Reclamation Planning for Energy Development Projects: Wamsutter, WY; A Case Study

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June 3, 2013

Outline

Background

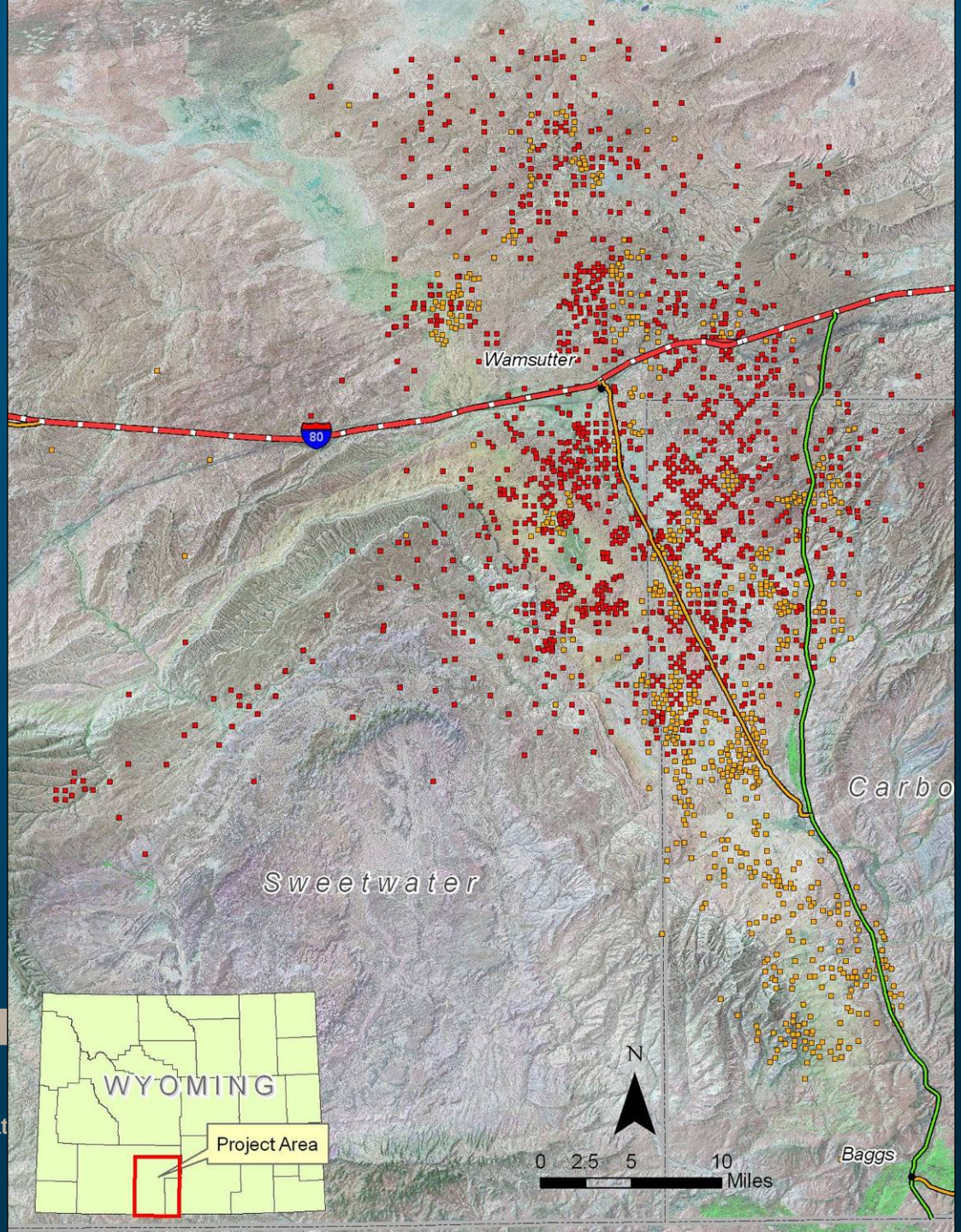
- Wamsutter Field Reclamation Challenges
- Regulatory Framework

Pre-Construction Planning

- Components of a Reclamation Plan
- Case Studies

Conclusions

Wamsutter Natural Gas Field



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Reclamation Challenges

- Climate
- Soils
- Invasive species
- Grazing

Problem

Construction process often reduces soil suitability

- **Mixing of salts and clays into surface soils**
- **Loss of soil structure**
- **Compaction**
- **Dilution of organic matter**

Solutions

Pre-construction planning

- Determine soil quality and plant community types prior to surface disturbing activities
- Create a site-specific reclamation plan based on pre-construction assessment

Pre-Construction Planning

- **Wyoming Reclamation Policy (BLM, 2009)**

  10 reclamation requirements for proposed disturbances

- **Rawlins Reclamation Guidance (BLM, 2011)**

  Describes how to meet the 10 requirements

Reclamation Plan

- Site description
- Map soils and vegetation communities
- Soil salvage plan
- Seed mix
- Weed management
- Monitoring plan

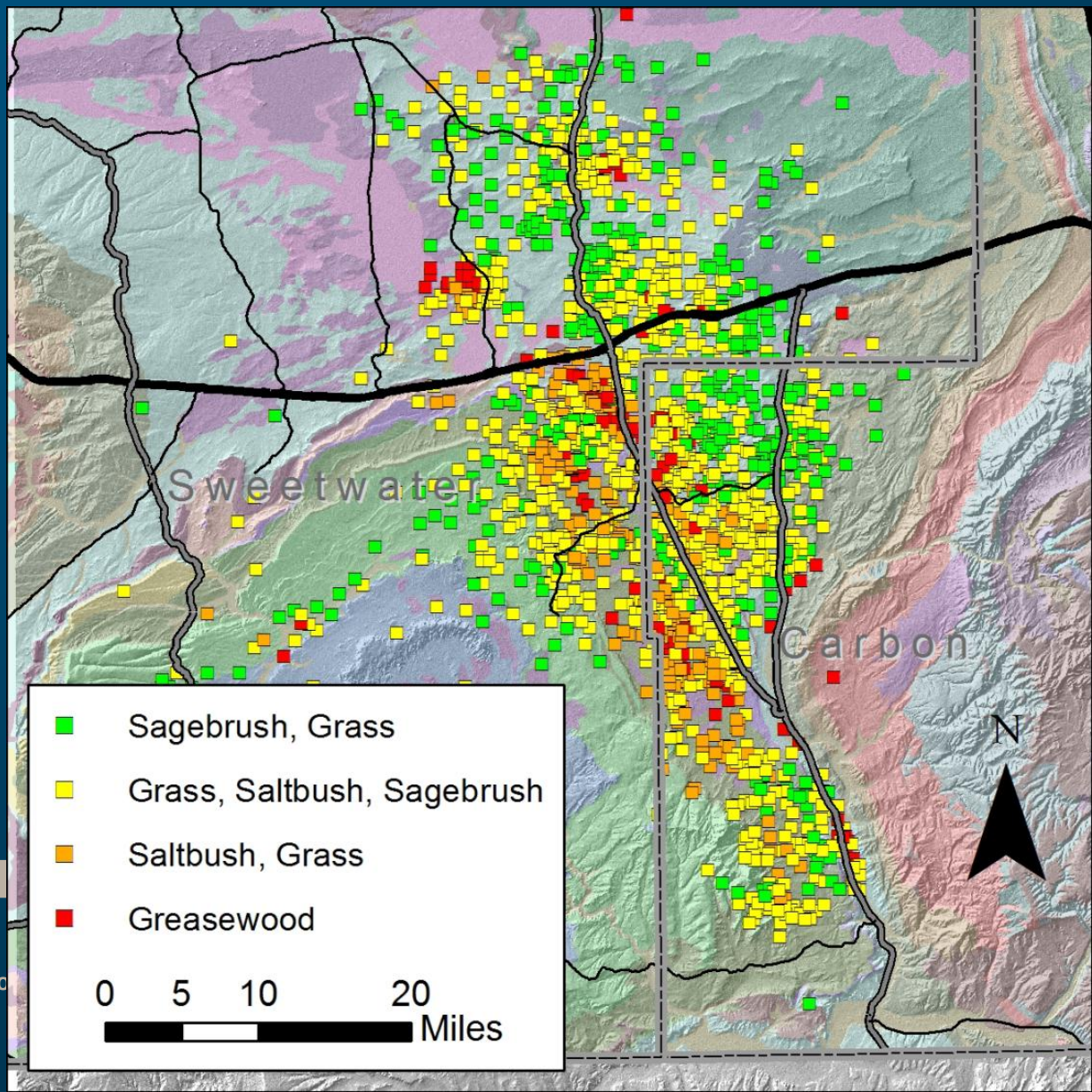
Site Description

- Legal description
- Size/shape
- Landowner
- Land use
- Slope/aspect
- Other features
- General observations on soil and vegetation

Soil and Vegetation Communities

Strongly influenced by:

- Geology
- Topography



Correlation of Soil Chemistry and Plant Community

Sagebrush, grass
Suitable soils

Grass, saltbush, sagebrush
Slightly-Moderately Saline soils

Saltbush, Grass
Saline (or sodic) soils

Greasewood
Sodic, (or saline/sodic)

Suitability for Plant Growth

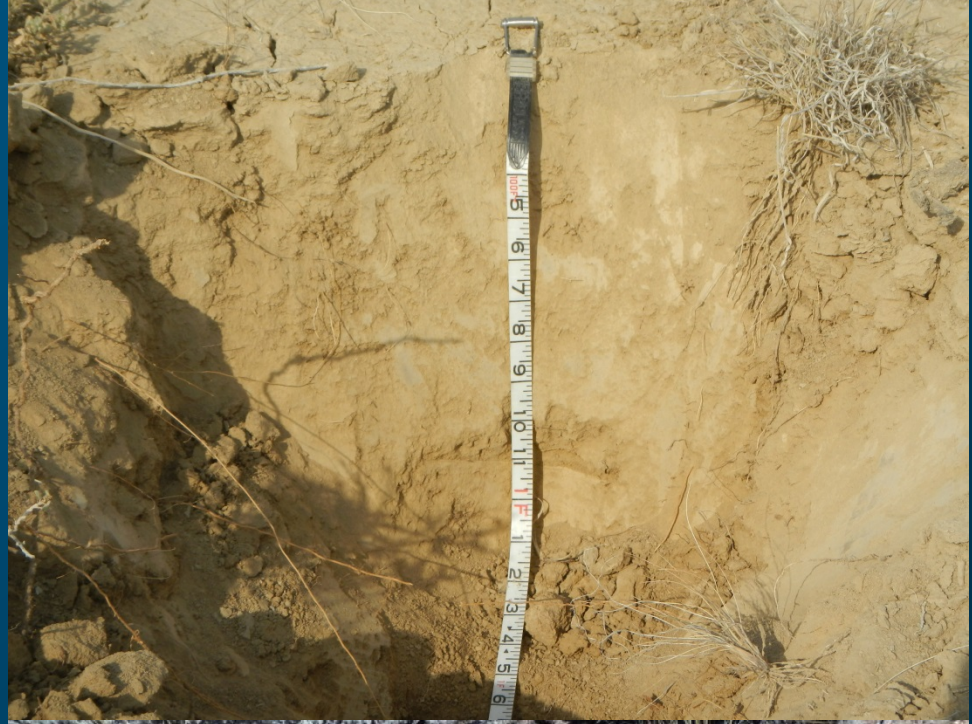
Abundant

Moderate

Minimal

Soil and Vegetation Communities

- **Map soil/vegetation communities**
- **Within each community:**
  - Soil samples
  - Species composition and cover
  - Ecological Site Description (ESD)



Soil/Vegetation Communities

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Develop Soil Salvage Plan

Division	Depth (inches)	Parameter					
		pH	EC (dS/m)	SAR	% Saturation	% Lime	Texture
A	0-6	7.5	0.6	0.1	30.5	1.5	Sandy Loam
	6-12	7.7	0.5	0.2	32.3	4.2	Sandy Loam
B	0-6	7.6	4.6	2.6	57.8	4.9	Clay
	6-12	7.8	6.3	4.4	65.4	6.5	Clay
C	0-6	7.8	0.3	0.2	35.3	4.9	Silty Loam
	6-12	7.8	0.3	0.4	41.8	10.5	Sandy Clay Loam

Develop Seed Mixes

- Species present
- Species adapted to local conditions

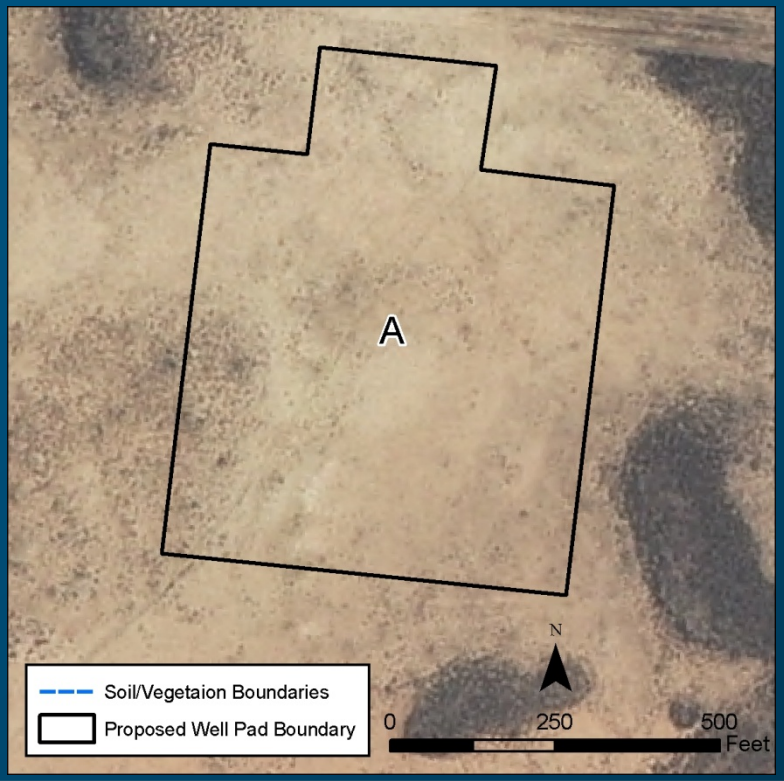
Common Name	Scientific Name (Cultivar)	Seeds/lb	Seeding Rate (PLS lbs/acre)	Seeds/ft^2	Percent of Seed Mix
Bottlebrush squirreltail	*Elymus elymoides*	192,000	2	9	16%
Indian ricegrass	*Achnatherum hymenoides*	161,920	2	7	14%
Sandberg bluegrass	*Poa secunda*	1,046,960	0.3	7	13%
Slender wheatgrass	*Elymus trachycaulus*	154,000	2	7	13%
Thickspike wheatgrass	*Elymus lanceolatum*	154,000	1.5	5	10%
Scarlet globemallow	*Sphaeralcea coccinea*	500,000	0.4	5	8%
Green rabbitbrush	*Chrysothamnus vicidiflorus*	782,000	0.5	9	16%
Winterfat	*Krascheninnikovia lanata*	56,700	4	5	10%
		Total	**13**	**55**	**100%**

Monitoring and Weed Management

- **Monitoring schedule**
- **Reporting**
- **Weed management:**
  - Prevention
  - Monitoring
  - Control
  - Reporting

Case Study 1

Saltbush-grass community



Case Study 1

	Division	Depth (inches)	Parameter					
			pH	EC (dS/m)	SAR	% Saturation	% Lime	Texture
Pre-Construction	A	0-6	7.6	**5.65**	11	43.3	6.0	Clay Loam
		6-12	7.8	**11.00**	**23**	48.7	5.0	Clay Loam

Salvage 6 inches of soil

Case Study 1

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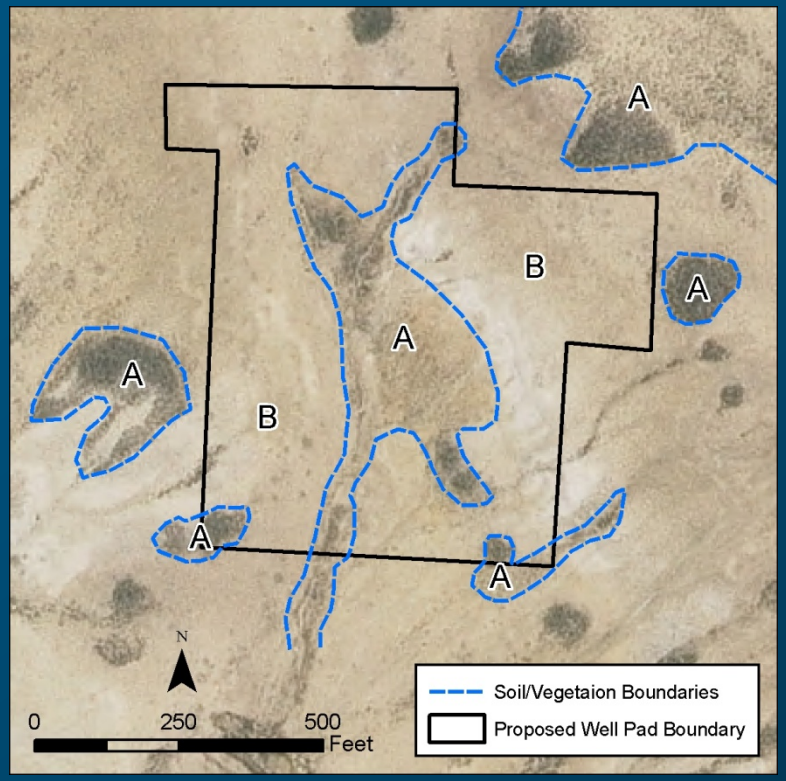
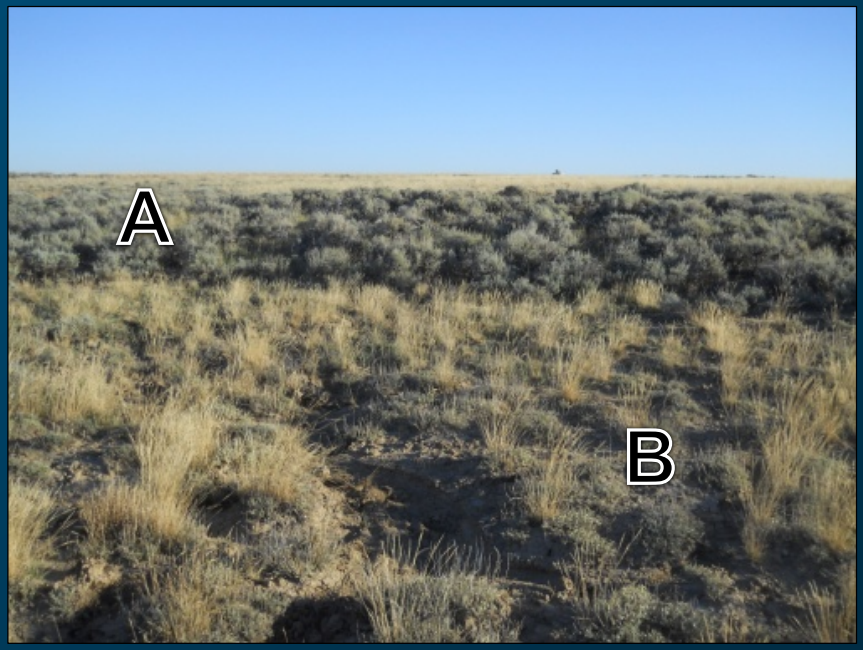
		6-12	7.8	**11.00**	**23**	48.7	5.0	Clay Loam
Post-Construction	All	0-6	7.8	**5.2**	7.2	37.1	5.4	Sandy Clay

Case Study 2

Sagebrush (A) and saltbush-grass (B) communities





Case Study 2

	Division	Depth (inches)	Parameter					
			pH	EC (dS/m)	SAR	% Saturation	% Lime	Texture
Pre-Construction	A	0-6	7.9	1.00	8.6	48.0	5.0	Clay Loam
		6-12	8.0	**4.13**	6.6	51.1	5.0	Clay Loam
	B	0-6	7.1	**5.06**	8.5	50.4	3.0	Clay Loam
		6-12	7.4	**10.40**	**22.0**	**64.3**	3.0	**Clay**

Salvage 12 inches in sagebrush community (A)

Salvage 6 inches in saltbush-grass community (B)

Case Study 2

	Division	Depth (inches)	Parameter					
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Pre-Construction	A	0-6	7.9	1.00	8.6	48.0	5.0	Clay Loam
		6-12	8.0	**4.13**	6.6	51.1	5.0	Clay Loam
	B	0-6	7.1	**5.06**	8.5	50.4	3.0	Clay Loam
		6-12	7.4	**10.40**	**22.0**	**64.3**	3.0	**Clay**
Post-Construction	All	0-6	7.8	1.7	11.1	49.1	9.4	**Clay**

Conclusions

- Over 150 pre-construction assessments completed
- Few proposed well pads have been built and reclaimed
- Proper soil salvage maximizes suitable material for reclamation
- Communication of soil salvage plan

Conclusions

Effective Pre-construction Planning…

- **Maximizes suitable material**
- **Reduces mixing**
- **Reduced need for soil amendments**
- **Leads to faster revegetation**