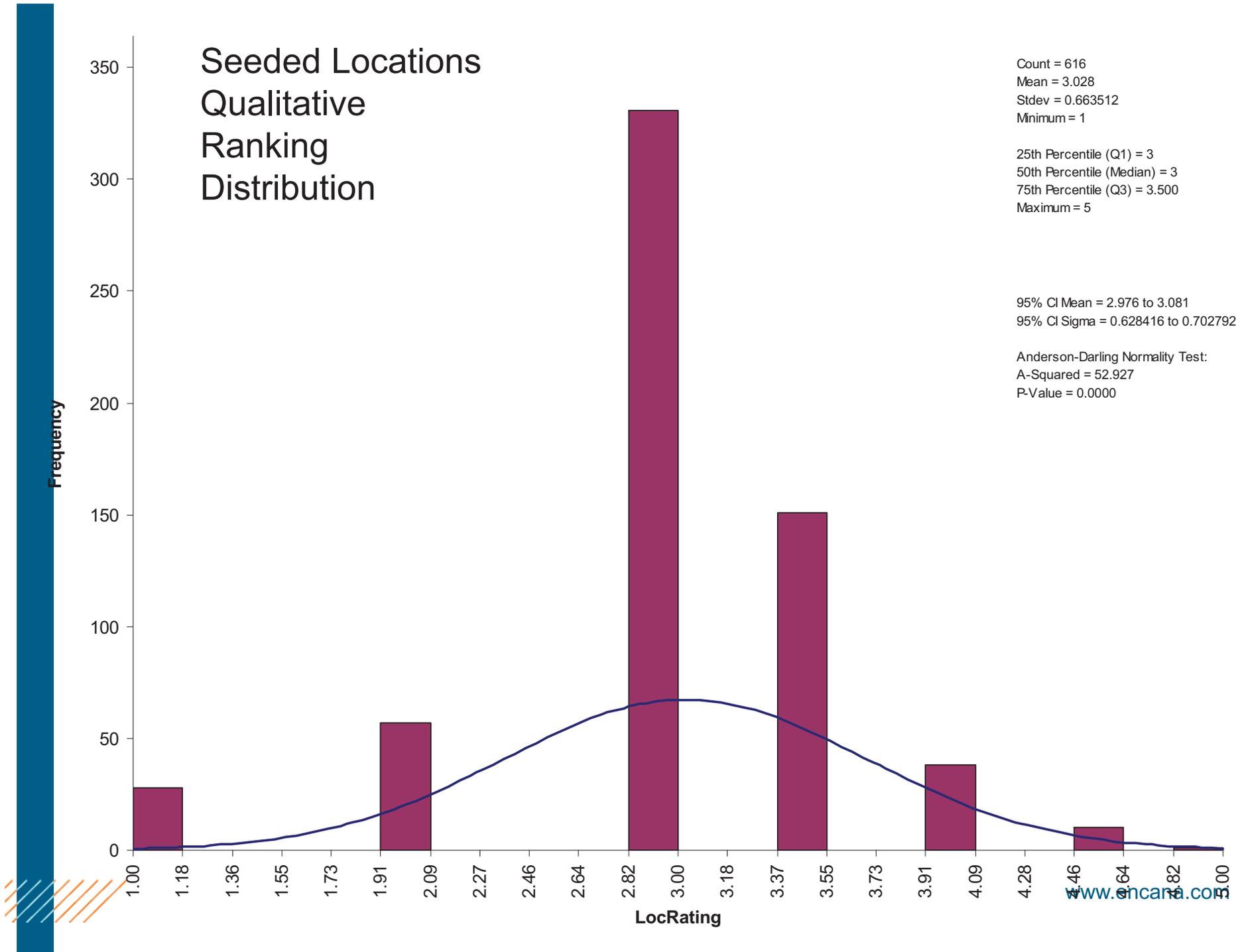
# Seeded Locations Qualitative Ranking Distribution

Count = 616  
Mean = 3.028  
Stdev = 0.663512  
Minimum = 1

25th Percentile (Q1) = 3  
50th Percentile (Median) = 3  
75th Percentile (Q3) = 3.500  
Maximum = 5

95% CI Mean = 2.976 to 3.081  
95% CI Sigma = 0.628416 to 0.702792

Anderson-Darling Normality Test:  
A-Squared = 52.927  
P-Value = 0.0000



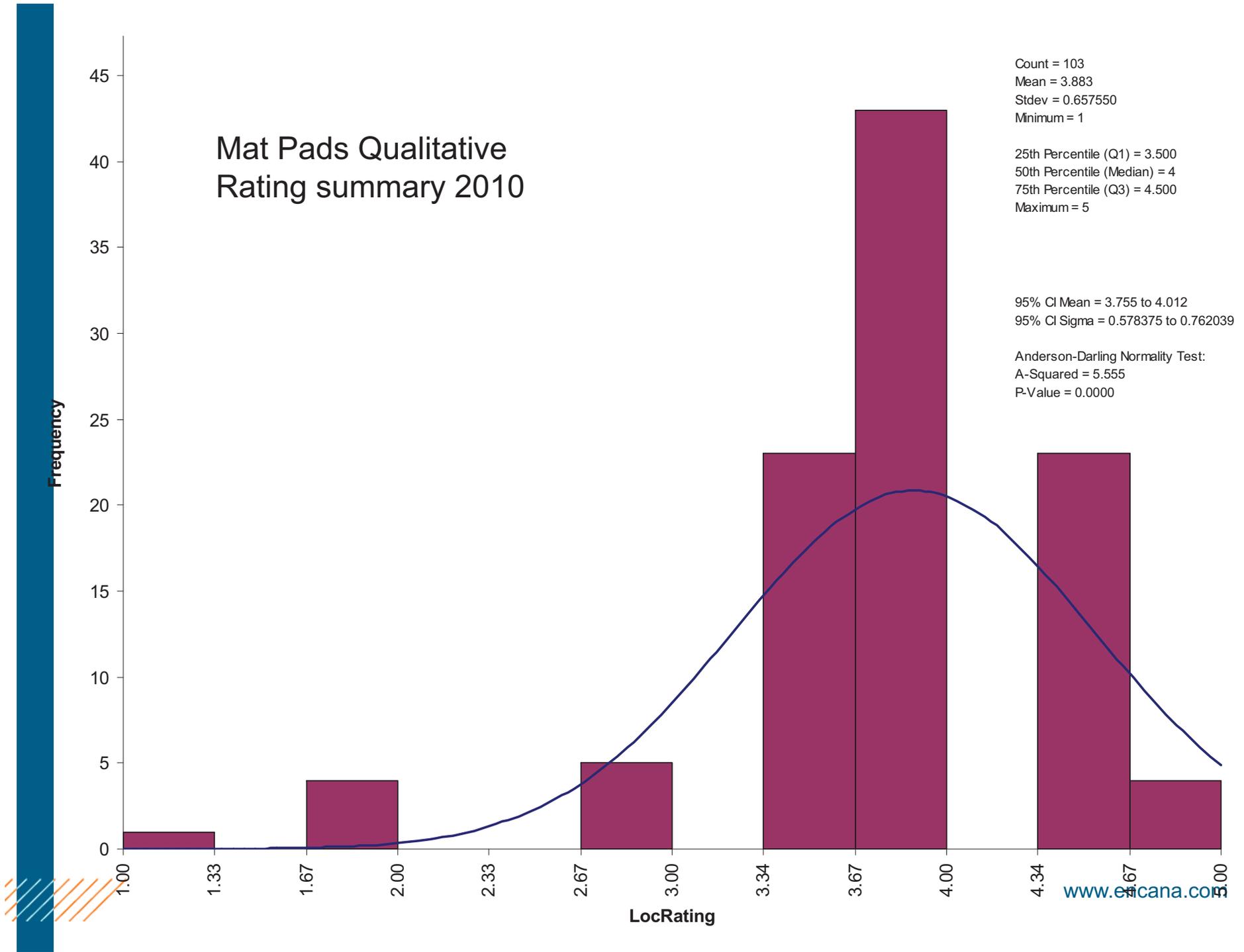
# Mat Pads Qualitative Rating summary 2010

Count = 103  
Mean = 3.883  
Stdev = 0.657550  
Minimum = 1

25th Percentile (Q1) = 3.500  
50th Percentile (Median) = 4  
75th Percentile (Q3) = 4.500  
Maximum = 5

95% CI Mean = 3.755 to 4.012  
95% CI Sigma = 0.578375 to 0.762039

Anderson-Darling Normality Test:  
A-Squared = 5.555  
P-Value = 0.0000



# QUANTITATIVE MONITORING SUMMARY

## Roll over criteria for Disturbance Seeded Locations

Disturbed % Bare Ground	Disturbed Avg. Density/Freq. Forbs	Disturbed No. Forbs	Disturbed Avg. Density/Freq. Shrubs	Disturbed No. Shrubs	No. Grass Species	No. Bunch Grasses
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SEEDED SITES REVIEWED IN 2010 INCLUDED ALL SITES SEEDED IN 2007 AND 2005/2006

225 Seeded location inventoried

Number of Locations	Roll Over Criteria Met
20	>4
188	3
15	<3

# QUANTITATIVE MONITORING

## Roll Over Criteria Comparison for Mat Locations

Disturbed % Bare Ground	Disturbed Frequency Forbs	Disturbed Number of Forbs	Disturbed Frequency of Shrubs	Disturbed Number of Shrubs	Number of Grass Species	Number of Bunch Grasses
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Number of Mat Locations Inventoried \_\_\_\_ 95

Number of Locations	Roll Over Criteria Met
7	4
5 or 6	22
3	30
<3	39



### Welcome to The Jonah Infill Data Management System

Refresh Map

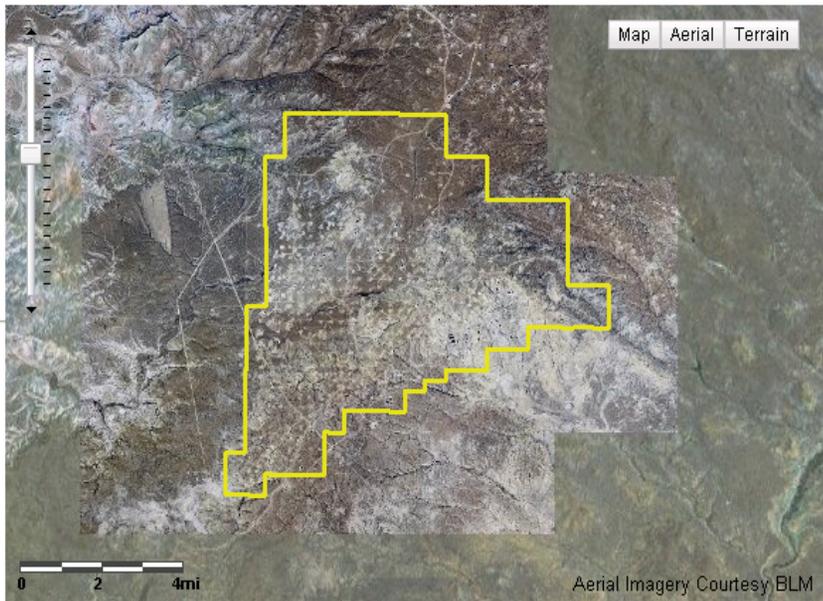
Operator:  
All Operators

Type:  
All Types

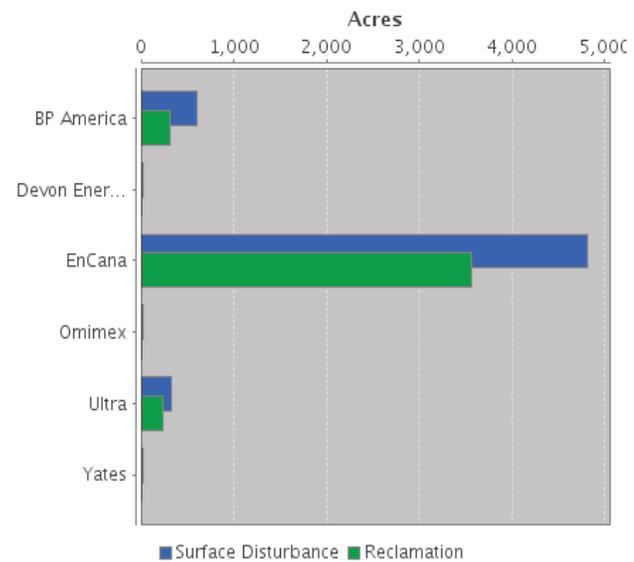
Show Disturbances  
 Show Reclamation Areas

Show Mitigation  
 Show Leases  
 Show Operated Acreage  
 Auto-Zoom to Selection

Printable Map



### Operator Summary



### Reports, Downloads & Interactive Maps:

Frequently used reports:

- Site Regression by Stage
- Presence of Noxious Weeds
- Presence of Erosion
- Rollover Status Pending Review
- Seeding Method Used
- Ad-Hoc
- All Reports

Downloads:

### Operators:

- BP America
- Devon Energy Corporation
- EnCana
- Omimex
- Ultra
- Yates

### Pipeline Companies:



Location 53-14 seeded in late fall 2009 with B1 seed mix



















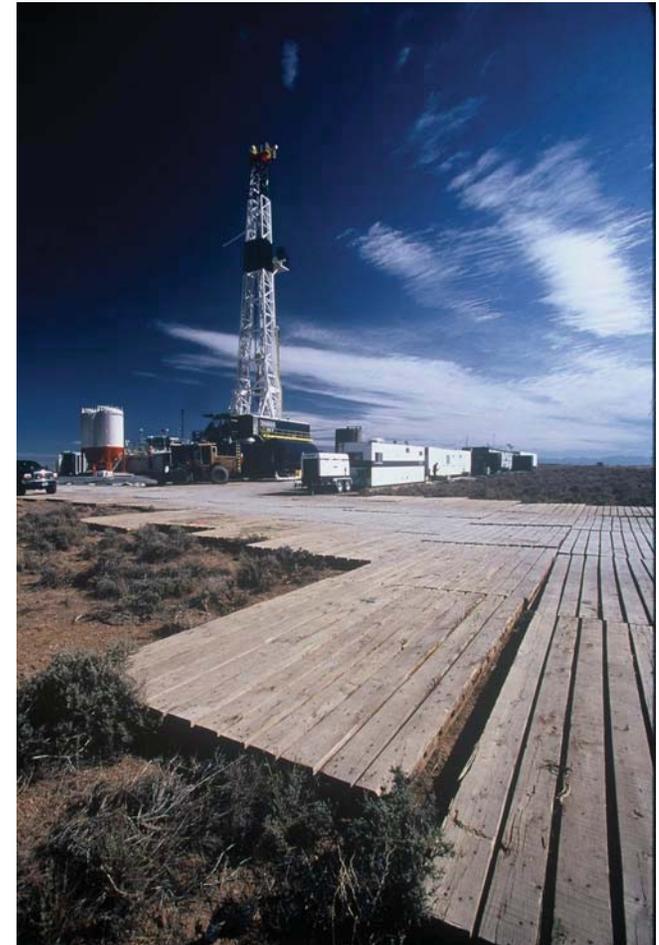


# GRUBBING CHEAT GRASS



# EnCana's Mat Program Objectives

- Mat Drilling
  - Reduced surface disturbance.
  - Hybrid locations built in areas where we cannot completely utilize mats
  - Reach roll over criteria in 3-5 years

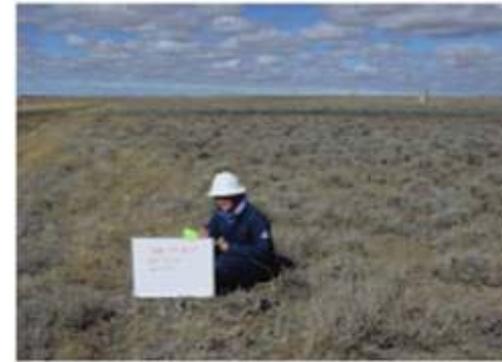


## Soil Compaction with Oak Mats

Depth	Before	After	Change
0-2	1.29	1.26	-2.3%
0-6	1.32	1.35	+2.3%
0-12	1.32	1.41	+6.8
Mean	1.31	1.34	+2.3%
Mean 17 sites	Density threshold 1.65 g/cm <sup>3</sup>		

# Vegetation Photo Points

SHB 53-20 Pre Mat



SHB 53-20 Post Mat





## **Vegetation on Mat Locations compared to native Range on average:**

- **Grass production same or higher**
- **Grass diversity, density and cover same or higher**
- **Forbs diversity, density, and cover same or higher**
- **Shrub cover, density and diversity less than native**
- **Bare ground higher on mats than in native**



## Soils summary:

- Does not impact soil structure
- Does not change the distribution of salts in the soil profile
- Cause little or no loss in the viability of the seed bank
- Soil bulk density after mat removal was either slightly lower or higher when compared to the pre-mat construction condition, but the increase never exceeded  $0.08 \text{ g/cm}^3$ .
- Bare ground and rock in oak mat locations were not significantly different compared to native rangeland.





**Cultural: Only one artifact was damaged, and it cannot be determined if it was due to human error at burial or due to the use of the oak mats**

**Wildlife use:**

- **More use by all species compared to conventional reclamation**
- **Higher wildlife utilization of vegetation than native sites**
- **Higher insect diversity and density. Single species varied in amounts on native vs. mat site.**

# Can you spot the 16 mat locations?

The mat locations on average are 1.5-2.0 acres in size compared to a conventional location of 3.0-4.0 acres.





## Roll Over Acreage Approved

- 2007 = 2 pads 4 ac
- 2008 = 2 pads 4 ac
- 2009 = 4 pad 8 ac
- 2010 = 5 pads 10 ac

Total Pads with roll over credit 13 and 26 acres





## Thanks to:

- KC Harvey, LLC
- Aster Canyon Consulting, LLC
- Current Archeological Research, Inc.
- Wyoming Wildlife Consultants, LLC



# Summary

- Reclamation on track to have around 75-80% of disturbance under restoration efforts by the end of Field Drilling
- Reclamation of native grasses is being accomplished on 90% of the reclamation locations.
- Forbs and Shrubs are slower to establish and still search for right prescription.



# Moving Forward

- Protecting wildlife and habitat is everyone's responsibility
- Industry leadership, cooperation and stronger partnerships can produce effective results



## Questions?



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