Endangered Species Management on Private Land: Interior Least Tern

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Presented at OSM Bond Release Forum
August 2001

Acknowledgements

J. Matthew Tanner - TXU Business Services, 1601 Bryan Street, Dallas, TX 75201-3411

R. Douglas Slack - Texas A&M University

TXU Environmental Research Fellowship

Big Brown Mine Reclamation Personnel

Least Tern (*Sterna antillarum*)

Coastal Least Tern (*S. a. antillarum*)

California Least Tern (*S. a. browni*)

Interior Least Tern (*S. a. athalassos*)

1997

Interior Least Tern Recovery Project

Big Brown Mine

Teaming to Save
Endangered Terns

Five-Year Management Plan

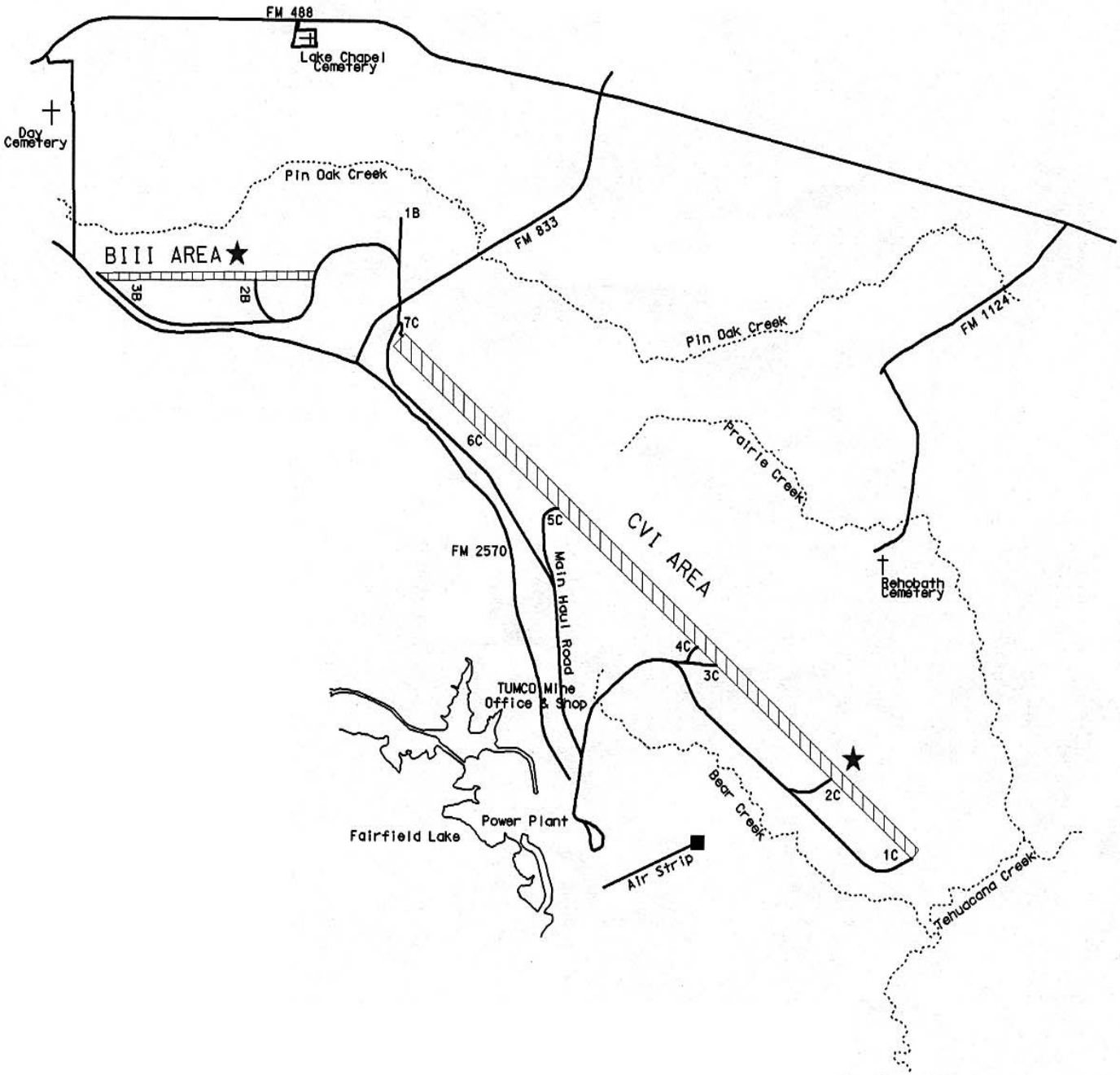
Objectives

- Provide manageable nesting and foraging habitats that are compatible with mine activities.
- Increase available nesting and foraging habitats for the Texas population of Interior Least Terns.
- Provide Interior Least Tern data and develop strategies for future management of the species on Texas Utilities Mining Company properties.
- Provide data for use by Federal and State agencies and other interested parties.
- Support the U.S. Fish & Wildlife Service goal of returning the Interior Least Tern to non-endangered status as stated in the federal recovery plan.

Nest Area Construction

Nest Area Construction

- Site selection
- Soil testing of nesting substrate
- Vegetation control
- Fencing
- Nesting Supplements


FM 488
Lake Chapel Cemetery
Day Cemetery
Pin Oak Creek
1B
FM 833
BIII AREA
3B
2B
7C
Pin Oak Creek
FM 1124
6C
Prairie Creek
5C
CVI AREA
FM 2570
Main Haul Road
Behobath Cemetery
4C
3C
TUMCO Mine Office & Shop
Bear Creek
2C
Power Plant
Fairfield Lake
1C
Air Strip
Tehuacana Creek

Nest Area Construction

- Site selection
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Nest Area Construction

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1998

Nest Area Construction

- Site selection
- Soil testing of nesting substrate
- Vegetation control
- Fencing
- Nesting Supplements

Decoys

Project History

1997 to 1999 Data Comparison

	1997	1998	1999
Arrival Date	May 28	May 12	May 14
Adults	40	44	32
Total Nests	25	28	35
Total Eggs	45	69	76
Est. Chicks Hatched	35	44	19
Fledglings	15	14	15
Migration Date	August 24	August 14	Sept. 14

No wonder they're endangered!!!

2000

2000 Nesting Data

Arrival	10 May 2000
Adults	~25
Total Nests	27
Total Eggs	60
Predated	24 (10 nests)
Abandoned	21 (10 nests)
Total Hatched	12
Total Fledged	2
Migration	21 August 2000

2001 Nesting Data

Adults	~20
Total Nests	12
Total Eggs	27
Predated	7 eggs (3 nests)
	3 chicks (3 nests)
Abandoned	8 (4 nests)
Total Hatched	11 (6 nests)
Total Fledged	7 (4 nests)

Ecology of Interior Least Terns Nesting on Reclaimed Mine Spoil

Andrew C. Kasner and R. Douglas Slack
Department of Wildlife and Fisheries Sciences
Texas A&M University
College Station, TX

What is known?

- Habitat preferences in natural nesting areas of both interior and coastal populations
- As preferred nesting habitat declines, the species has increased use of artificial nesting areas
- Prey density affects overall nesting success

What is not known?

- Habitat preferences in artificial nesting areas
- How the landscape at a non-riverine site affects behavior of Interior Least Terns
- How prey density affects foraging and individual fitness

Pond Stocking

2000

Fathead minnows (*Pimephales promelas*)

2001 and 2002

Bluegill (*Lepomis macrochirus*)

Golden shiner (*Notemigonus crysoleucas*)

Spatial attributes of sites

METHODS

- examine physical attributes of the two possible nesting sites at Big Brown Mine

- examine landscape use by Interior Least Terns nesting on artificial sites on the Big Brown Mine

Soil

	1997 B-area	2000 B-area	1997 C-area	2000 C-area	2000 WC-V
Sand	.34	.28	.35	.27	.71
Silt	.38	.44	.39	.36	.07
Clay	.28	.28	.26	.37	.22

ANOVA - Soils 1997 vs 2000

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SAND	Between Group	.526	6	8.771E-02	12.895	.003
	Within Groups	.081E-02	6	6.802E-03		
	Total	.567	12			
SILT	Between Group	.536	6	8.940E-02	10.522	.006
	Within Groups	.098E-02	6	8.497E-03		
	Total	.587	12			
CLAY	Between Group	.507E-02	6	5.845E-03	2.629	.132
	Within Groups	.334E-02	6	2.224E-03		
	Total	.841E-02	12			

Plant Species Found In Nesting Areas

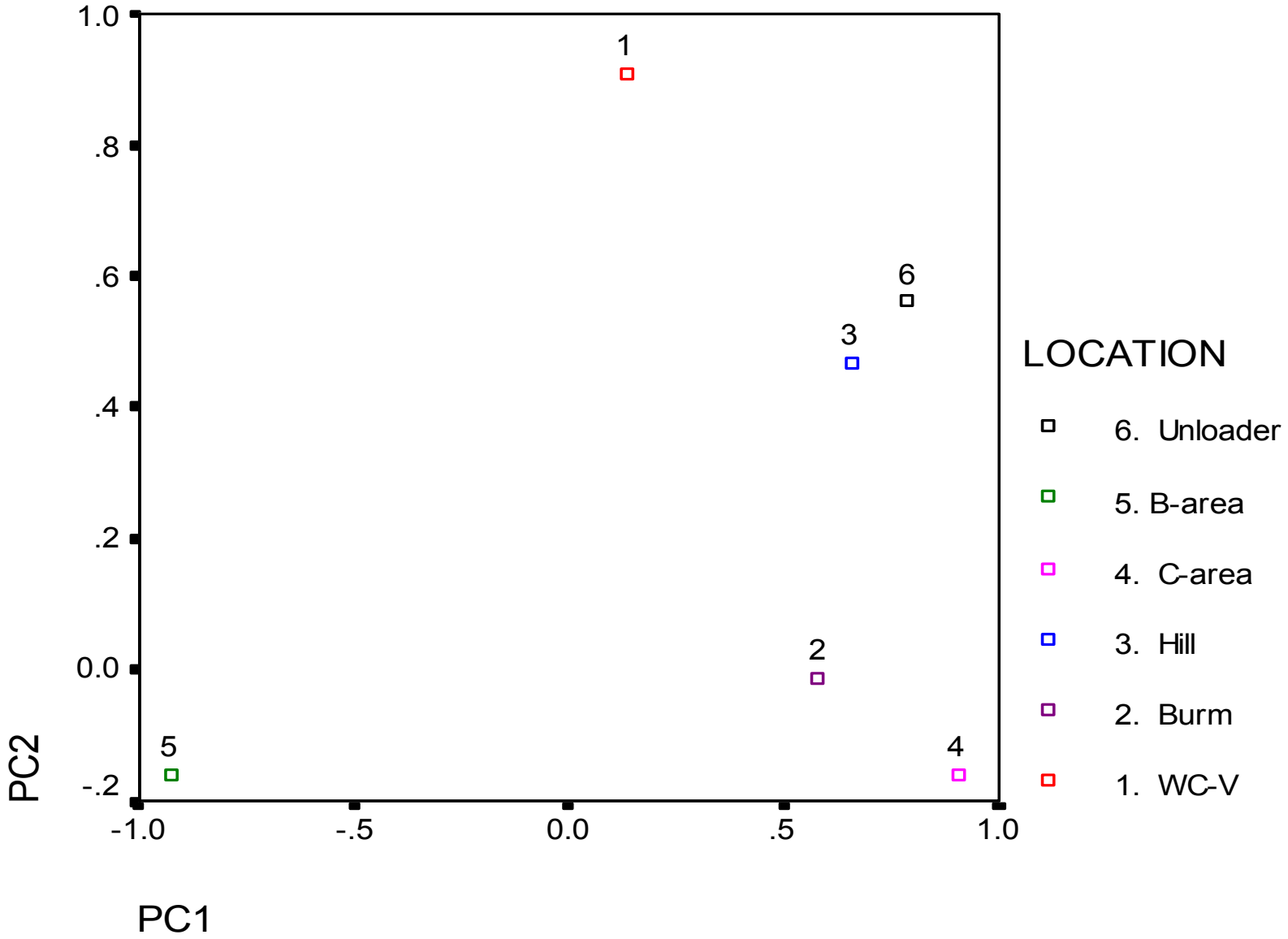
Yellow Nutsedge (C*yperus*)
Crabgrass (*Digitaria*)
Carpetweed (*Mollugo*)
Goatweed (*Croton*)
Tumble Pigweed (*Amaranthus*)
Millet
Johnson grass
Green Sprangletop
Red lovegrass
Bermuda
Knot-root bristle grass
Jungle rice (*Echinochloa*)
Spotted Spurge (*Euphorbia*)
Rattlepod (*Sesbania*)
Ragweed

Principal Components Analysis Nest Site Characteristics

	% Var.	Cumulative %
Component 1	37.9	37.9
Component 2	24.8	62.7
Component 3	18.5	81.2

PCA Component Loadings

	PC1	PC2	PC3
Sand	.133	.910	-.151
Silt	.580	-.012	.512
Clay	.657	.468	.556
Forbs	.906	-.160	-.271
Grasses	-.929	-.160	.232
Bare	.787	.561	-.247
Nutsedge	.971	-.087	-.089
Crabgrass	.788	.147	.049
Croton	.603	-.702	-.317


1.0
.8
.6
.4
.2
0.0
-.2
PC2
-1.0
-.5
0.0
.5
1.0
PC1
1
2
3
4
5
6
LOCATION
6. Unloader
5. B-area
4. C-area
3. Hill
2. Burm
1. WC-V

ANOVA Among Sites

	DF	F	P
Bare	5	1.51	.236
Forbs	5	2.83	.047
Grasses	5	6.88	.001
Sand	5	10.49	.011
Silt	5	8.04	.020
Clay	5	2.49	.170

ANOVA Among Sites

	DF	F	P
Nut sedge	5	1.65	.199
Carpetweed	5	1.35	.289
Croton	5	1.15	.370
Tumble Pigweed	5	1.75	.175
Spotted Spurge	5	.54	.744
Sesbania	5	1.35	.289
Ragweed	5	.36	.869

ANOVA Among Sites

	DF	F	P
Crabgrass	5	1.80	.165
Millet	5	25.34	<.001
Johnson grass	5	3.30	.027
Green Sprangletop	5	15.30	<.001
Red Lovegrass	5	3.30	.027
Bermuda	5	16.76	<.001
Knot-root Bristle grass	5	3.30	.027
Jungle rice	5	--	--

Management Recommendations

DON’T DO ANYTHING

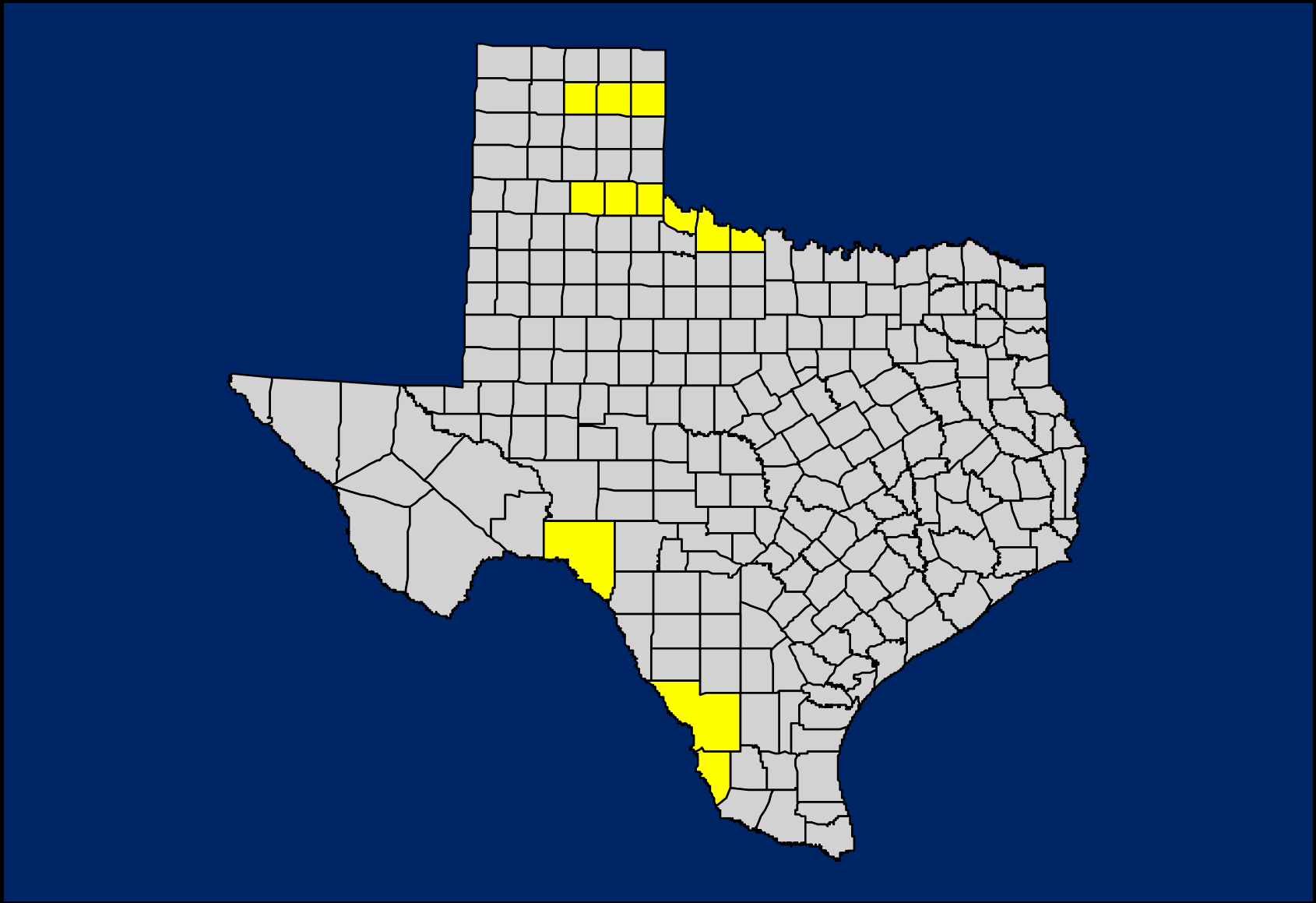
Management Recommendations

Large expanse of relatively bare ground, FRESHLY DISTURBED

High sand content

Water nearby

Historical Distribution: Interior Least Tern



Revised Distribution

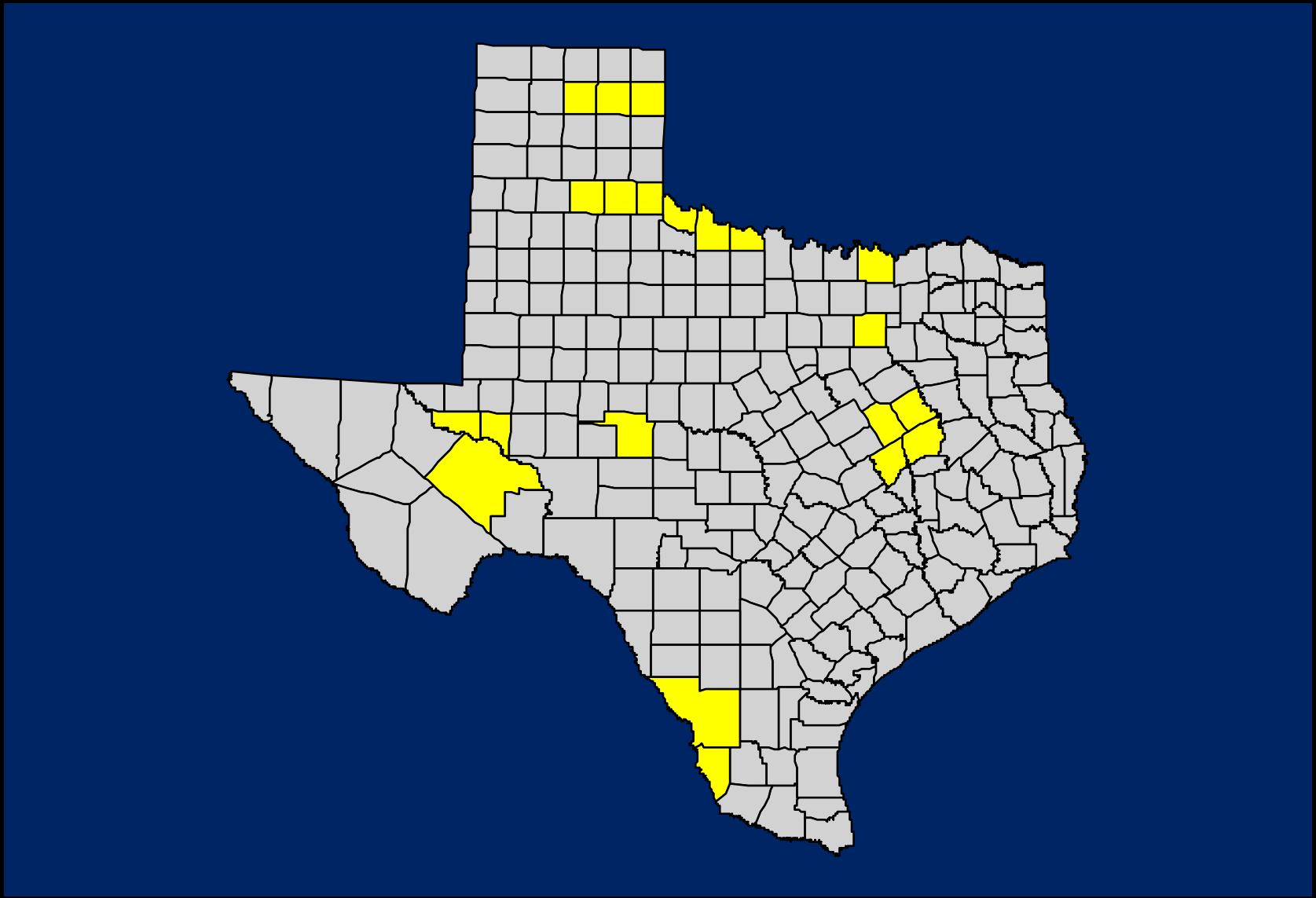


Photo by
Peter LaTourrette

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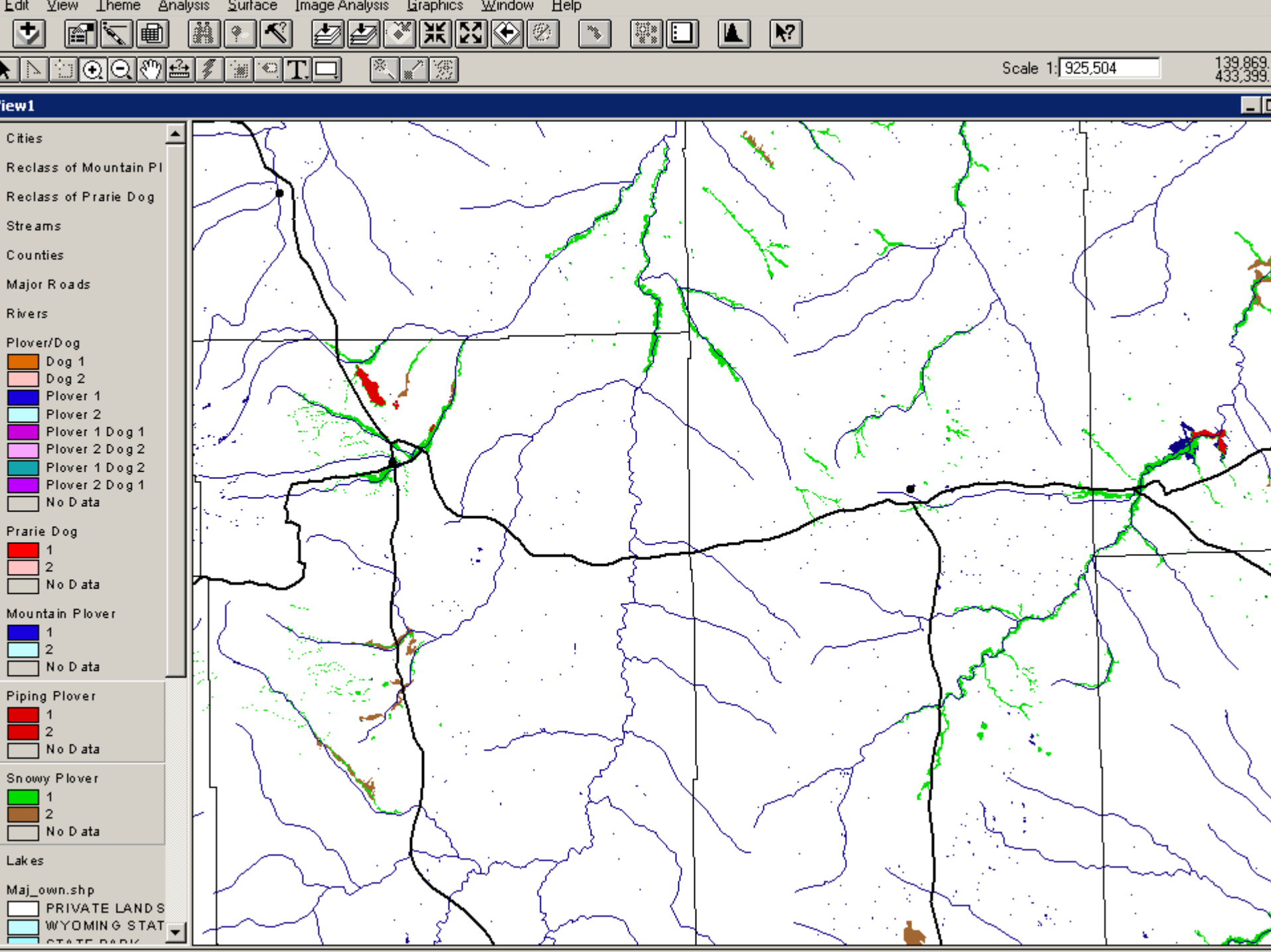
View1

- Cities
- Reclass of Mountain Pl
- Reclass of Prarie Dog
- Streams
- Counties
- Major Roads
- Rivers
- Plover/Dog
  - Dog 1
  - Dog 2
  - Plover 1
  - Plover 2
  - Plover 1 Dog 1
  - Plover 2 Dog 2
  - Plover 1 Dog 2
  - Plover 2 Dog 1
  - No Data
- Prarie Dog
  - 1
  - 2
  - No Data
- Mountain Plover
  - 1
  - 2
  - No Data
- Piping Plover
  - 1
  - 2
  - No Data
- Snowy Plover
  - 1
  - 2
  - No Data
- Lakes
- Maj_own.shp
  - PRIVATE LANDS
  - WYOMING STAT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Cities
Reclass of Mountain Pl
Reclass of Prarie Dog
Streams
Counties
Major Roads
Rivers
Plover/Dog
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Dog 2
Plover 1
Plover 2
Plover 1 Dog 1
Plover 2 Dog 2
Plover 1 Dog 2
Plover 2 Dog 1
No Data
Prarie Dog
1
2
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Mountain Plover
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Piping Plover
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Snowy Plover
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Lakes
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PRIVATE LANDS
WYOMING STAT

Photos by

Peter LaTourrette

ArcView GIS 3.2a

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View1

- Cities
- Reclass of Mountain Pl
- Reclass of Prarie Dog
- Streams
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- Plover/Dog
  - Dog 1
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  - Plover 2
  - Plover 1 Dog 1
  - Plover 2 Dog 2
  - Plover 1 Dog 2
  - Plover 2 Dog 1
  - No Data
- Prarie Dog
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  - No Data
- Mountain Plover
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- Piping Plover
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- Snowy Plover
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- Maj_own.shp
  - PRIVATE LANDS
  - WYOMING STAT

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View1

- Cities
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- Reclass of Prarie Dog
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  - Plover 2 Dog 1
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- Prarie Dog
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- Mountain Plover
  - 1
  - 2
  - No Data
- Piping Plover
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- Snowy Plover
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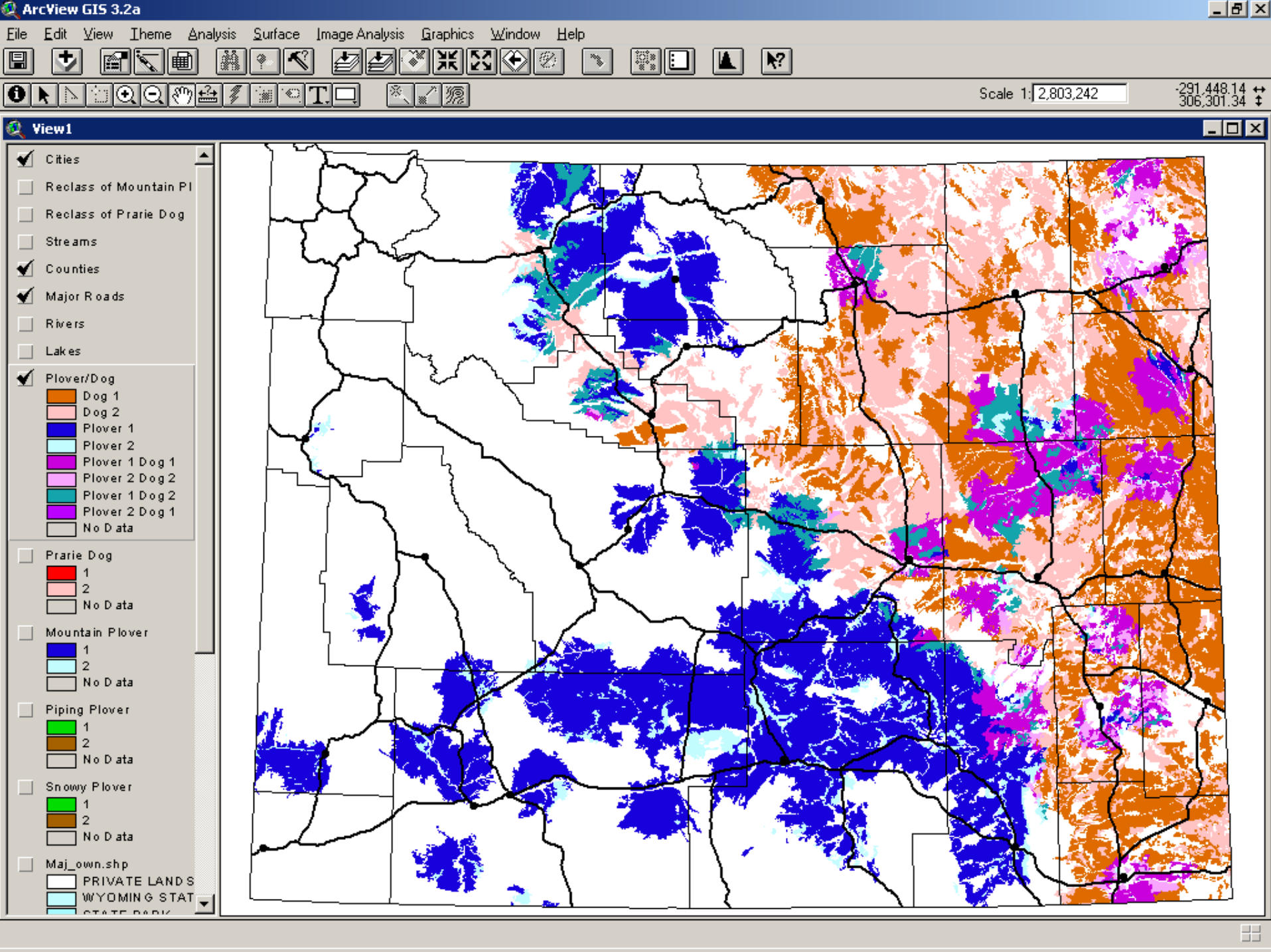
  - WYOMING STAT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Reclass of Prarie Dog
Streams
Counties
Major Roads
Rivers
Lakes
Plover/Dog
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Piping Plover
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PRIVATE LANDS
WYOMING STAT

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY (WDEQ)

LAND QUALITY DIVISION (LQD)

Bob Giurgevich
District III Office
Sheridan, Wyoming
(307) 672-6488

Presented at OSM Bond Release Forum
August 2001

WDEQ/LQD EVALUATION OF WILDLIFE HABITAT: PROTECTION AND RESTORATION

1. PERMIT AND ANNUAL REPORT

- **APPROVED PRACTICES DEMONSTRATE PROTECTION OF AND MINIMIZATION OF EFFECTS ON POPULATIONS AND HABITATS**
- **APPROVED ANNUAL MONITORING PROGRAM PROVIDES DATA VIA ANNUAL REPORT**
- **WYOMING GAME AND FISH DEPARTMENT PERIODICALLY REVIEWS ANNUAL REPORT DATA**
- **APPROVED RECLAMATION PLAN ADDRESSES RESTORATION OF WILDLIFE HABITAT CHARACTERISTICS AND STRUCTURES**

2. FIELD INSPECTIONS

- **NORMAL LQD INSPECTIONS MAY RECORD EXECUTION OF PERMIT COMMITMENTS**
- **LQD HAS NO DESIGNATED WILDLIFE BIOLOGIST POSITION ON STAFF**

3. BOND RELEASE TYPES AND EVALUATIONS

- **NO DIRECT EVALUATION WHEN GRANTING AREA BOND RELEASE**
- **NO DIRECT EVALUATION WHEN GRANTING PHASE 1 PARTIAL INCREMENTAL BOND RELEASE**
- **NO DIRECT EVALUATION WHEN GRANTING PHASE 2 PARTIALINCREMENTAL BOND RELEASE**

- **MOST DIRECT EVALUATION MADE WHEN GRANTING PHASE 3 FULL INCREMENTAL BOND RELEASE**

- **DIRECT ELEMENTS PRESENTED AND EVALUATED**

  - **PERMITTEE MAKES CASE THAT ALL PERMIT COMMITMENTS HAVE BEEN ACHIEVED**

  - **LQD SEEKS WYOMING GAME AND FISH OPINION THAT HABITAT HAS BEEN ADEQUATELY PROTECTED AND RESTORED**

  - **LQD NOTES HABITAT FEATURES AND STRUCTURES DURING BOND RELEASE INSPECTION**

- **INDIRECT ELEMENTS PRESENTED AND EVALUATED**
  - **LQD AGREES WITH PERMITTEE'S DEMONSTRATION OF ACHIEVEMENT OF POSTMINING SHRUB HABITAT RESTORATION PERFORMANCE STANDARDS**
  - **LQD AGREES WITH PERMITTEE'S DEMONSTRATION THAT POSTMINING WETLAND RESTORATION ACHIEVED ARMY CORPS OF ENGINEER'S PERFORMANCE STANDARDS**

SHARP-TAILED GROUSE RESPONSE TO THE DEVELOPMENT OF A LARGE SCALE SURFACE COAL MINE IN SOUTH-EASTERN MONTANA

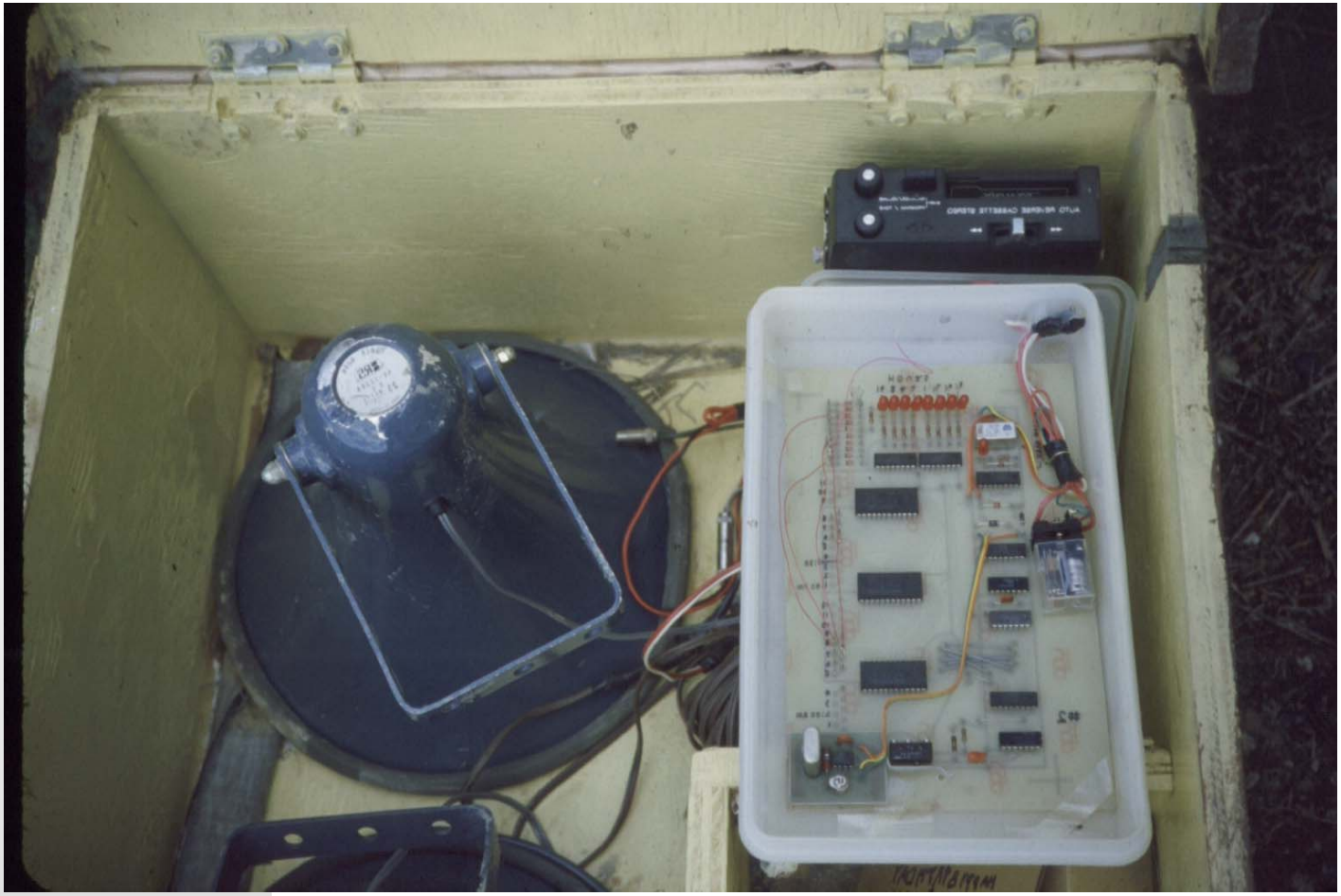
Bruce Waage
Scientific Specialist
Western Energy Company

presented at
OSM Bond Release Forum
August 2001

- I will discuss the life history of a unique grouse species Tympanuchus phasianellus, known as a Sharp-tailed grouse.
- Review with you the issues our mine has dealt with in regard to this species.
- Finally, I will report responses of grouse to large scale mining activities and shed light on how we are measuring up – premine to postmine.

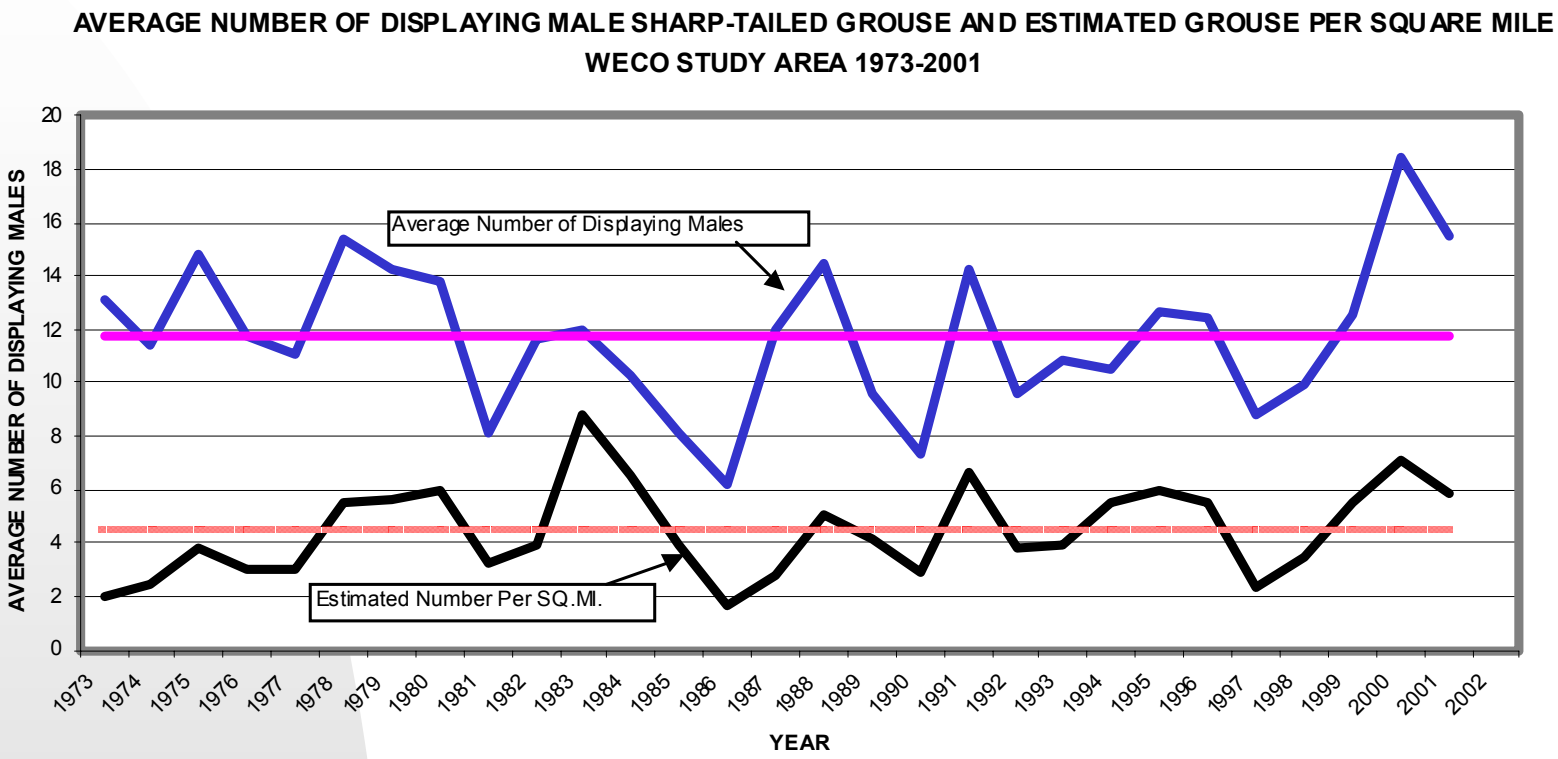
- I will review data collected through long-term monitoring of sharp-tailed grouse;
- Explore a progression of mitigations efforts; and
- Briefly, review our reclamation of grouse habitat

Luring



Habitat Re-establishment

Management


AVERAGE NUMBER OF DISPLAYING MALE SHARP-TAILED GROUSE AND ESTIMATED GROUSE PER SQUARE MILE
WECO STUDY AREA 1973-2001
AVERAGE NUMBER OF DISPLAYING MALES
20
18
16
14
12
10
8
6
4
2
0
Average Number of Displaying Males
Estimated Number Per SQ.MI.
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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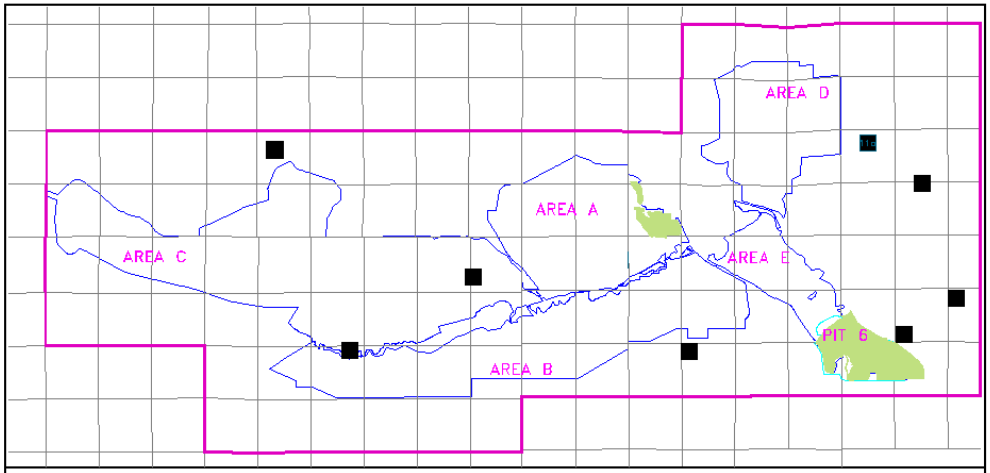
2001
2002
YEAR



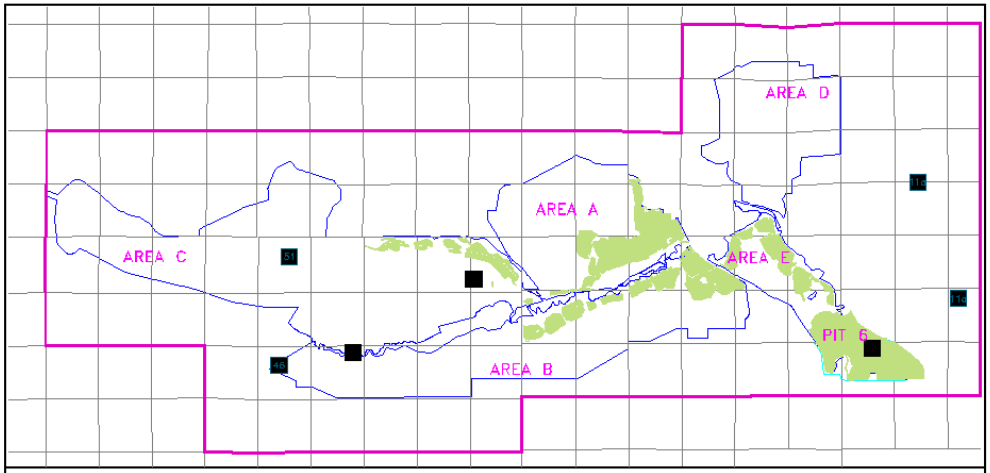
1977 Sharp-tailed Grouse Dancing Grounds

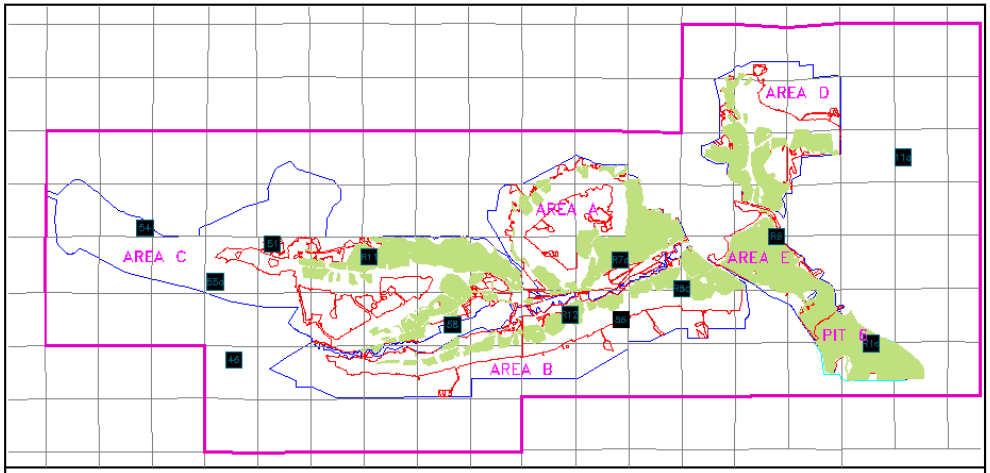
LEGEND

RECLAMATION AREAS

...PERMIT BOUNDARY

...WILDLIFE STUDY AREA BOUNDARY


AREA D
AREA A
AREA C
AREA E
AREA B
PIT 6
1987 Sharp-tailed Grouse Dancing Grounds
LEGEND
RECLAMATION AREAS
...PERMIT BOUNDARY
...WILDLIFE STUDY AREA BOUNDARY

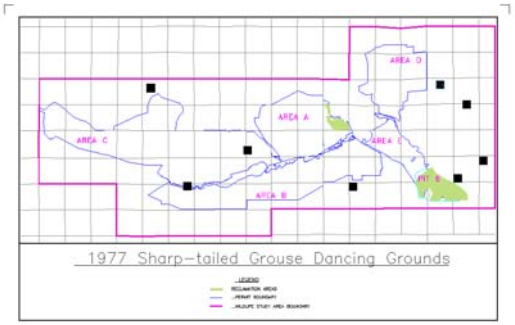


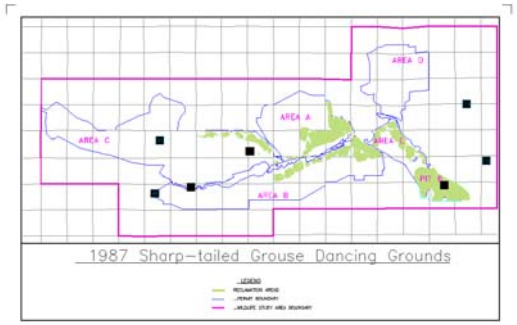
2001 Sharp–tailed Grouse Dancing Grounds

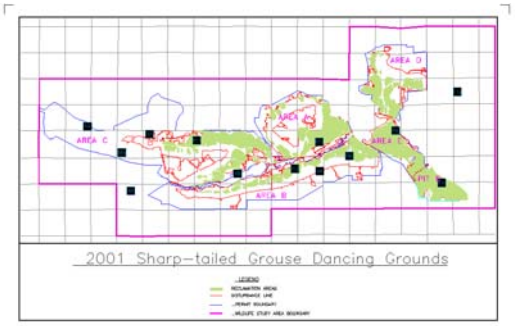
LEGEND

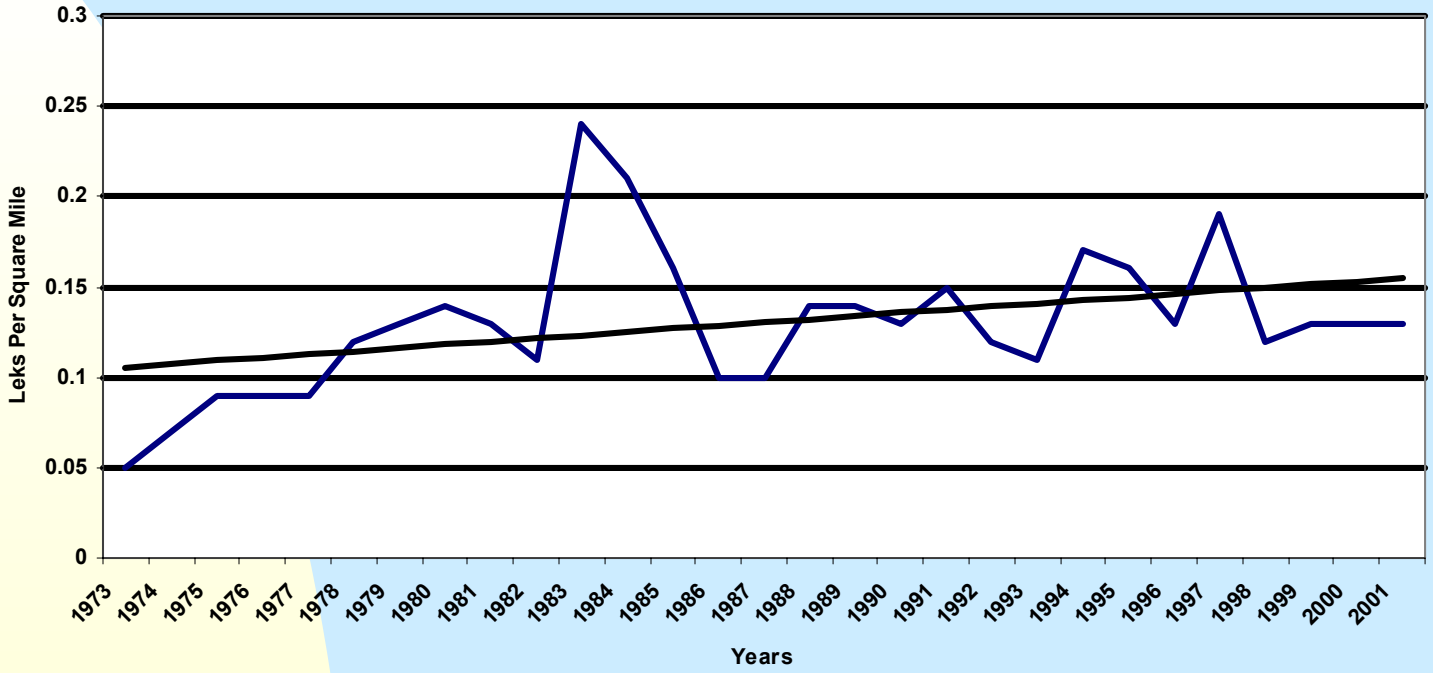
- RECLAMATION AREAS
- DISTURBANCE LINE
- ...PERMIT BOUNDARY
- ...WILDLIFE STUDY AREA BOUNDARY

Dancing Ground Locations 1977, 1987 & 2001








0.3
0.25
0.2
0.15
0.1
0.05
0
Leks Per Square Mile
1973
1974
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1976
1977
1978
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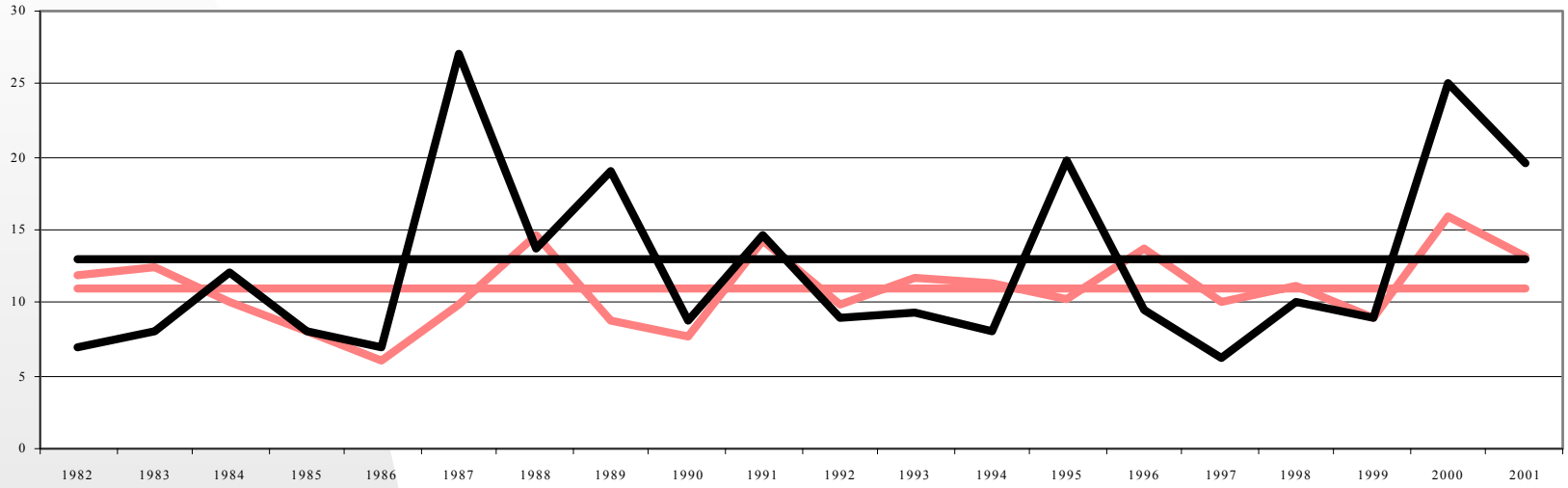
1996
1997
1998
1999
2000
2001
Years

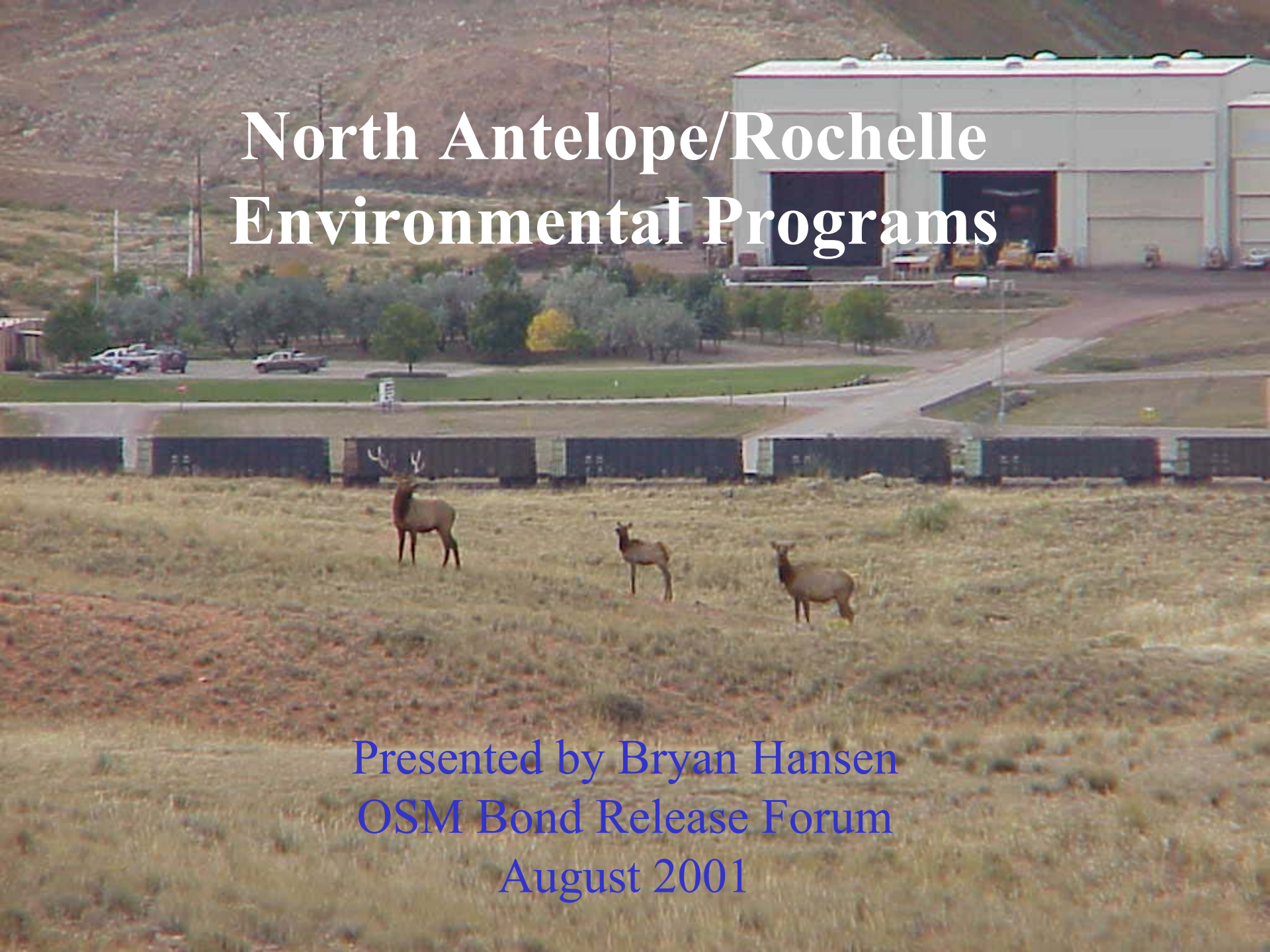
AVERAGE NUMBER OF DISPLAYING MALE SHARP-TAILED GROUSE NATIVE VS RECLAMATION 1982-2001



What have we learned

- We confirmed what we already knew; that habitat is what is important, not the physical dancing ground
- After 33 years of mining, grouse appear to be doing well
- Sharp-tailed grouse readily use reclamation for dancing grounds
- When compared to native grounds, reclamation grounds had the same attendance levels or better

North Antelope/Rochelle Environmental Programs



Presented by Bryan Hansen
OSM Bond Release Forum
August 2001

PROJECT FORKHORN

FORKHORN GOALS

- Increase available browse and cover utilizing Wyoming Big Sagebrush and other important browse species.
- Increase structural diversity.
- Achieve shrub density standards.

SHRUB UTILIZATION STUDY

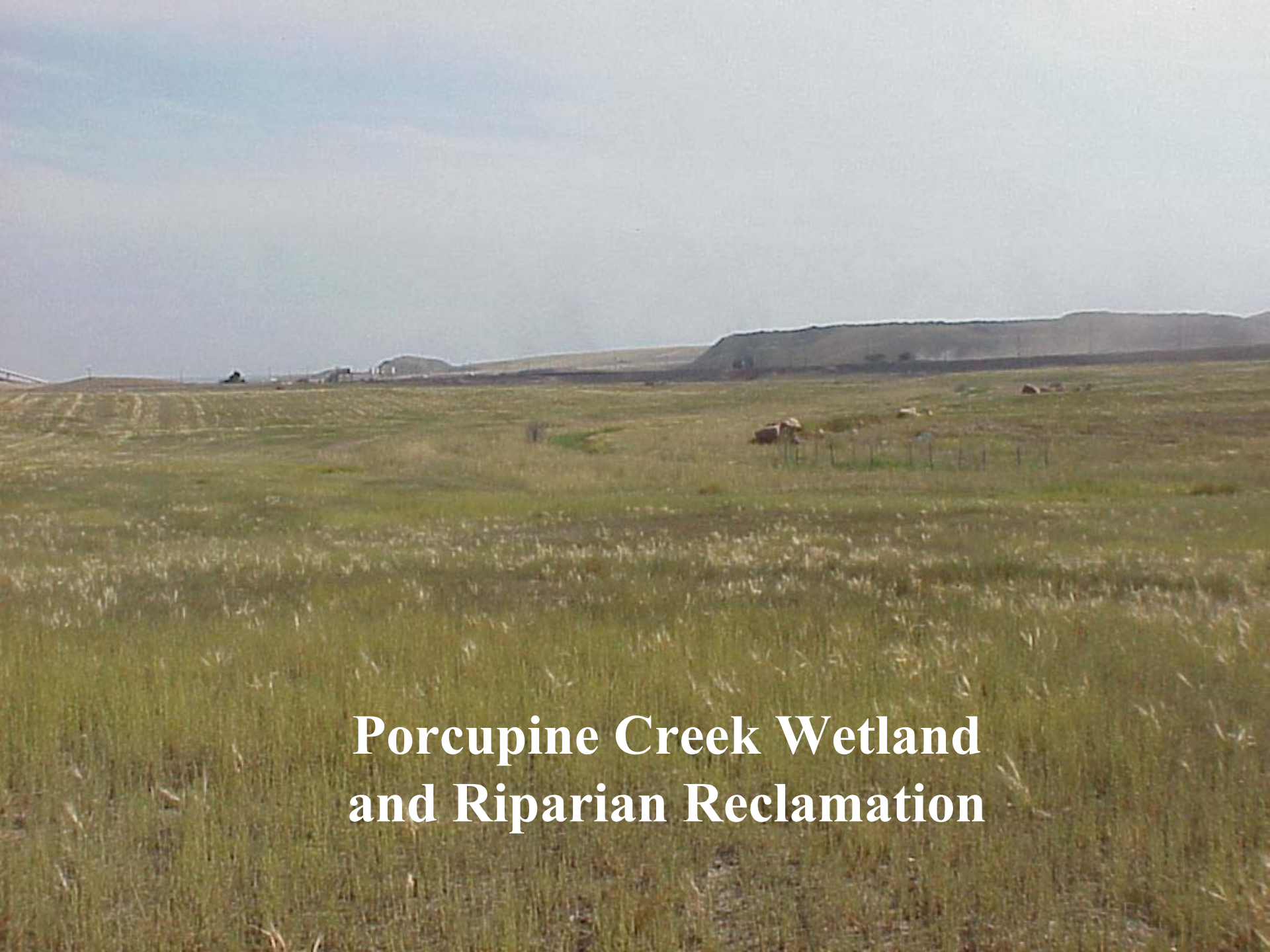
NATIVE UNGULATE MANAGEMENT

- **2000 Big Game Monitoring Data: 367 Pronghorn, 75 Mule Deer *(44%), 20 Elk: Total = 499,082 lbs of forage per year.**
- **Reduce damage to shrubs.**
- **Combination of fencing, lure crops and tightly controlled employee hunts. Hell'uva Hunt.**
- **Herbivory reduces survival of young plants and the amount of seed**

Just as deer live in mortal fear of wolves, so do mountains live in fear of deer

SAGE GROUSE HABITAT UTILIZATION AND RESTORATION

RADIO TELEMETRY


Porcupine Creek Wetland
and Riparian Reclamation

Reference Reach

The Use of Closed Basin Habitats as Wildlife Refugia on Reclaimed Mine Lands

Bryce L. Marshall
SWCA, Inc., Environmental Consultants
Vernon R. Pfannenstiel and Gary W. Wendt
Peabody Energy

Presented at OSM Bond Release Forum
August 2001

The Office of Surface Mining and Reclamation Act requires surface coal mine operators to reclaim mined lands to conditions comparable to or surpassing those prior to disturbance.

Although these mine reclaimed lands unavoidably experience changes in the biotic community, community diversity can be maintained by providing microhabitats within newly formed reclaim lands. Today, I am going to discuss one such habitat enhancement measure that provides habitat for various forms of wildlife within the grassland habitats of reclaimed mine.

Reclaiming Mine Lands

- **Must maintain the biodiversity of the system.**
  - **Floral diversity**
  - **Faunal diversity**
  - **Community diversity**

As I said before, reclaiming surface mined lands requires that land managers maintain the biological diversity of the system. Since lands are unavoidably changed through surface mining activities, community structure will also change correspondingly. Maintaining the diversity of such lands includes maintaining the floral, faunal, and community diversity.

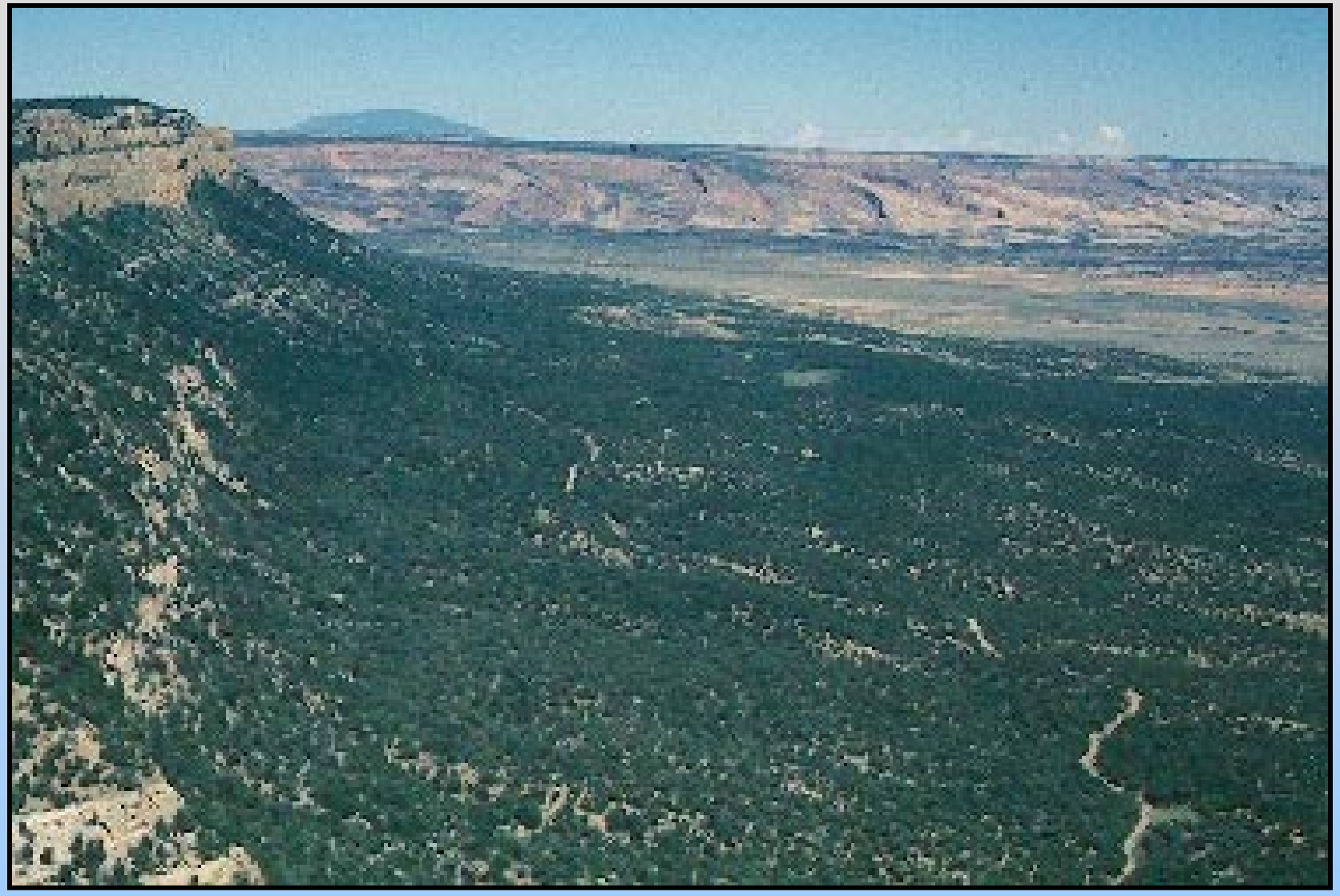
Biological Inventory and Monitoring

- Baseline Biological Inventory
  - As necessary under the ESA
  - As required by local and state agencies
- Annual Monitoring Activities
  - TES Species
  - Wildlife
  - Plant community

To determine the efficacy of reclaim habitats for providing equivalent community diversity, baseline biological inventories and continued biological monitoring are required to determine the similarities and differences of reclaimed lands from previous conditions. Baseline biological inventories and monitoring are also required by the ESA of 1973, to determine if impacts will occur to TES species. Other state and local agencies may require similar documentation. During and after mining activities, annual monitoring is needed to determine if mining is impacting species found within the leasehold and what species are utilizing mine reclamation.

Peabody's Black Mesa and Kayenta Mine leaseholds are located in northeastern Arizona, approximately 2 hours northeast of Flagstaff and immediately south of Kayenta. Note its proximity to Lake Powell, four corners, and the Hopi and Navajo Indian Reservations.

Unlike some other surface mines where the habitat surrounding the mine is contiguous with other adjacent features, Black Mesa is a geological feature that is distinct from the surrounding area. The Mesa is a monocline that rises to an elevation of over 8,000 feet.



At the northern edge of Black Mesa, the habitat is dominated by ponderosa pine/Gamble oak woodland. The deep narrow canyons support mixed-coniferous habitat consisting of Douglas fir, aspen, ponderosa pine, and Gamble oak. This habitat support species such as Clark's nutcracker and Mexican spotted owl. The cliff faces that are produced by the northern escarpment and that are found along the numerous canyons are frequently used by nesting raptors including red-tailed hawks and peregrine falcons.

Peabody’s leasehold is found within the pinyon-juniper woodland and sagebrush shrubland habitats of the central portion of Black Mesa. This pinyon-juniper woodland supports a moderate-to-low diversity community and has been greatly impacted by previous land management activities including intense livestock grazing. Note in this photo the lack of ground-level grasses and forbes, a situation that is not unusual in a well-developed P-J woodland, but understory vegetation is unusual sparse on most of Black Mesa.

Reclamation Characteristics

- **Rolling hills dominated by grasses and shrubs**
  - **Western wheatgrass (*Agropyron smithii*)**
  - **Indian rice grass (*Oryzopsis hymenoides*)**
  - **Squirreltail (*Sitanion longifolia*)**
  - **Russian wildrye (*Elymus junceus*)**
  - **Desert wheatgrass (*Agropyron desertorum*)**
  - **Alkali sacaton (*Sporobolus airoides*)**
  - **Salt bush (*Atriplex canescens*)**

The reclamation on the Black Mesa and Kayenta Mines is characterized by low, rolling grassland habitats. Saltbush is the dominant shrub species and the grass community is made up of Western wheatgrass, Indian rice grass, and squirrel tail. Three species are predominantly warm or cold weather grasses. These include Russian wildrye and desert wheatgrass (warm-weather species) and alklai sacaton (a cold weather species).

Numerous flowering, disturbance adapted species can be found on the reclamation. Some species shown in this photograph include sunflower (*Helianthus annuus*), purple aster (*Macaranthera canescens*), and Rocky Mountain beeflower (*Cleome serrulata*). Note the amount of open ground showing in this photo. This is a newly reclaimed portion of the mine.

Here is another photo of reclamation with a flowering Penstemon in the foreground. Again, note the amount of vegetation cover in this photograph.

This is an older, more developed area of reclaim. This stand is predominantly saltbush. Note the pinyon-juniper habitat in the upper right portion of the photo.

This photo shows a drainage structure on some newly formed reclaim of the N14 pit.

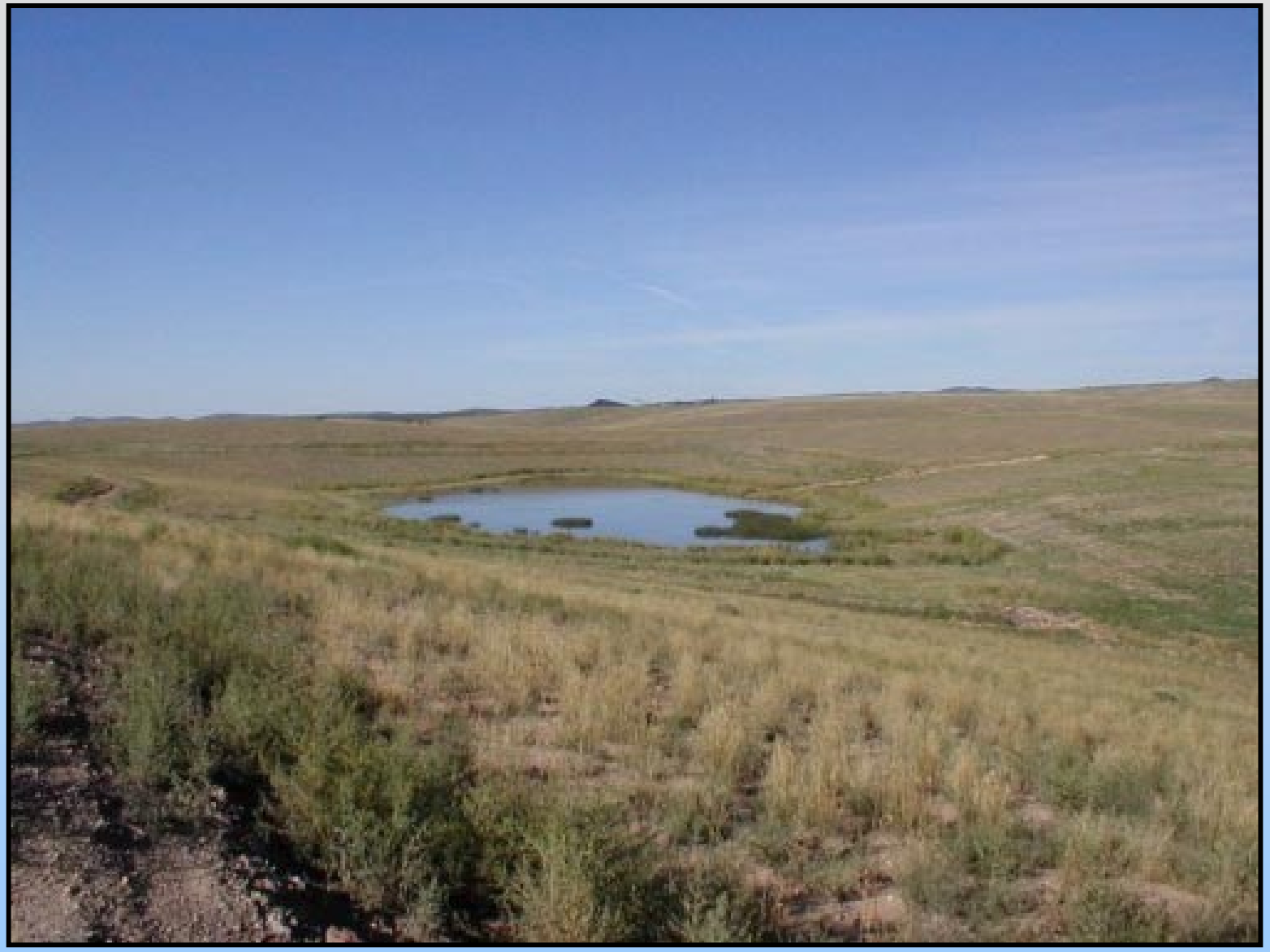
More reclamation….note the amount of ground showing and the area between grass bunches. Also note the abrupt pinyon-juniper edge in the background.

Closed Basins on Mine Reclaim

- Topographically Distinct Features
  - Provides basin for water to pool
  - Increases water availability
    - Salt cedar (*Tamarix* sp.)
    - Spikerush (*Eloecharis* sp.)
    - Bulrush (*Scirpus* sp.)
    - Coyote willow (*Salix exigua*)
    - Saltbush (*Atriplex canescens*)

During the formation of the reclamation on the Black Mesa and Kayenta mines, some closed basins were formed. These closed basins are topographically distinct features in which water flows from the surrounding reclaim. There is no exit for water to flow, so the water collects in the bottom of the basins and forms ephemeral, transient, or perennial ponds. Water enters these basins in the form of spring flow and rainfall runoff.

Closed basins vary in size and development. This is the N1-RA basin. This is a rather large basin that has perennial water. As you can see, the increased water availability provides conditions for wetland species to occur. The vegetation surrounding this pond is very different from the surrounding reclamation and consequently, this area supports a more diverse faunal assemblage.



This is another look at the N1-RA pond. Note the large green areas in the pond. These are bulrushes which grow to around five feet in height. The second ring of green vegetation is predominantly salt cedar and spikerushes.

Here is another fairly large closed basin…the N2-RA basin. During some portions of the year, this basin will go completely dry. The green ring of vegetation is salt cedar and when this is dry, the middle area of the basin is dominated by foxtail barley (*Horeum mutica*). It is in this basin that we captured the highest numbers of Mexican voles also. I would like to point out the proximity of the rip-rap structure to this basin. Although this is necessary from an engineering and erosion standpoint, I think this type of habitat provides corridors for species such as the Mexican vole to colonize.

This is one of the smaller basins. Although we tried trapping here, livestock were present on this portion of the reclaim and made trapping a difficult chore. Note the height of the salt cedar in this basin. Also note the presence of other hydrophytic plant species including curly dock (*Rumex crispus*).

Wildlife Use of Closed Basins

- Threatened, Endangered, and Sensitive Species
- Migratory Waterfowl
- Raptors
- Bats
- Small Mammals
- Migratory Birds

Numerous species of wildlife have been documented using these closed basins. Such wildlife commonly seen around closed basins include coyote, deer, elk, lagomorphs, raptors, and herpetofauna. Two species of herpetofauna that have been observed breeding or foraging in closed basins are spadefoot toads and gopher snakes.

Closed Basin Study

- **Objective: To determine if several special status species utilized closed basins for foraging or breeding.**

Euderma maculatum

Plecotus townsendii

Microtus mexicanus

So, to determine the extent of special-status wildlife use of closed basins, we proceeded to conduct a study, using one rodent and two bats as target species. These species were chosen because all of them are listed as Group 4 species on the NESL due to incomplete information on distribution and current status on the Navajo Nation. Although previous rodent work has been conducted on Black Mesa, little, if any data has been collected on the bat community.

Small Mammals

- **Target Species: Navajo Mountain Mexican Vole**
  - **Group 4 species on NESL**
- **Other Species: Record data on other rodent species to determine trends.**
  - **Determine if vegetation height determines species composition**

For the small mammal portion of this project, we were targeting the Navajo Mountain Mexican vole. As I previously said, this species is listed by the NNHP as a Group 4 species. Voles have been captured along the edges of the larger permanent ponds found on the leasehold, and their presence within these basins were suspected due to the increased vegetation height and diversity these basins have. We also wanted to determine what other species of rodents might be utilizing closed basins and determine if any trends were occurring.

Methods

- Sherman live-traps placed in 7x7 grids in closed basins and reclaim control plots
- 3 closed basin and 1 control plot sampled for three consecutive nights
- Mark recapture used

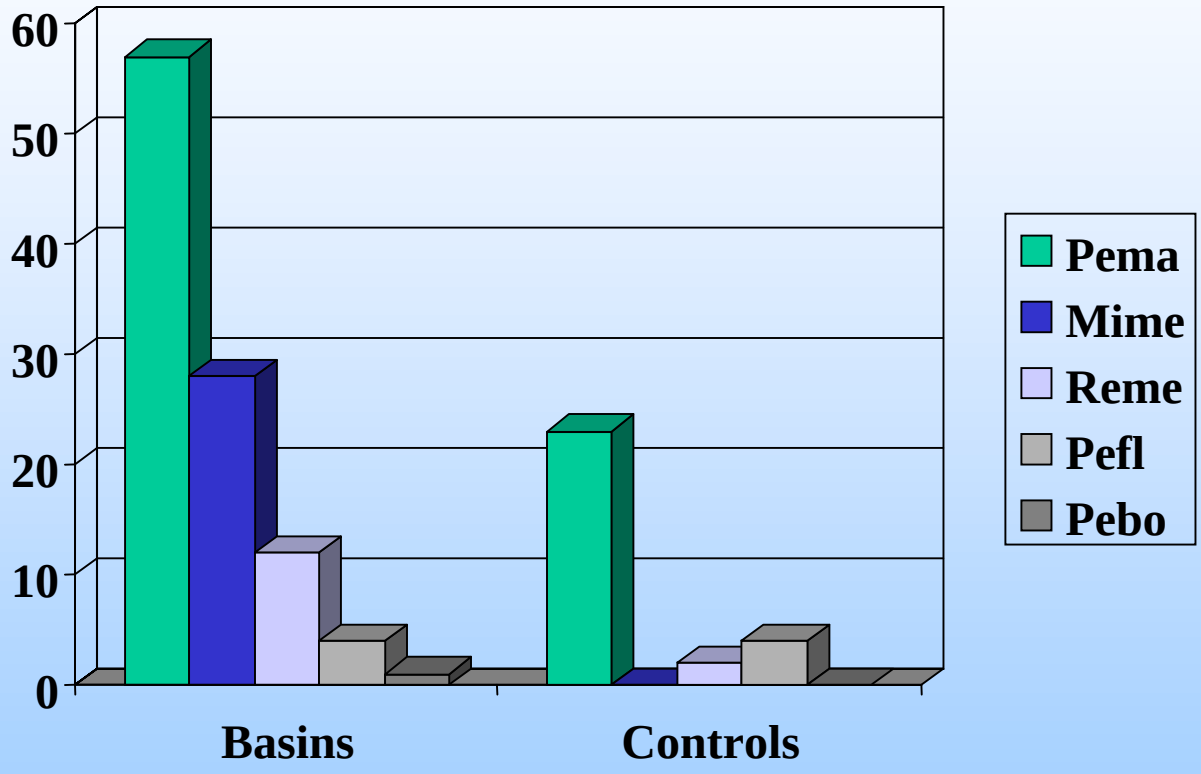
  semi-permanent ink marking

Sherman live-traps were placed in 7X7 grids within three closed basins each week of survey. A single reclaim control plot was set in the adjacent reclaim. These control plots were typically less than 250 m from the closed basins being surveyed. All of the traps were monitored for three consecutive nights and animals captured were marked with semi-permanent ink tags on the belly, feet and ears of each animal.

Results

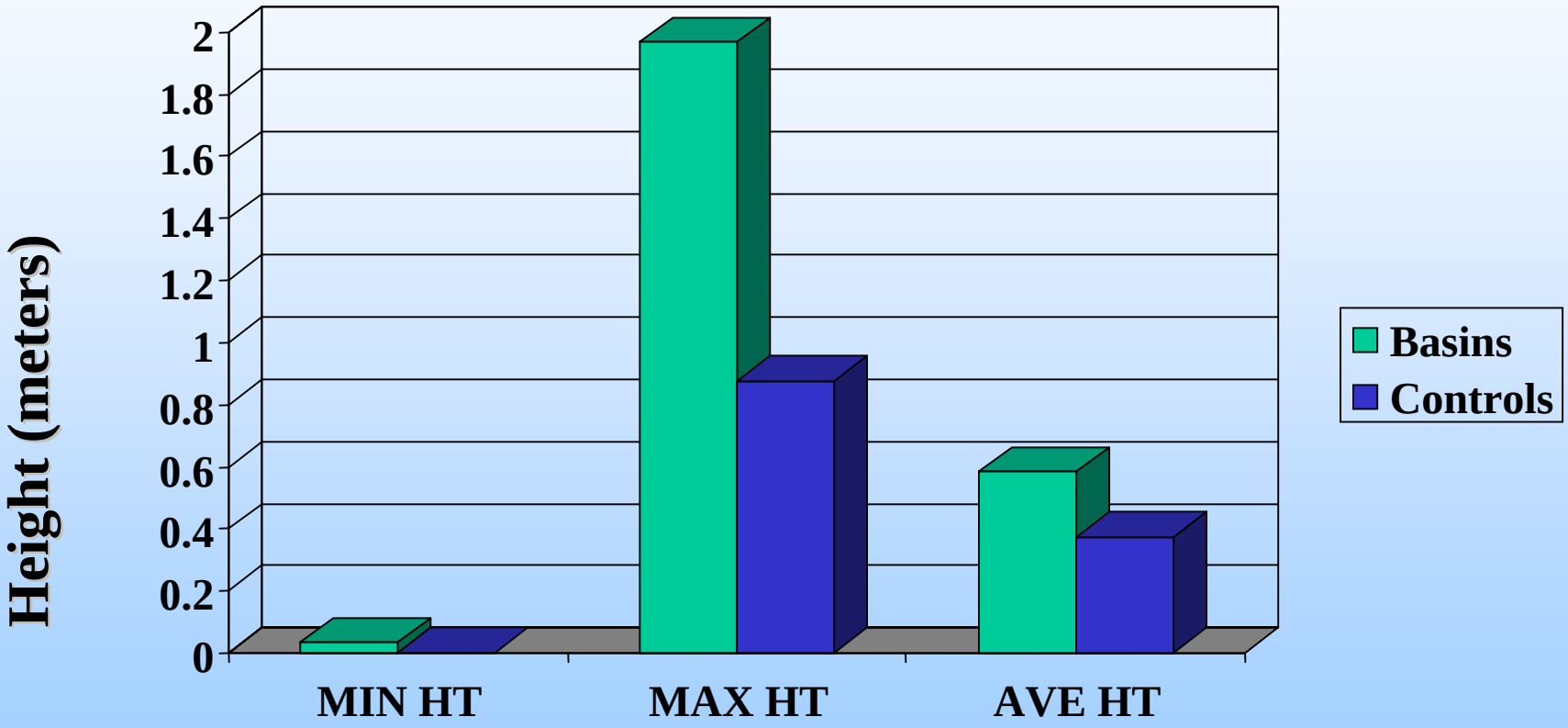
- **2,940 trap nights**
- **Six species of small mammals**
  - ***Peromyscus maniculatus***
  - ***Microtus mexicanus***
  - ***Reithrodontomys megalotis***
  - ***Perognathus flavus***
  - ***Peromyscus boylii***

Total numbers by species



Note: *Increased numbers of small mammals in closed basins (possibly a function of unequal sample sizes between basins and controls).*

Vegetation Analysis



On this slide I have vegetation results.

Note: *Difference in maximum heights and that it was significant. Also note that the differences in mean height and minimum height although possibly biologically significant, was not statistically significant.*

Summary

- There were significantly more rodents captured within closed basins
- Deer mice were the most abundant species trapped
- Mexican voles (N=28) and brush mice (N=1) were only trapped within closed basins

To summarize these data, there were more small mammals captured within closed basins than in adjacent control plots. Deer mice were the most abundant species captured, and Mexican voles and brush mice were only captured in closed basin habitats.

Bats Surveys

- Target Species:
  - **Townsend's big-eared bat**
  - **Spotted bat**
- Other Species:
  - **Record data on the bat community on Black Mesa**
  - **Determine if there were any differences in the bat community between closed basins and adjacent pinyon-juniper woodland**

The second part of the study was aimed at determining the status of two special status bat species, the Townsend's big-eared bat and the spotted bat, and to determine if the species assemblage was different from the adjacent pinyon-juniper woodland. Both special-status species are listed as Group 4 species on the NESL due mainly to lack of information on the Navajo Nation. We also wanted to collect general information on the bat assemblage of Black Mesa. As previous said, the bat fauna is poorly known in this region of the Navajo Nation and we wanted to add to that body of knowledge.

Methods

- Set mist nets over closed basin study sites and adjacent pinyon-juniper control areas
- Netted and conducted acoustic monitoring activities from sunset to 12 AM
- Compared closed basins to pinyon-juniper sites

To determine what bat species were using closed basins, we conducted mist-netting and acoustic sampling for bats at four closed basin and four pinyon-juniper sites. Nets were set prior to dusk and tended until 1200 AM. Active acoustic monitoring was conducted during this time as well. Due to the size of some of these closed basins, nets were set along edges, across ends, and across vegetation openings at the edge of the basin ponds.

Results

- **18 bats from six species were captured using netting techniques**
  - **Big-brown bat (*Eptesicus fuscus*)**
  - **Long-legged myotis (*Myotis volans*)**
  - **Pallid bat (*Antrozous pallidus*)**
  - **Silver-haired bat (*Lasionycteris noctivagans*)**
  - **Finged myotis (*Myotis thysanodes*)**
  - **unknown *Myotis***

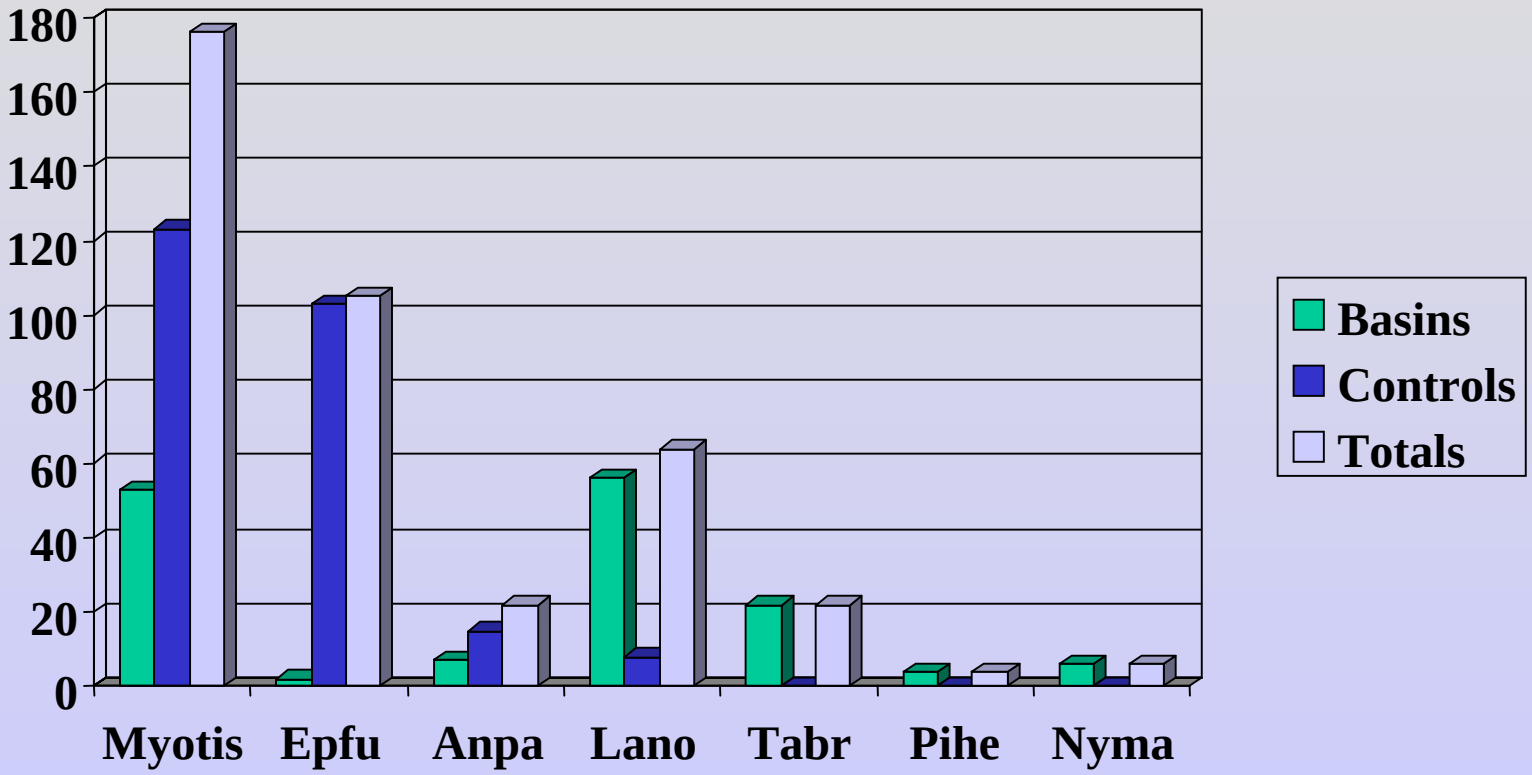
Netting efforts were concentrated on closed basins and that only one-third of our time was spent sampling adjacent pinyon-juniper areas.

Results (cont.)

- **A total of 439 call sequences recorded during acoustic monitoring identifying 9 bat species**
  - **Western small-footed Myotis (*Myotis ciliolabrum*)**
  - **Western pipistrelle (*Pipistrellus hesperus*)**
  - **Mexican free_tailed bat (*Tadarida brasiliensis*)**
  - **Big free-tailed bat (*Nyctinomops macrotis*)**

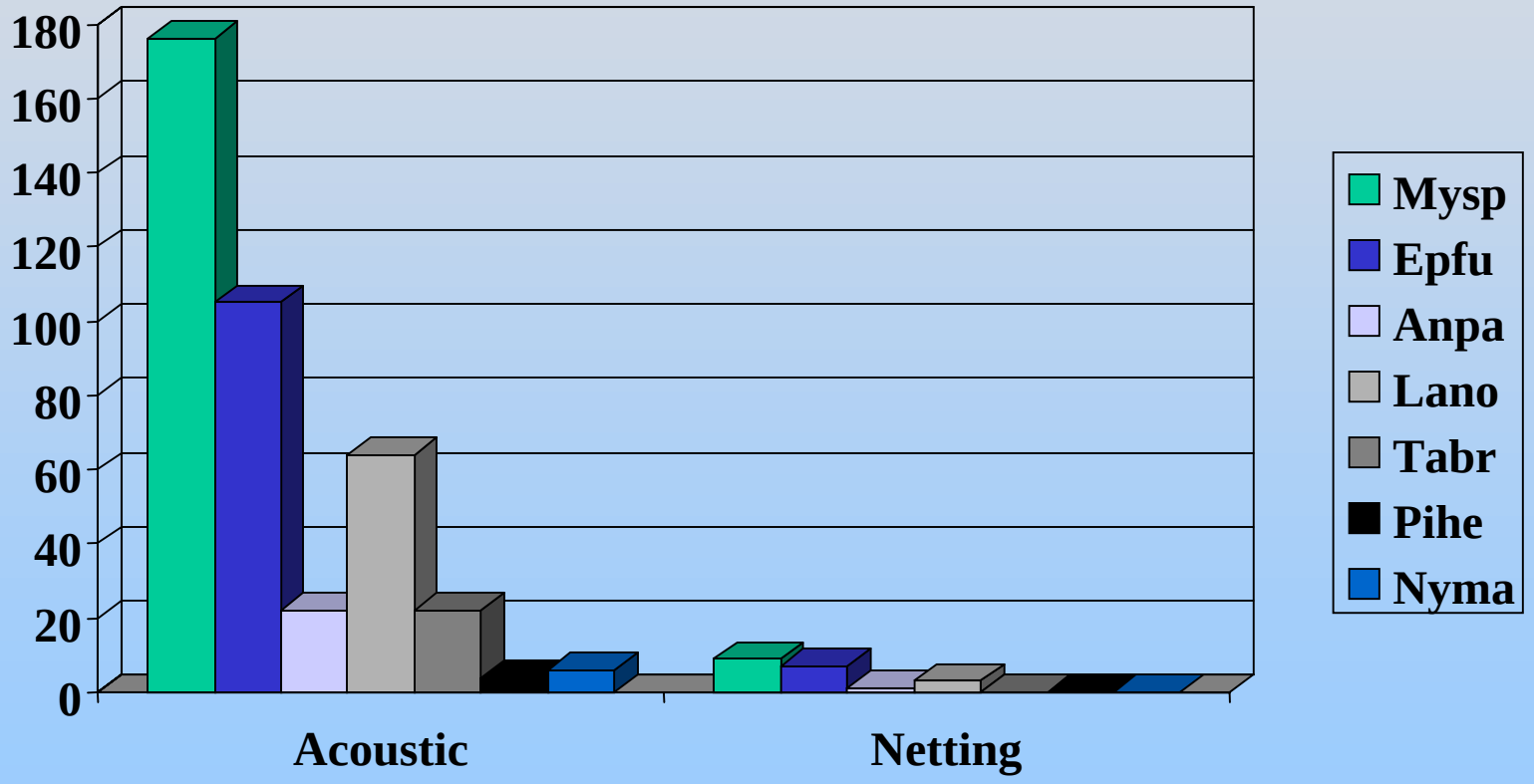
In addition to the previously-mentioned species, acoustic sampling was able to identify four additional species…these were…

Total Records by Species

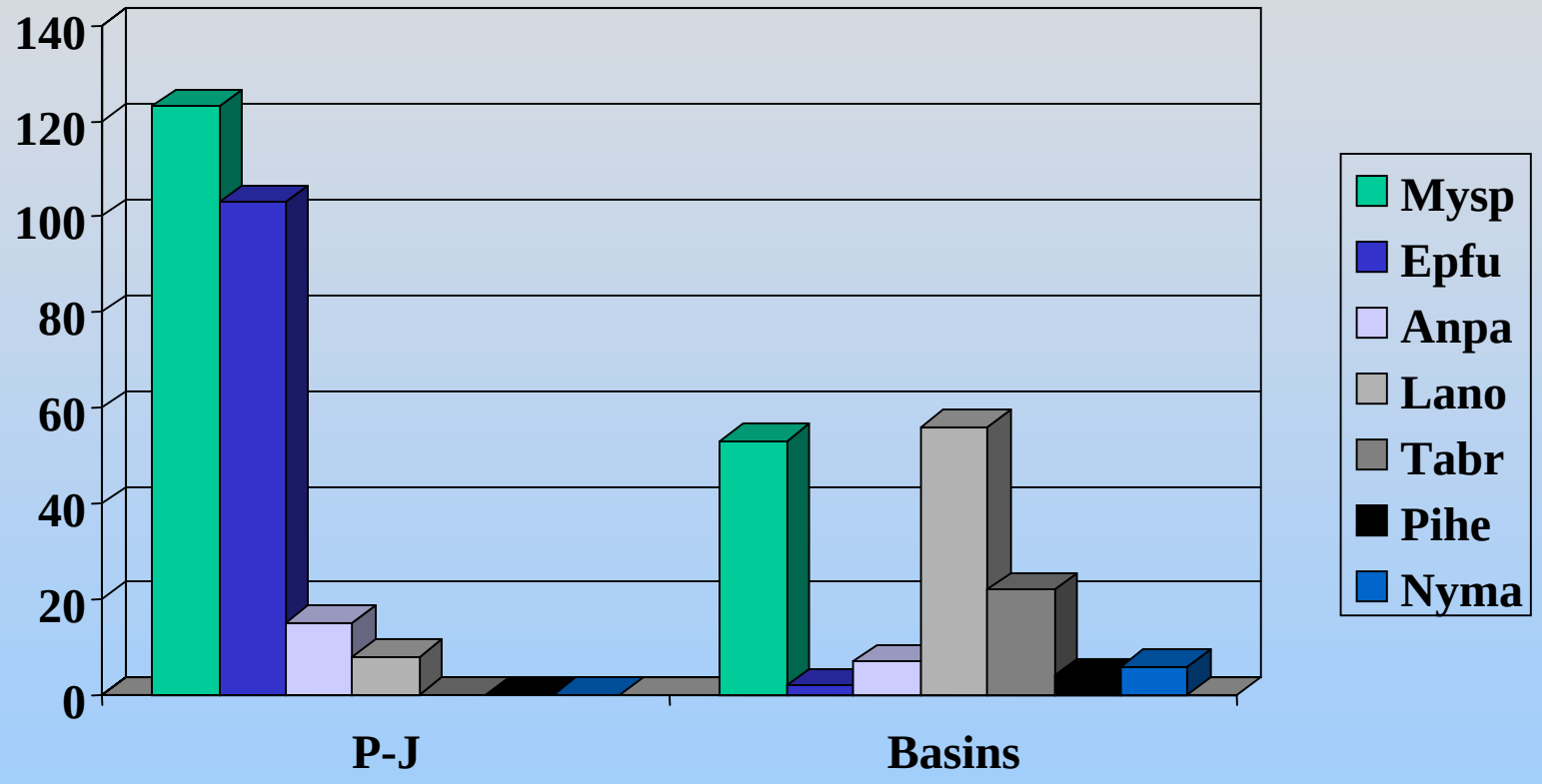


This slide shows total number of call records by Species. Total numbers of calls is shown on the Y axis and the Species is shown on the X axis. Note that all Myotis species have been lumped together to avoid misrepresentation of other Myotis species by acoustic records. Note that species are shown by site (closed basin or control and total.) Myotis species makes up the bulk of the records documented. Epfu is much more common at control sites and represents the second most frequent bat recorded.

Total Acoustic and Netting Results

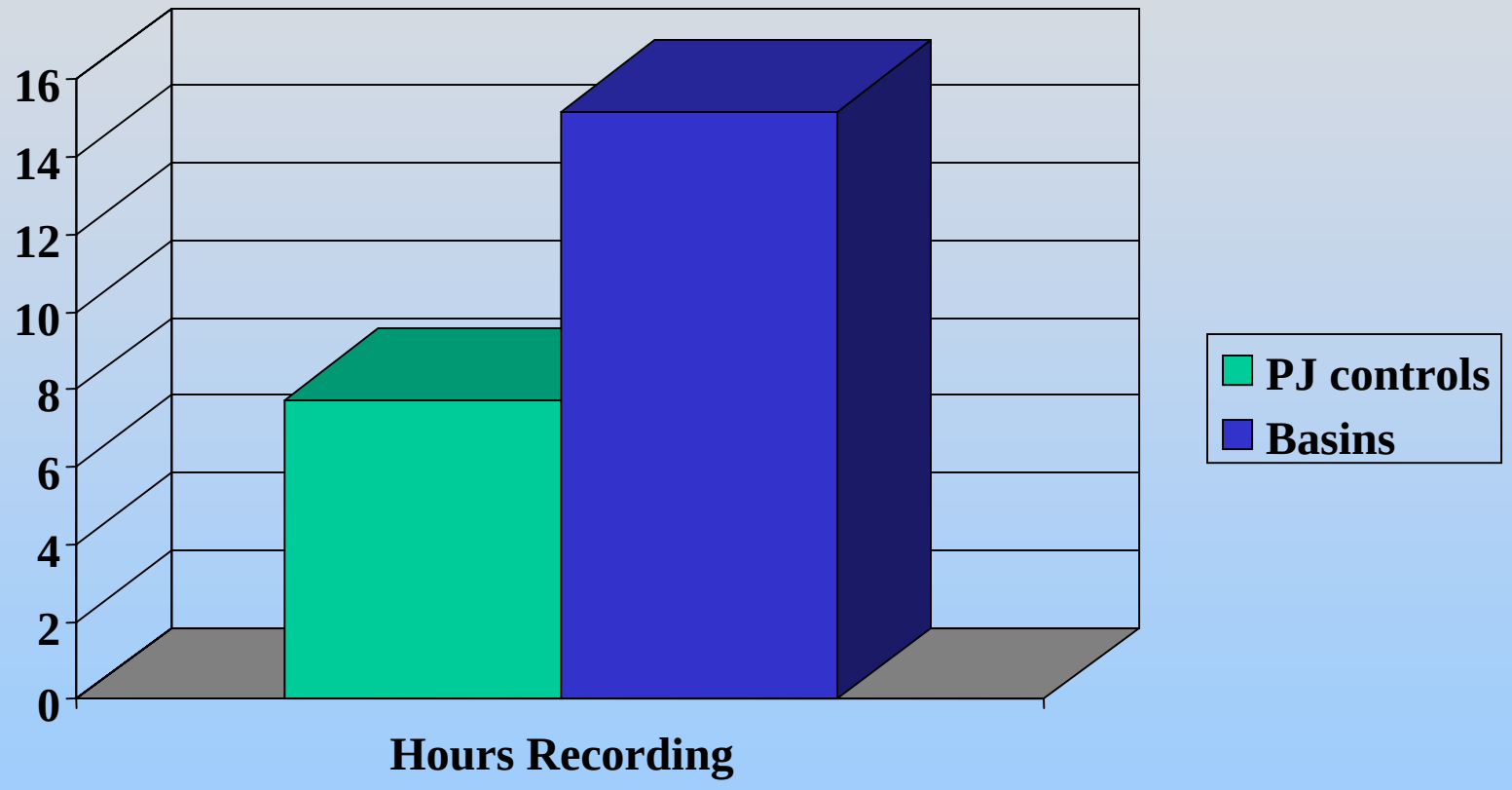


Acoustic Results by Site



This slide shows the differences in acoustic records only between PJ habitats and closed basins. Note the overwhelming majority of calls within PJ habitats were from Myotis and big-brown bats. However, several species that were identified in closed basins were not present at PJ control sites. Identify these from the slide.

Recording Effort



Last, I would like to reiterate the amount of recording effort at both study site types. This was done to maximize survey efforts at closed basins and that PJ areas were only to be used to distinguish potential differences between these two habitats; these data cannot be soundly analyzed statistically.

Summary

- There were significantly more bats captured and recorded within the pinyon-juniper habitat
- Although more bats were recorded in pinyon-juniper habitat, species assemblages differed
- Acoustic recording methods were only methods able to detect some species

Conclusions

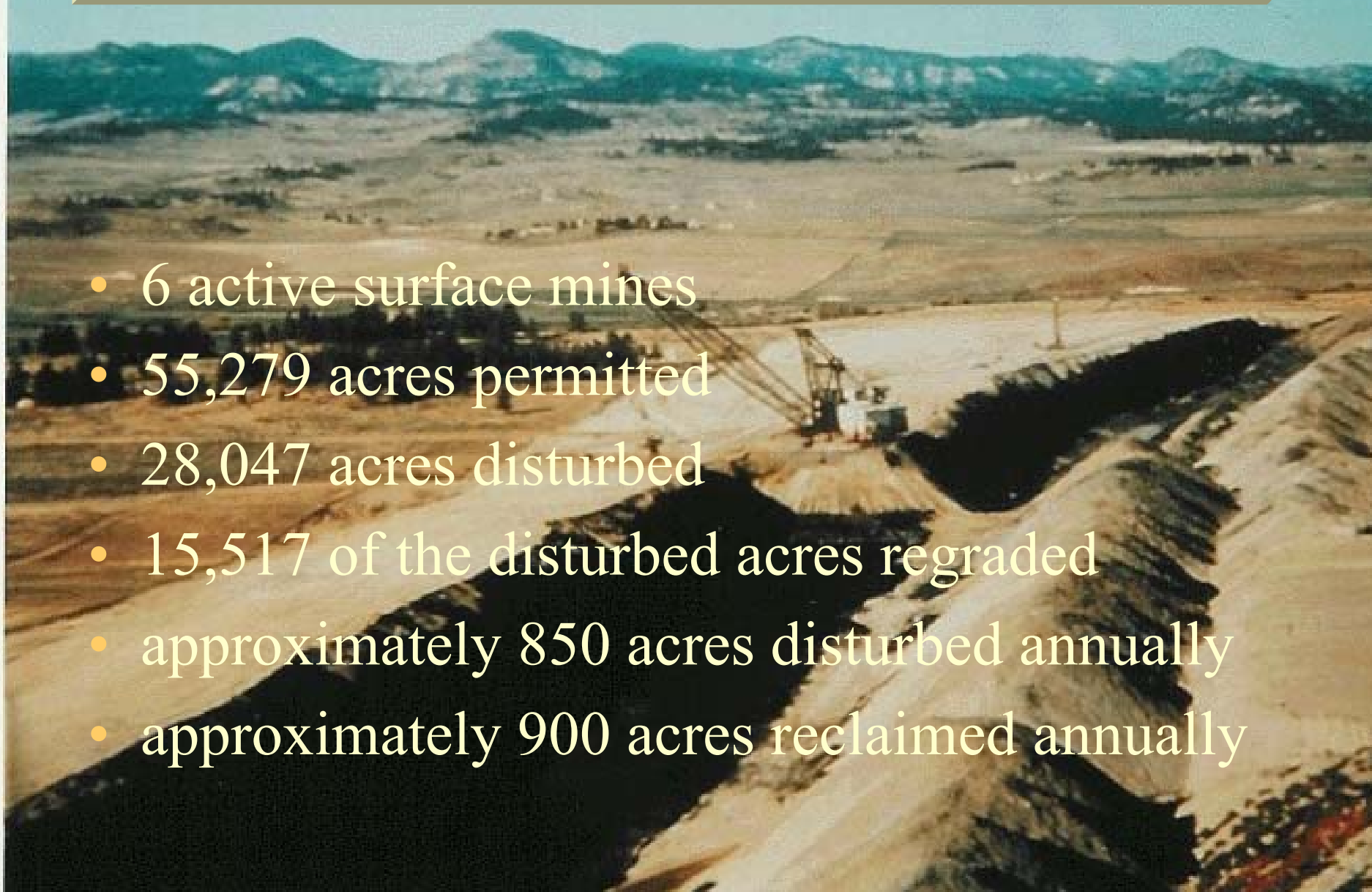
- Although these data are preliminary, closed basins appear to be important habitats on reclaimed lands.
- Future studies of closed basins will need to use equal sample sizes to determine differences
- Abiotic analysis recommended for future studies

Surface Habitat Disturbance, Protection and Enhancement Associated with Active Surface Mining and Reclamation

Chris Yde

Montana Department of Environmental Quality

Surface Mining in Montana



- 6 active surface mines
- 55,279 acres permitted
- 28,047 acres disturbed
- 15,517 of the disturbed acres regraded
- approximately 850 acres disturbed annually
- approximately 900 acres reclaimed annually

Bats in Montana

- Fifteen species are known to occur in the state
  - Five are listed as Species of Special Concern
- Ten species have been found on active coal mines
  - Three are listed as Species of Special Concern

Habitats found within coal mines in Montana

Examples of Reclamation

Mitigation Measures

Additional Mitigation Measures

- Bat houses
- Continuing education about bats
  - life history
  - habitats
  - potential health hazards
  - living in sympatry

Bat use of mine facilities

CHEVROLET

Closure and Reclamation of the Bull Mountains Mine #1

Montana's last active underground mine

Reclamation in Progress

- Topsoil redistribution - wildlife habitat - suitable preparation

Channel Construction

Geomorphic Design

- Meander - Armoring - Flow event design

Micro-site Construction

- Half grass-half forb plant community
- Shrub transplants

Pine/Juniper transplants - 1999

- Micro-site establishment
- Lower quality soils
- Wildlife habitat

Juniper Transplants

- PAR1 - Three years old - Scoria landform

PAR1

- Planted in 1989/90 - Diverse vegetation - Shrub mosaic

Mother Nature at work

- All vegetation is volunteer - suitable unclassified stockpile - 20 yrs old

Micro-Site Rock Outcrop with Transplants

Habitat Enhancements

on New Mexico Coal Mine Reclamation

Presented at
OSM Bond Release Forum

by
Dave Clark
NM Mining and Minerals Division

August 2001

19.8.20.2055.A NMAC General Grading Requirements

(2) backfill and grade to the most moderate slope possible, to eliminate the highwall which does not exceed either the angle of repose or such lesser slope as is necessary to achieve a minimum static safety factor of 1.3. In all cases the highwall shall be eliminated unless retention of portions of the highwall is approved by the Director, if the operator demonstrates that:

(i) it will have a static safety factor of 1.3;

(ii) it will not pose a hazard to persons or wildlife in the area;

(iii) it will be backfilled to cover the uppermost minable coal seam to a minimum depth of 4 feet;

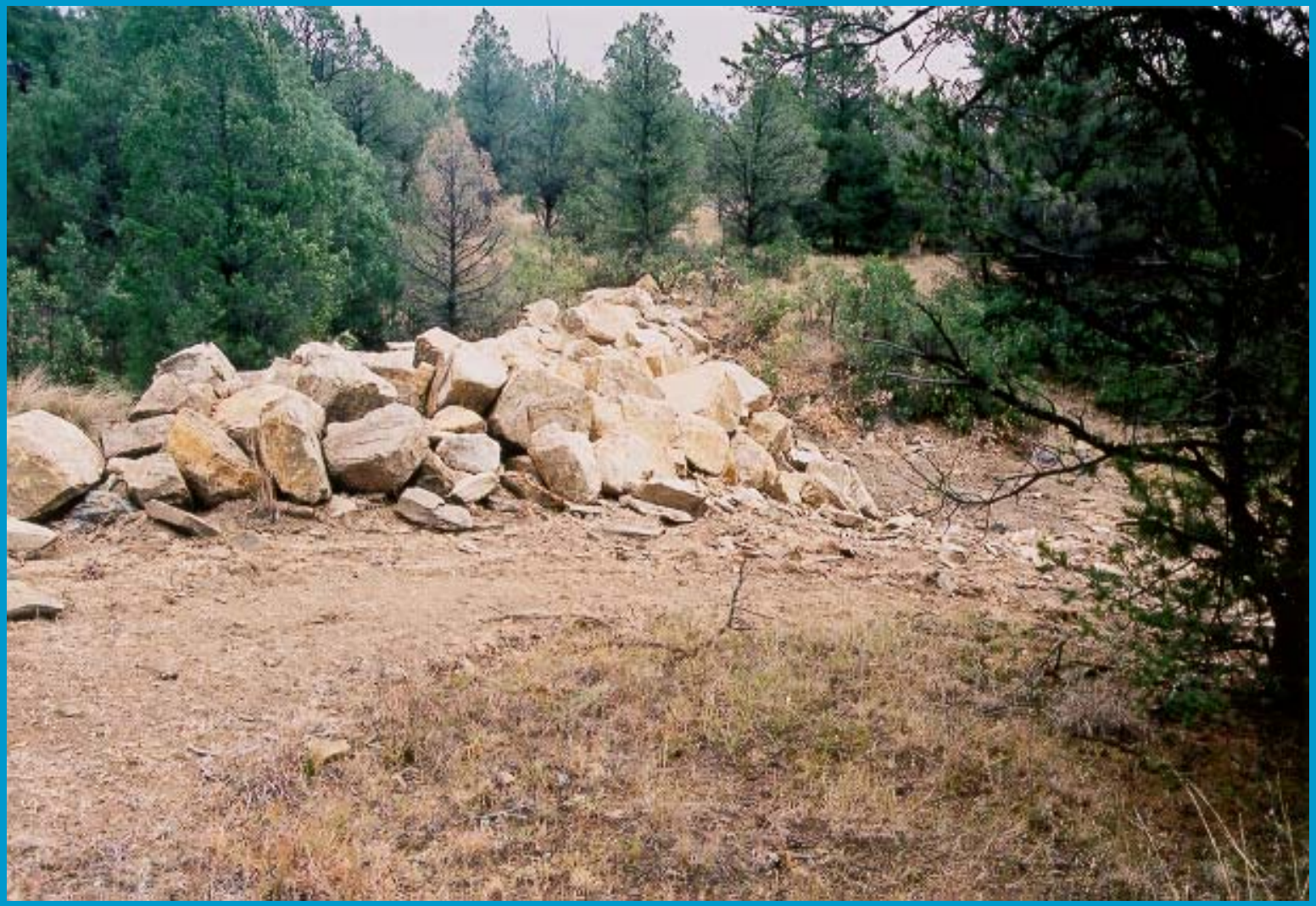
(iv) the retained portion left standing shall not exceed pre-existing cliff lengths. However, the Director may require shorter lengths.

(v) it is necessary to replace cliff type habitats that existed in the natural topography prior to mining; and

(vi) the ends of the highwall portions left standing will be contoured into the surrounding topography with slopes of 3:1 or less. Retention of any portion of the highwall must be approved by the Director.

JUL 24 2001

JUL 24 2001



Trapper Mining Inc.
Wildlife Use of Reclaimed Areas

Presented at:

OSM Bond Release Forum

by Forrest V. Luke

August 2001

Welcome to Big, Wonderful!

Discussion Outline

- Overview of Trapper Wildlife
- Big Game Discussion
- Bond Release Implications
- Sharp-tailed Grouse Discussion
- Factors Influencing Wildlife Success

Trapper Mine in Northwest Colorado

- North flank of Williams Fork Mtns
- Premine mtn brush habitat
- Elevation: 6400’ to 7800’
- Mining on 14% slopes
- Precipitation: 14” average

Trapper Wildlife

- How has surface mining impacted wildlife?

Trapper Wildlife

- Pronghorns have become a significant presence.

Trapper Wildlife

- Mule Deer numbers are stable.

Trapper Wildlife

- Elk numbers have increased dramatically.

Trapper Wildlife: Aerial Elk Photos

- Bottom--700 head, 12/99
- Right--550 head, 4/00

History of big game aerial surveys of Trapper Mine study area.

Big Game Species	Winter Surveys (Dec-Mar) Premining Mean Estimate (1973-1976)	Winter Surveys (Dec-Mar) Active Mining Mean Estimate (1982-1986)	Winter Surveys (Dec-Mar) Active Mining Mean Estimate (1999-2001)	Summer Survey (June-July) Active Mining Mean Estimate (2000)
Elk	148	339	1,568	156
% use of reclaim			(59.7%)	(18.0%)
preference index*			7.0	2.1
Mule Deer	80	120	92	108
% use of reclaim			(2.2%)	(23.1%)
preference index*			0.3	2.7
Antelope	0	no data	43	166
% use of reclaim			(16.3%)	(41.1%)
preference index*			1.9	4.8

*Preference Index is calculated by dividing % of reclaimed lands located in study area (3,017 of 35,300 acres = 8.5%) into % of animals counted on reclaimed lands.

TOTAL NUMBERS OF ANIMALS OBSERVED DURING EACH FLIGHT
LATE FALL THROUGH EARLY SPRING - 1999-2000

DATE	ELK	DEER	ANTELOPE
11/16/99	488	110	314
12/21/99	1820	172	89
12/29/99	3966	99	136
1/13/00	2139	101	11
1/29/00	1608	131	87
2/18/00	1505	64	22
2/23/00	1571	67	11
3/11/00	1975	50	14
3/22/00	1969	94	66
4/4/00	1670	149	31
4/21/00	1788	153	141
TOTAL	20,499	1190	922
AVERAGE	1864	108	84

Winter Wildlife Survival

TOTAL NUMBERS OF ANIMALS OBSERVED DURING EACH FLIGHT
LATE FALL THROUGH EARLY SPRING - 2000-2001

DATE	ELK	DEER	ANTELOPE
11/29/00	1801	164	84
12/11/00	1838	110	90
12/22/00	1193	65	0
1/15/01	816	53	0
1/30/01	872	67	0
2/10/01	827	85	8
2/22/01	729	55	0
3/12/01	891	76	0
3/27/01	1370	180	139
4/11/01	1371	119	223
TOTAL	11,708	974	544
AVERAGE	1171	97	54

TOTAL NUMBERS OF ANIMALS OBSERVED DURING EACH FLIGHT
JUNE AND JULY - 2000

DATE	ELK	DEER	ANTELOPE
6/7/00	118	104	155
6/30/00	125	99	133
7/14/00	224	129	211
TOTAL	467	324	499
AVERAGE	156	108	166

Bond Release Implications of Abundant Big Game Animals

- Impact to establishment and vigor of shrub and forb species.

- Grazing exclosure demonstrates impact of big game grazing on shrubs and forbs.

Typical Bitterbrush vigor inside & outside of exclosure.

Bond Release Implications of Abundant Wildlife

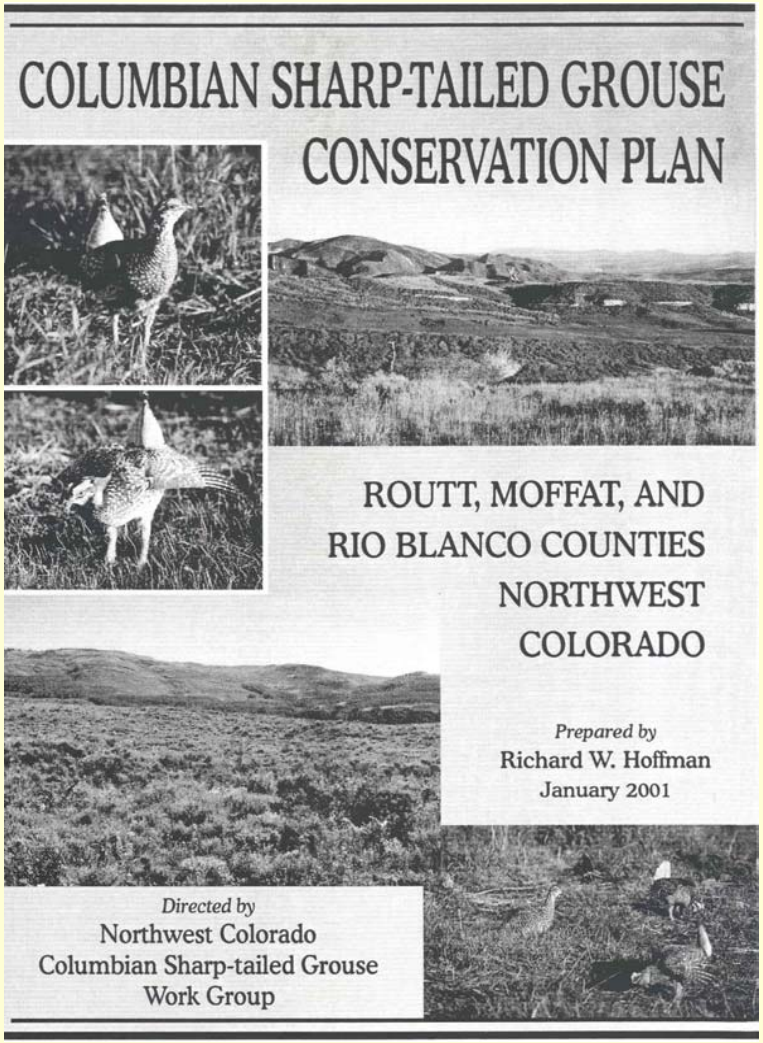
- Bond release focus away from strict numerical woody plant density standard.
- Consider other innovative approaches to wildlife habitat establishment.

Columbian Sharp-tailed Grouse

- Mine reclamation success story in NW Colorado.
- Recent research indicates CSTG are flourishing on mined land reclamation in contrast to remainder of home range.
- Reclamation success, conservation plan and ongoing research aided in heading off T&E listing.

Columbian Sharp-tailed Grouse (CSTG) Research and Conservation Planning

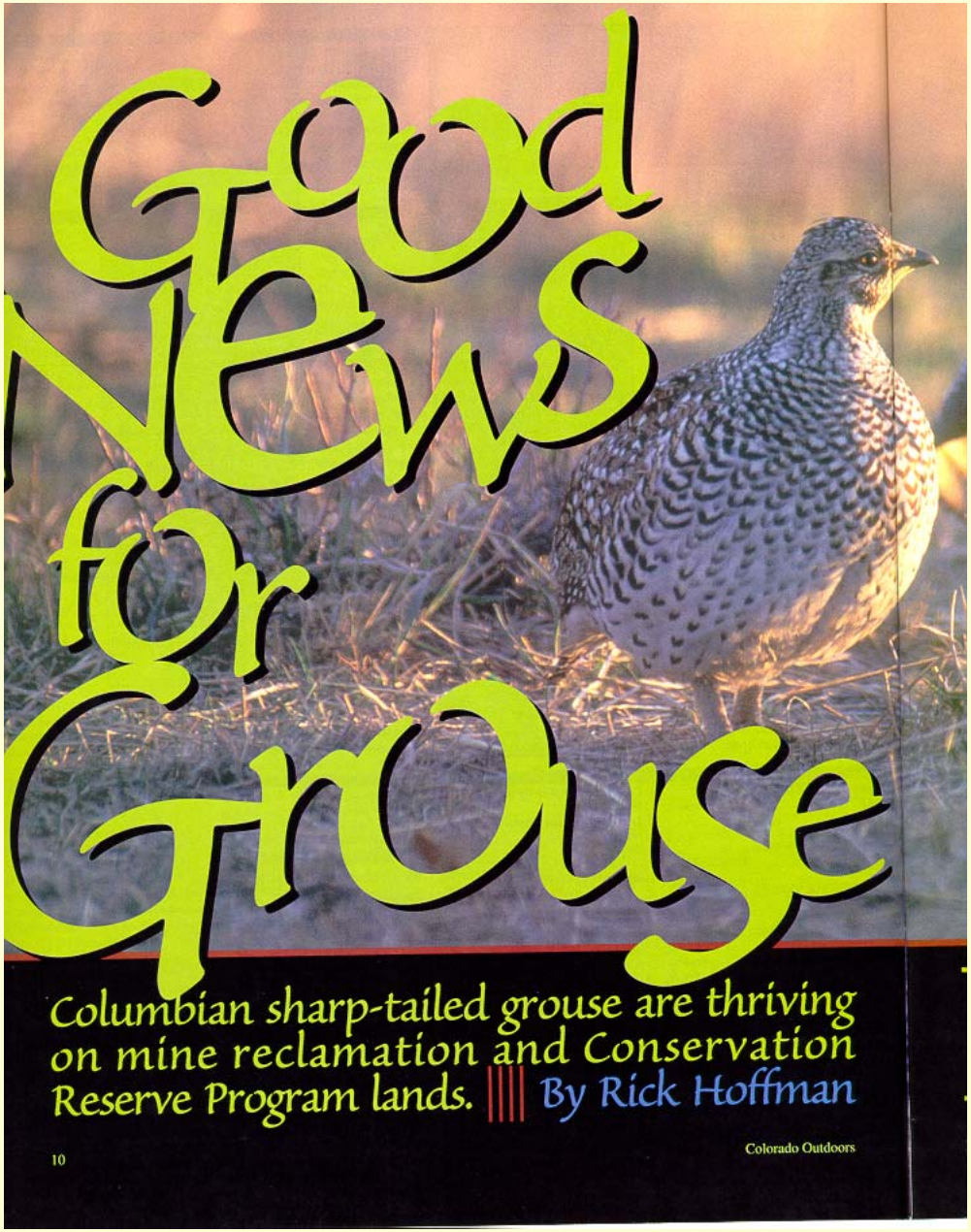
•Colorado DOW researcher Rick Hoffman applies radio transmitter to female CSTG at Trapper Mine.



CSTG Lek Site Considered in Final Pit Regrade Design

Public/Community Relations Opportunities

- **Early morning CSTG lek viewing as part of mine Earth Day activities for the local community.**



- Positive press response.

6D Tuesday, July 28, 1998 THE DENVER POST

Sky's the limit for fall hunts

Most bird species plentiful

A sky filled with doves. Pheasants galore. A turkey behind every bush.

Even conceding a bit of exaggeration, these are among the more enticing prospects that await Colorado's upland game-bird enthusiasts this autumn.

Although species such as sage grouse remain depressed and blue grouse fail to prosper, Colorado Division of Wildlife biologists believe bird hunting should be generally better than usual.

When dove season begins the fall fest Sept. 1, hunters should find large numbers of birds — a product of hot, dry weather that facilitated multiple broods. Any forecast for doves always contains a caveat about weather. A late-August cold snap sometimes sends local birds fleeing to warmer climes.

Barring a repeat of last October's blizzard, prospects for the northeast Colorado pheasant heartland are particularly good. Crowing counts have improved 10 percent in Phillips County, with an even greater projected boost in broods. Most northeast counties should have good hunting.

Charlie Meyers
Outdoors

Upland researcher Tom Remington cited mild winter weather and greater survival than anticipated from the October storm as the primary reasons for a rosy forecast.

"When tracking hens wearing radio collars, we found pheasant broods all over the place," Remington said.

The good news also includes South Platte River bottom bobwhites. Last season's quail hunt was the best of the decade and broods remain strong. The lone exception is an area near Fort Morgan and Brush devastated by a June hailstorm.

Although counts haven't been completed in southeast Colorado, both pheasant and quail seem to have fared better than expected.

Pheasant numbers appear good and field reports tell of solid quail hatches.

Colorado's best bird success story might be about turkeys, which continue to prosper and proliferate.

"We have turkeys just about every place they could be," said researcher Rick Hoffman, who trumpets the attractions of the oft-neglected fall hunt. "Everyone seems to want to hunt in the spring and there's very little pressure in the fall."

Hoffman advises combining a turkey hunt with a September outing for grouse or trout, or even a bowhunt for big game.

Conversely, sage grouse remain in the doldrums over much of the range. Bird numbers are similar to a year ago, but a slow, downward spiral in habitat continues to auger against the big birds. Blue grouse, too, seemed to slip almost imperceptibly, a decline Hoffman attributes to habitat degradation by grazing animals.

The good news in the grouse family comes from the sharptails, particularly in Routt and Moffatt counties where successful reclamation of land used for coal mining provides excellent habitat.

Here's a rundown of fall seasons. Consult DOW brochures for precise details.

BIRDS OF AUTUMN

Blue Grouse: Sept. 1-Nov. 8 in units west of I-25. Bag limit 3, possession 9.

Band-tailed pigeon: Sept. 1-30. Bag 5, possession 10.

Chukar Partridge: Sept. 1-Nov. 22. Bag 4, possession 12.

Crow: Oct. 1-Jan. 31. No limit.

Dove: Sept. 1-Oct. 30. Bag 15, possession 30.

Pheasant: Nov. 7-Jan. 17 east of I-25 and south of a line formed by I-70 and U.S. 36; Nov. 7-Jan. 3 east of I-25 and north of a line formed by I-70 and U.S. 36; Nov. 14-Jan. 3 west of I-25. Bag 3, possession 12.

Ptarmigan: Sept. 12-Oct. 4 statewide except units 53, 54, 66, 67, 68, 70, 71, 74, 75, 751, 76, 77, 78, 79, 80 and 81. In those the season will be Sept. 12-Nov. 8. Bag 3, possession 6.

Quail: Nov. 7-17 east of I-25 and south of a line formed by I-70 and U.S. 36; Nov. 7-Dec. 13 east of I-25 and north of a line formed by I-70 and U.S. 36; Nov. 14-Jan. 3 west of I-25. Bag 8 of each species, possession 24.

Rails (Virginia and sora): Sept. 1-Nov. 9. Aggregate bag and possession 25.

Sage grouse: Sept. 12-18 for units 2, 3, 10, 11, 201 and 301. Sept. 12-27 for units 6, 16, 17, 18, 27, 28, 37, 54, 55, 56, 66, 67, 161, 171, 181 and 551. Bag 2, possession 4.

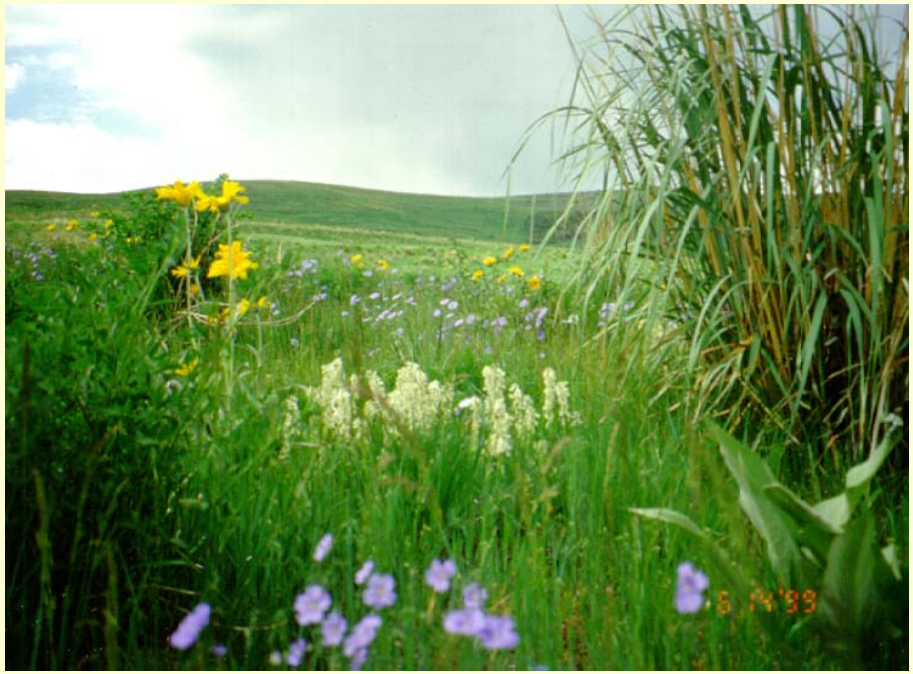
Sandhill crane: Oct. 4-Nov. 30 east of Continental Divide, excluding North Park and San Luis Valley. Bag 3, possession 6.

Sharp-tailed grouse: Sept. 1-20 for units 4, 5, 12, 13, 14, 131, 211, 214 and 441. Bag 2, possession 4. Snipe: Sept. 1-Dec. 16: Bag 9, possession 16.

Turkey: Sept. 1-Oct. 4: Bag 1 turkey, either sex.

Why are wildlife flourishing?

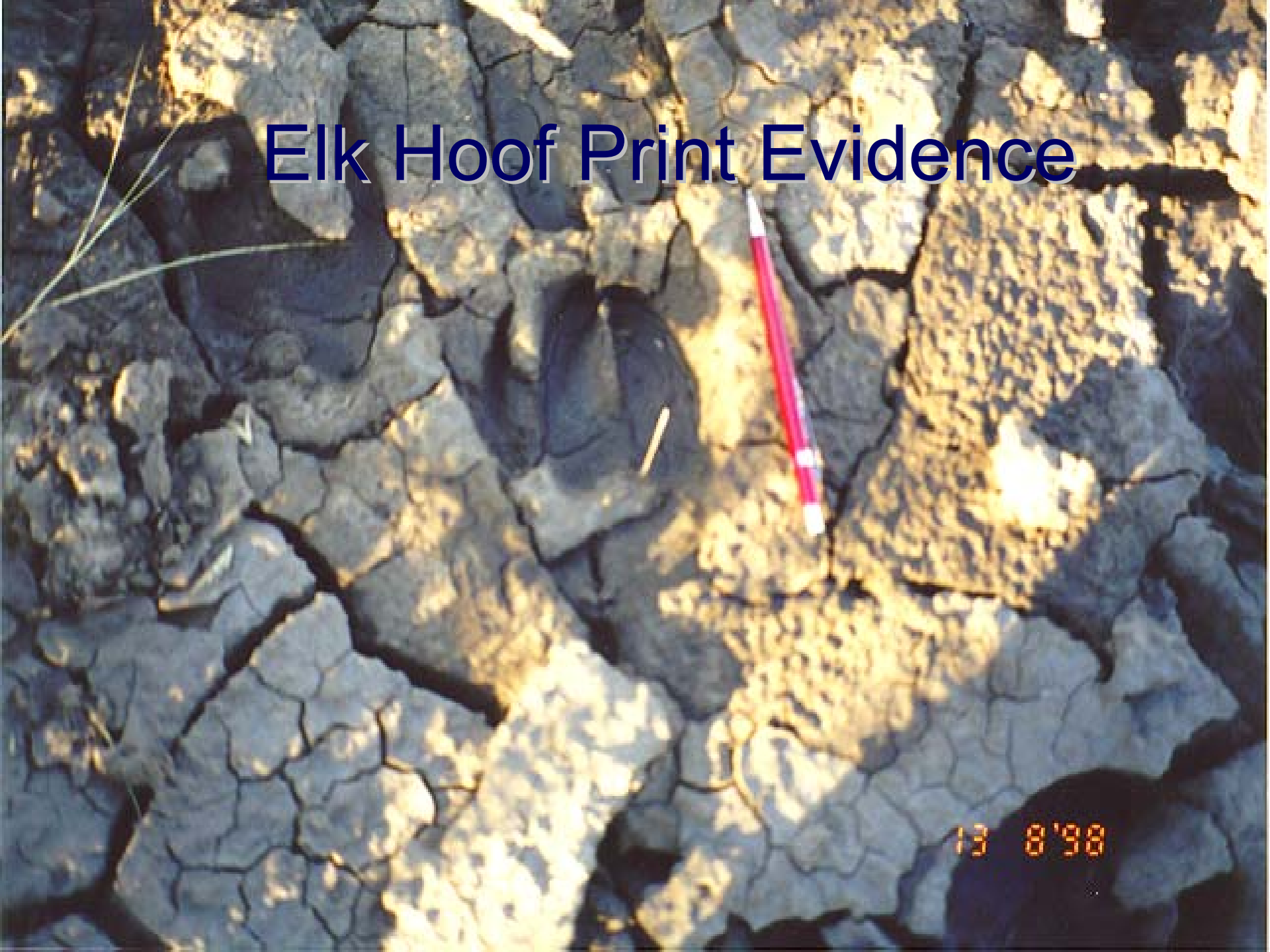
- Diverse, adapted, sustainable reclaimed plant communities



Why are wildlife flourishing?

- Stock ponds provide otherwise scarce drinking water

Elk Hoof Print Evidence



Deer, Elk & Pronghorn Hoof Prints

Deer Hoof Print Evidence

Deer "Other" Evidence

Photos courtesy of Roy Karo; taken at Peabody's Seneca Mine in NW CO.

Why are wildlife flourishing?

- Mature shrub clump under construction

- **Completed shrub clump**

Why are wildlife flourishing?

- Mature shrub clumps or islands provide cover for wildlife

Why are wildlife flourishing?

- Shrub clumps provide cover for wildlife

(350 elk loafing in a 1.5 acre shrub clump)

Why are wildlife flourishing?

- Available forage is much more abundant than it was pre-mining

Wyoming Natural Diversity Database (WYNDD)

Presented by Gary Beauvais at the
OSM Bond Release Forum
August 2001

A service and research unit of the University of Wyoming dedicated to collection, interpretation, and dissemination of information on the biological resources of Wyoming

WYNDD Philosophy

Best decisions regarding conservation, development, and management of Wyoming's natural resources will be made only when everyone involved has access to objective, complete, and current scientific information

Core Staff

Director
Zoologist
Botanist
Vegetation Ecologist
Database Manager

(6 – 10 assistants, interns)

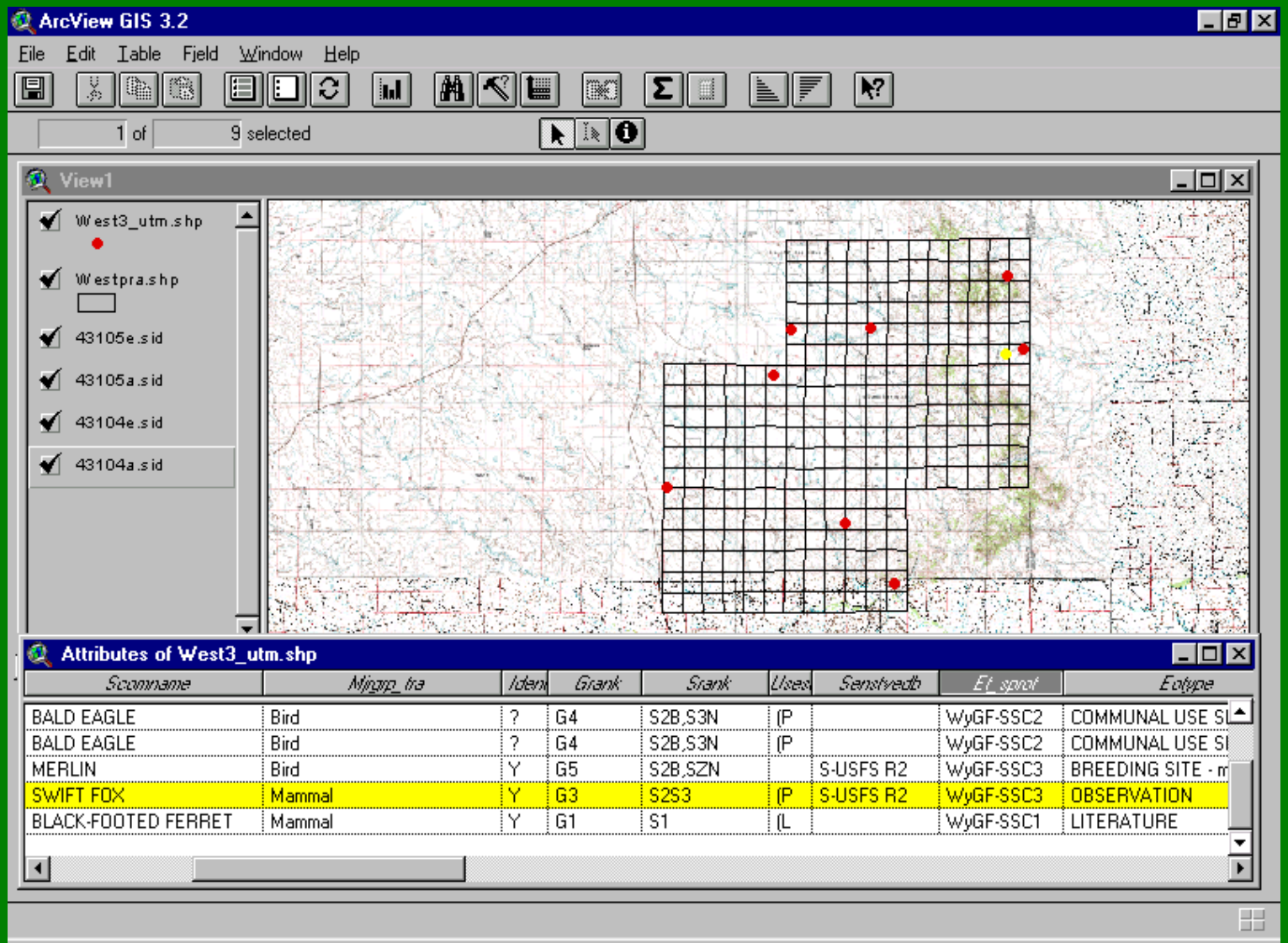
Central Biological Databases

WYNDD activities are focused on maintaining a series of on-site databases

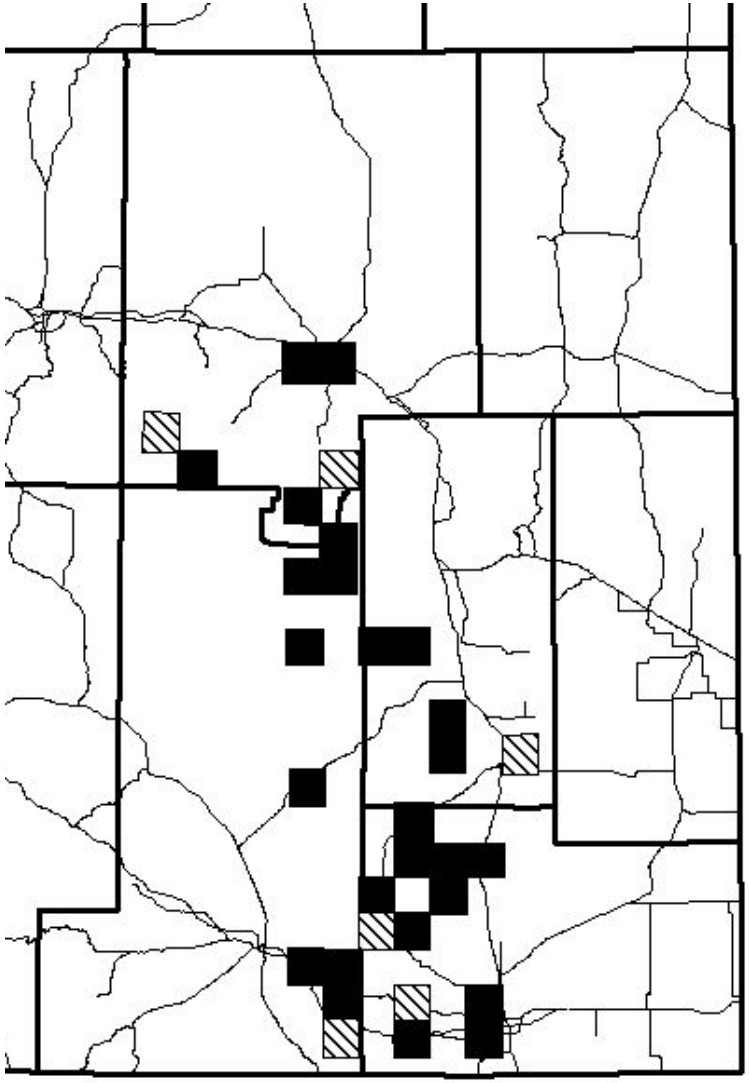
- Documented locations of rare species
- Life history and habitat use of rare species
- Taxonomic revisions, controversies
- Maps of common and rare vegetation types
- Structure and composition of vegetation types

WYNDD products and services derive from these databases

WYNDD Products and Services : maps of locations of rare species and communities



Distribution of suspected Preble's meadow jumping mouse in Townships of SE Wyoming



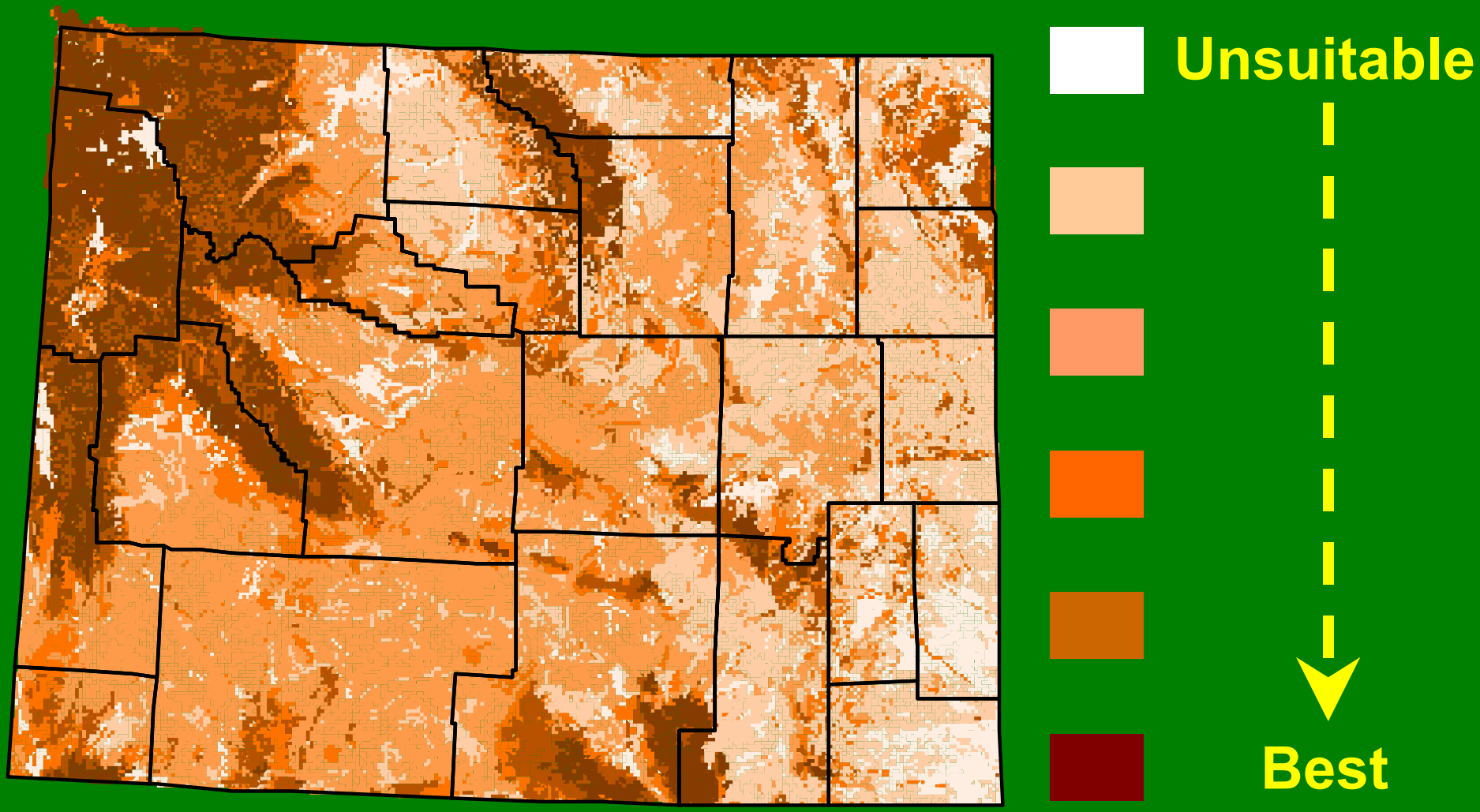
Presence documented at least once in each of 32 Townships

Presence documented in 26 Townships since 1998

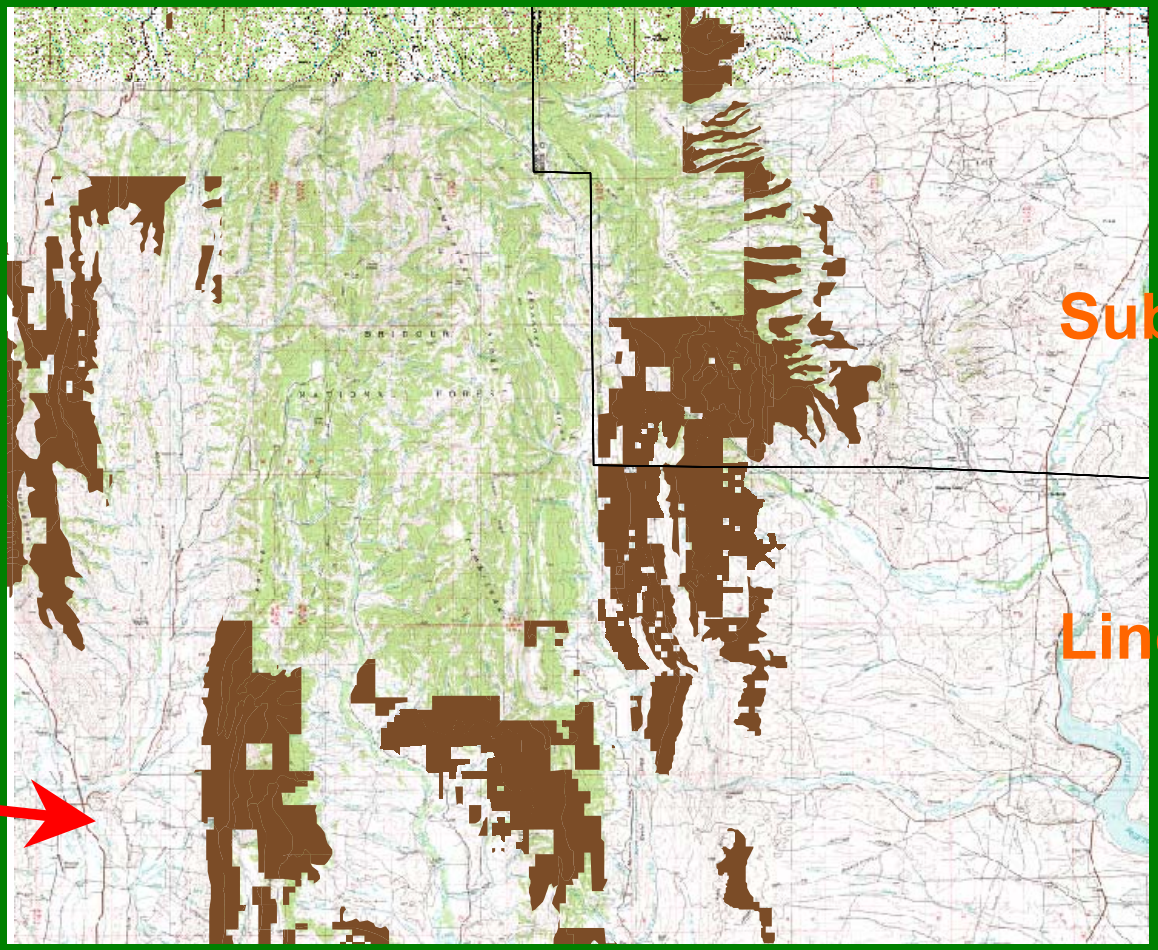
Presence documented on 46 stream segments

Before 1998 : 13 separate stream segments

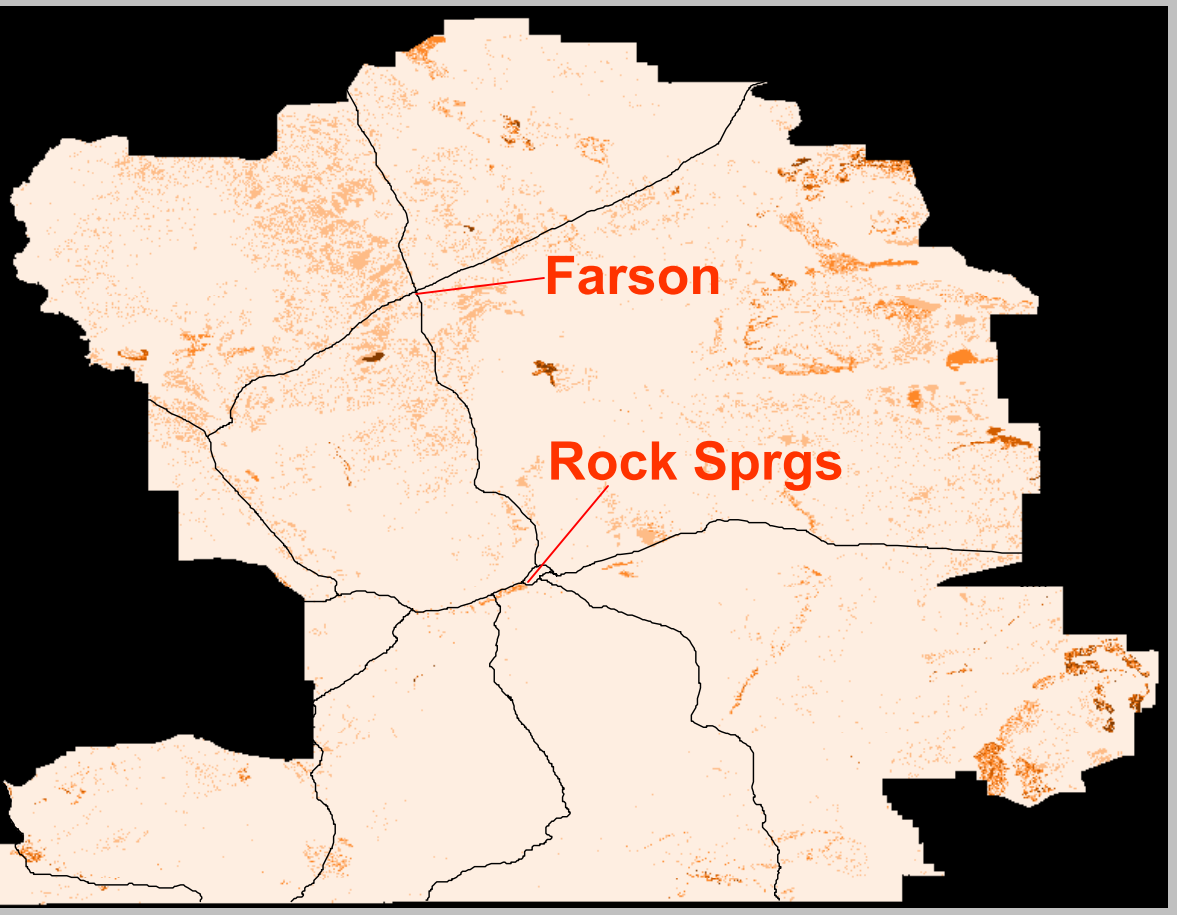
WYNDD Products and Services : spatial models of species distributions, habitat quality, and biodiversity patterns



Predicted high-suitability habitat for Canada lynx on BLM lands, southern Overthrust Belt



Probability of mountain plover occurrence, USDI Bureau of Land Mgmt - Rock Springs Field Office



0 - 20%

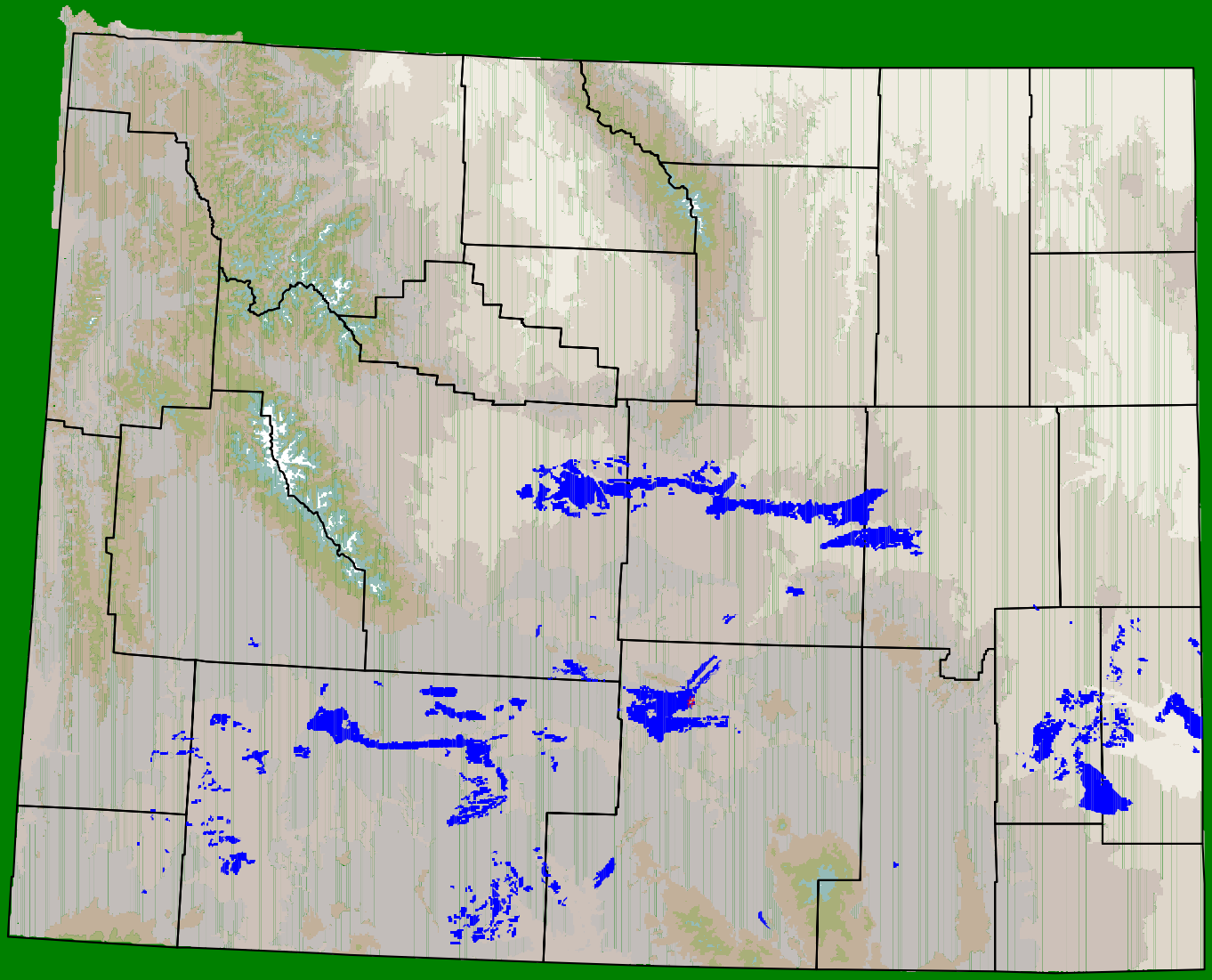
20 - 40%

40 - 60%

60 - 80%

80 - 100%

Predicted distribution of blowout penstemon in Wyoming



WYNDD Products and Services : status reports and summaries for rare species

-State Species Abstract-
-Wyoming Natural Diversity Database-

SPIRANTHES DILUVIALIS
UTE LADIES' TRESSES
Family: Orchidaceae

Status:
US Fish & Wildlife Service: LT
Agency Status: Listed as Threatened under the Endangered Species Act.

Heritage Rank:
Global: G2 State: S1
WYNDD Plant List: Sparse (High Conservation Priority)

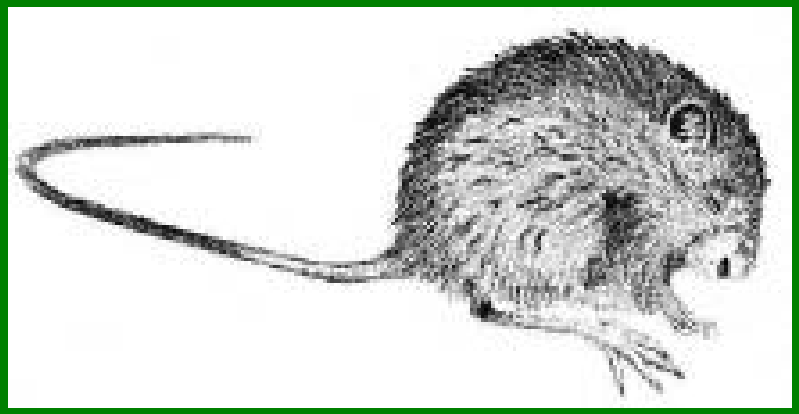
Left: *S. diluvialis,* Goshen Co., WY.
Above: Typical habitat; whitish clay benches and slopes along prairie streams. Goshen Co., WY.

Description: Ute ladies' tresses is a perennial herb with erect, glandular-pubescent stems 12-50 cm tall arising from tuberous-thickened roots. Basal leaves are linear, up to 1 cm wide and 28 cm long, and persist at flowering time. Leaves become progressively reduced higher up the stem. The inflorescence is a loose spike 3-15 cm long of numerous, small white to ivory flowers arranged in a gradual spiral. The lip petal is oval to lance-shaped, narrowed at the middle, and has crispy-wavy margins. Sepals are separate or fused only at the base (not forming a hood-like structure) and are often spreading at their tips (Sheviak 1984; Atwood et al. 1991; Fertig et al. 1994; US Fish and Wildlife Service 1995; Fertig 2000).

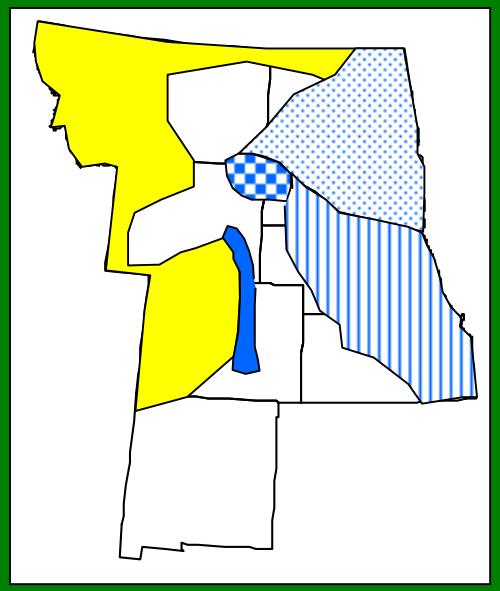
Synonyms: *Spiranthes romanzoffiana* var. *diluvialis.*

Similar Species: *Spiranthes romanzoffiana* has deeply constricted lip petals, sepals fused for at least 1/2 their length into a hood-like tube, and a densely congested inflorescence and typically occurs in montane wetlands. *S. magnicamporum*, a prairie species not currently known from Wyoming, has strap- shaped, wavy- margined lip petals and lacks leaves at flowering time. *S. porrifolia* (also not known from Wyoming) has yellowish flowers with sepals fused for about 1/2 their length (but not forming a hood), and strap-shaped lip petals with peg-like projections near their tip (Moseley 1998). *Habenaria* [*Platanthera*] *dilitata* has a more elongate inflorescence, broader leaves, and white flowers with an elongated spur on the back of the lip petal (Sheviak 1984; Fertig et al. 1994; Fertig 2000).

Flowering/Fruiting Period: Flowers from late July-September. Reproduces by seed. Plants probably do not flower every year and may remain



PREBLE'S MEADOW JUMPING MOUSE (*Zapus hudsonius preblei*) IN WYOMING: STATUS REPORT, JULY 2001



WYNDD Products and Services : analyses of the biological values of particular areas

Known and potential vascular plant flora of Fort Laramie National Historic Site. ***2001.***

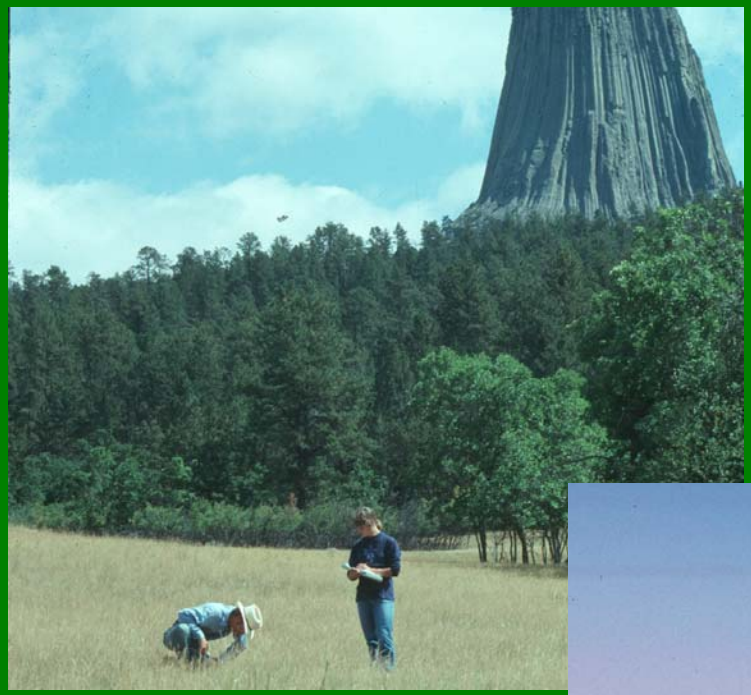
Vegetation of the TE Ranch, Park County, Wyoming. ***2001.***

Rare species and and riparian vegetation of the Snake River Basin in Wyoming. ***2001.***

Vegetation and rare species of Washakie County, Wyoming. ***2000.***

Status report for rare vertebrates and plants in Laramie County, Wyoming. ***2000.***

WYNDD Products and Services : field survey, research, and monitoring projects



WYNDD Products and Services : field classes and other educational services

Data Users

Environmental consultants

Federal resource managers (e.g., USFS, BLM, USFWS)

County governments

Private landowners

Agricultural organizations (e.g., WY Stockgrower Assn.)

Land trusts and conservation organizations

State of Wyoming agencies (e.g., WGFD, WYDOT)

University students and researchers

Data Contributors

Environmental consultants

Federal agency biologists (e.g., USFS, BLM, USFWS)

State of Wyoming biologists (e.g., WGFD, WYDEQ)

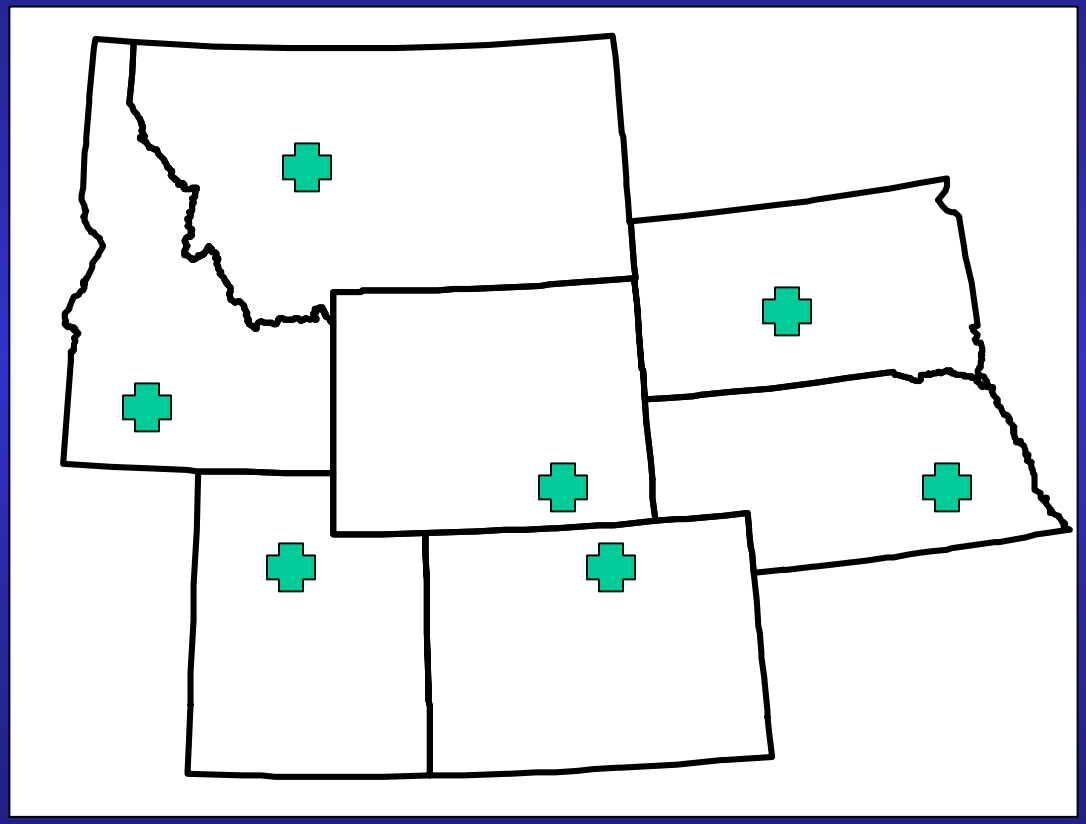
University students and researchers

Museum / herbarium staff and researchers

WYNDD Staff

Others… …

A Network of Similar Programs



74 PROGRAMS

53 United States
10 Canada
6 Mexico/ Carribean
5 South America

WYNDD's Future :

Increase access to central databases via the Internet

Reclaiming Wetlands in North Dakota

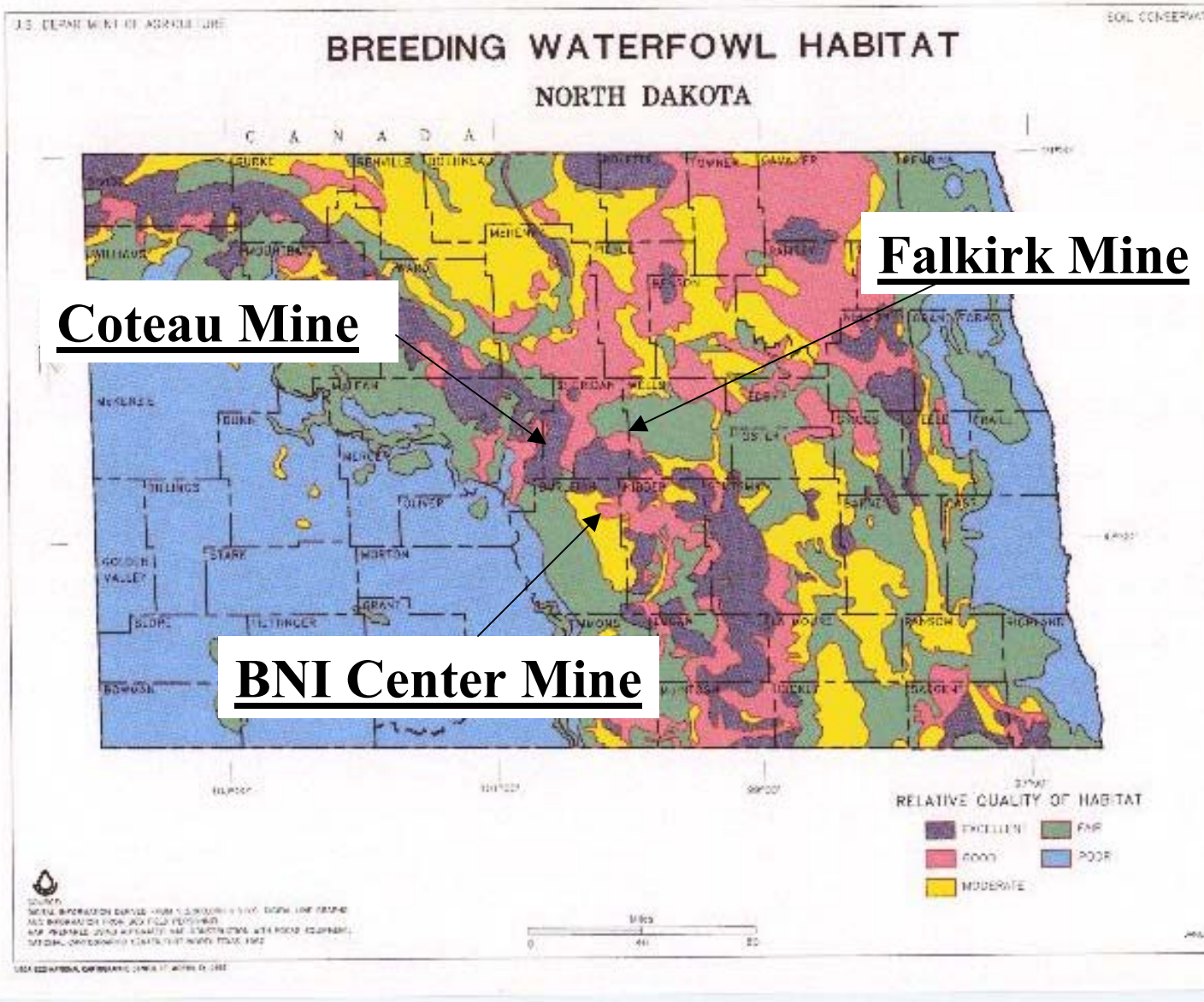
presented by Guy Welsh
at the OSM Bond Release Forum
August 2001

The Prairie Pothole Region

North Dakota lies within the Prairie Pothole Region. It extends from Canada to Iowa.

Wetlands within the Prairie Pothole Region are extremely valuable for a large number of wildlife species. Migratory and resident waterfowl species

Wetlands are also important for controlling flood waters, recharging ground water and retaining agricultural pollutants.



Two of North Dakota's largest surface coal mines are located in or on the edge of the Prairie Pothole Region where there is high quality waterfowl habitat. The BNI Center Mine is not in the Prairie Pothole Region but it has a number of closed depression wetland basins.

The dark purple area on the map is considered excellent waterfowl habitat

There are approximately 1,257 acres of wetlands under permit in ND. Most of these wetland will be disturbed by mining and since they are important wildlife habitat, they are mitigated and recreated when disturbed.

North Dakota wetlands provide habitat for resident and migratory duck species. Muskrats and other mammals reside in wetlands.

Shore Birds: , American Avocet

- **Hydric Soils**
- **Hydrophytic Vegetation**

Wetlands have hydric soils and hydrophytic vegetation.

Wetland Classes

Class I	Ephemeral Wetland	Low Prairie Zone
Class II	Temporary Wetland	Wet Meadow Zone
Class III	Seasonal Wetland	Shallow Marsh Zone
Class IV	Semi-Permanent	Deep Marsh Zone
Class V	Permanent Wetland	Permanent Open Water
Class VI	Alkali Wetland	Intermittent Alkali Zone
Class VII	Fen Pond	Fen Zone

In North Dakota wetlands are classified according to Stewart and Kantrud's classification system. Wetlands are classified by water quality and vegetation characteristics. The vegetation occurring in the central or deepest part of the basin and occupying 5% or more of the wetland determines the wetland class.

Wetland vegetation is grouped into zones characterized by an assemblage of plants. The majority of the wetlands affected by mining are the fresh water temporary, seasonal and semi-permanent wetlands.

These wetland are valuable for waterfowl.

The specific species of vegetation established in a wetland may vary with landuse – grazing, idle, haying and water quality.

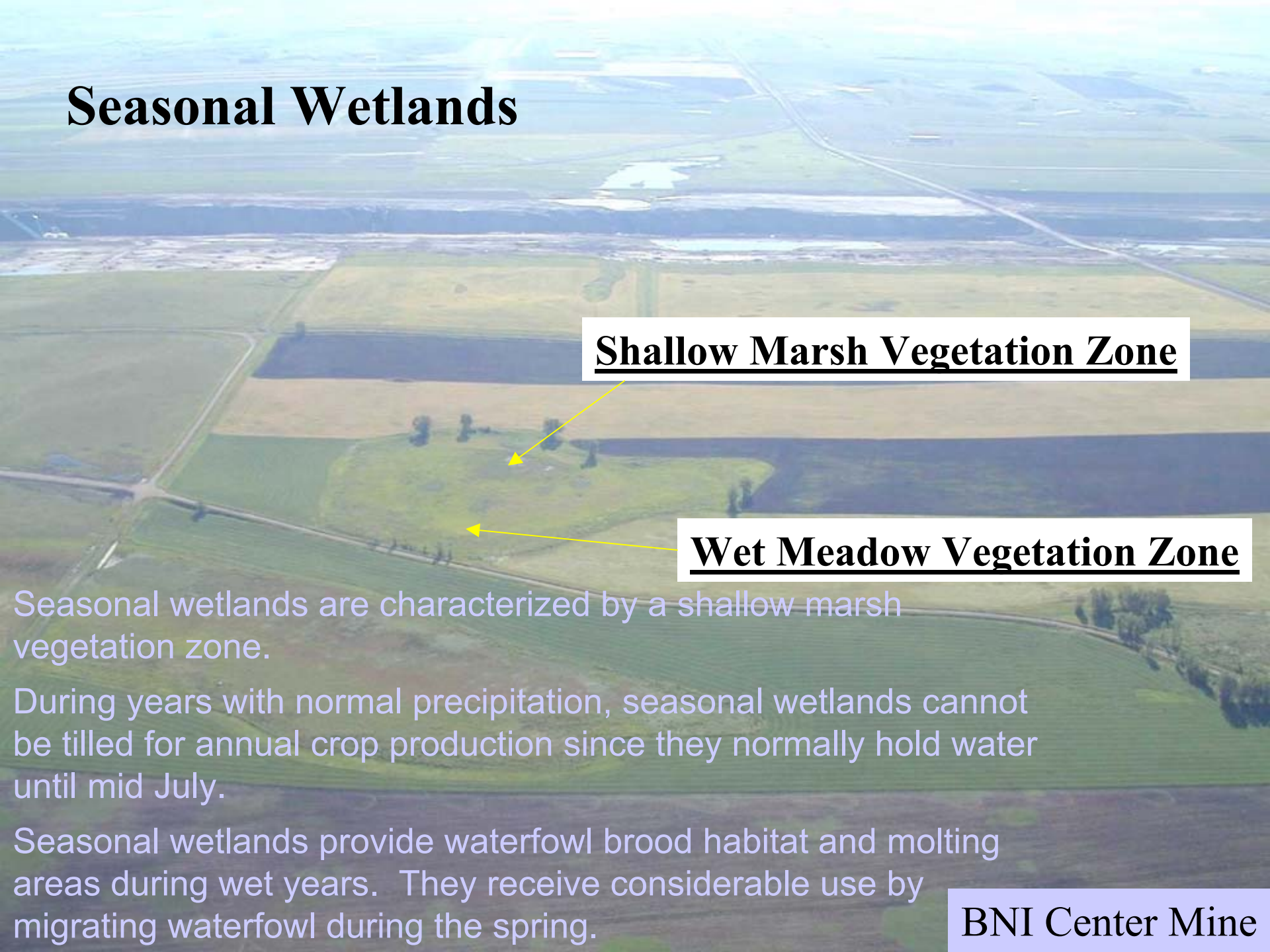
- Wet Meadow Zone: Foxtail barley, baltic rush, prairie cordgrass, fowl bluegrass, wooly sedge, quackgrass
- Shallow Marsh: Slough sedge, reed canarygrass, slough grass, spikerush, smartweed, water plantain,
- Deep Marsh Zone: Bulrush and cat-tails.

Ephemeral and Temporary Wetlands

Ephemeral and temporary wetlands are typically small in size. They are delineated in the premine inventory but they are not considered a separate land use. These wetlands are usually annually tilled when they are located in cropland.

Temporary wetlands provide isolation for breeding pairs of ducks and they supply invertebrate foods for waterfowl early in the spring.

Seasonal Wetlands



Seasonal wetlands are characterized by a shallow marsh vegetation zone.

During years with normal precipitation, seasonal wetlands cannot be tilled for annual crop production since they normally hold water until mid July.

Seasonal wetlands provide waterfowl brood habitat and molting areas during wet years. They receive considerable use by migrating waterfowl during the spring.

BNI Center Mine

Semi-Permanent Wetland

Semi-permanent wetlands supply most of the habitat needs for prairie nesting waterfowl.

Ideally, semi-permanent wetlands would be ½ open water and ½ emergent vegetation.

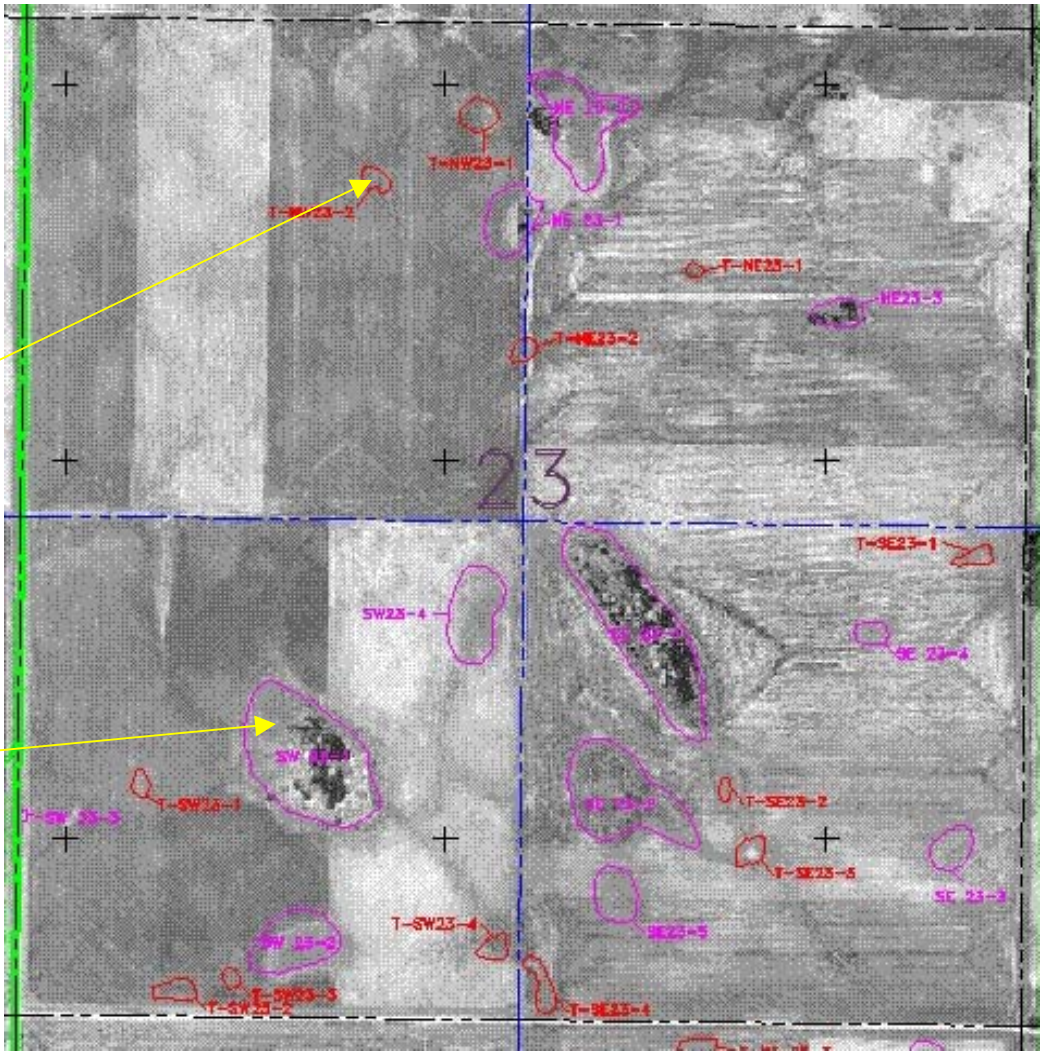
They do not provide an early source of invertebrate foods. Frozen.

Pre-Mine Wetland Inventory Map

Wetland basins are identified during the pre-mine inventory.

Temporary wetlands are outlined in red.

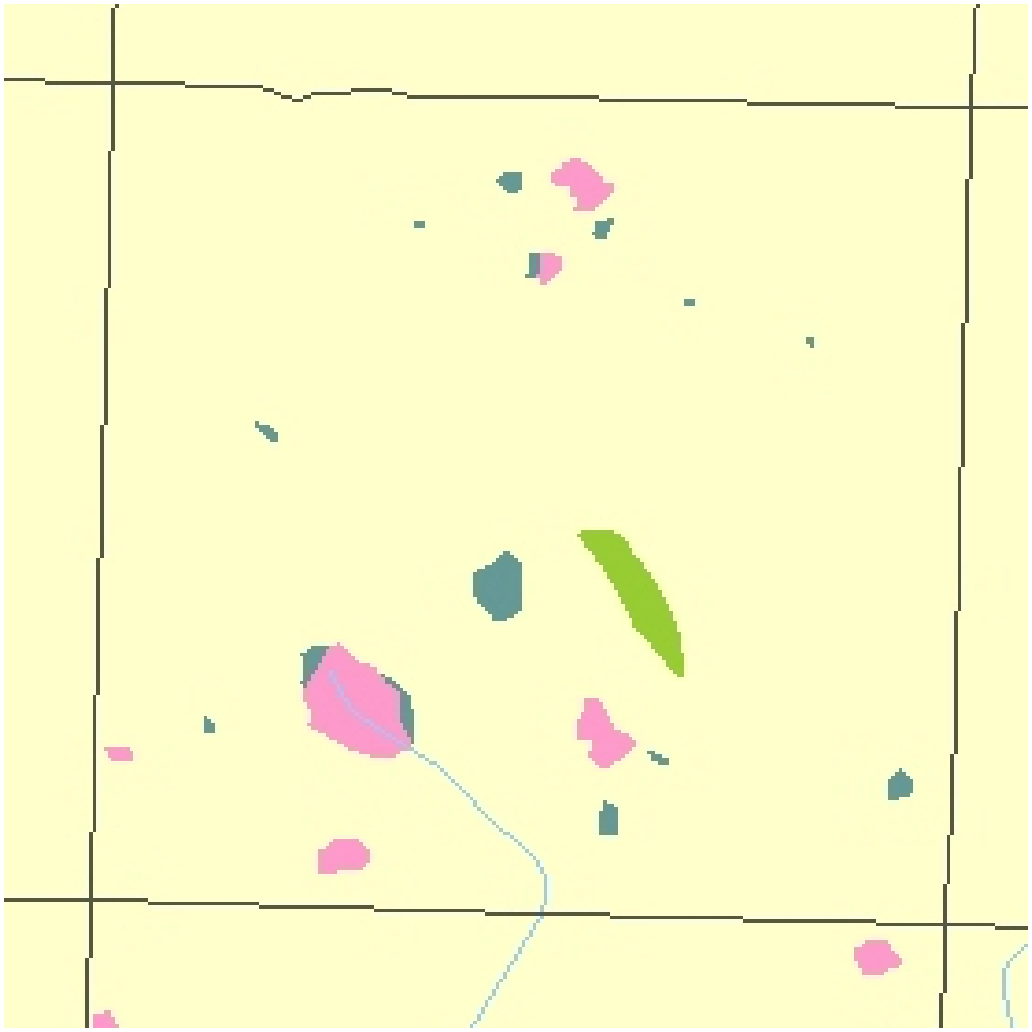
Seasonal wetlands are outlined in purple.



Falkirk Mine

Wetland Inventory Maps

- USFWS –National Wetlands Inventory Maps
- NRCS Maps
- Aerial Photos
- Soil Surveys

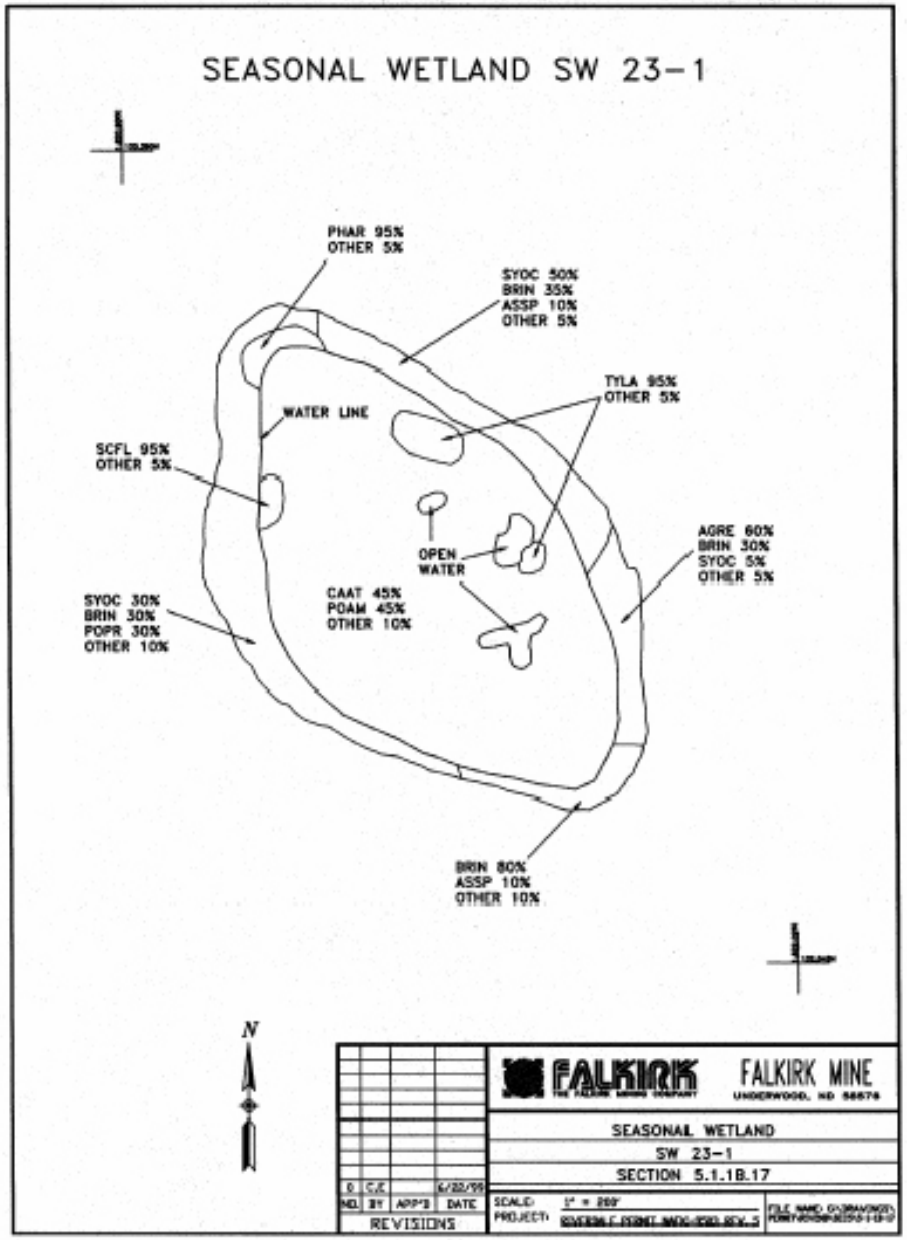


Mining companies use USFWS National Wetlands Inventory Maps, NRCS wetland maps, soil surveys and aerial photos to help identify wetlands. Of course wetlands are ground truthed in the field.

Pre-mine Wetland Inventory

Line drawings of representative pre-mine wetlands are prepared.

Vegetation is grouped into zones characterized by assemblage of plants.



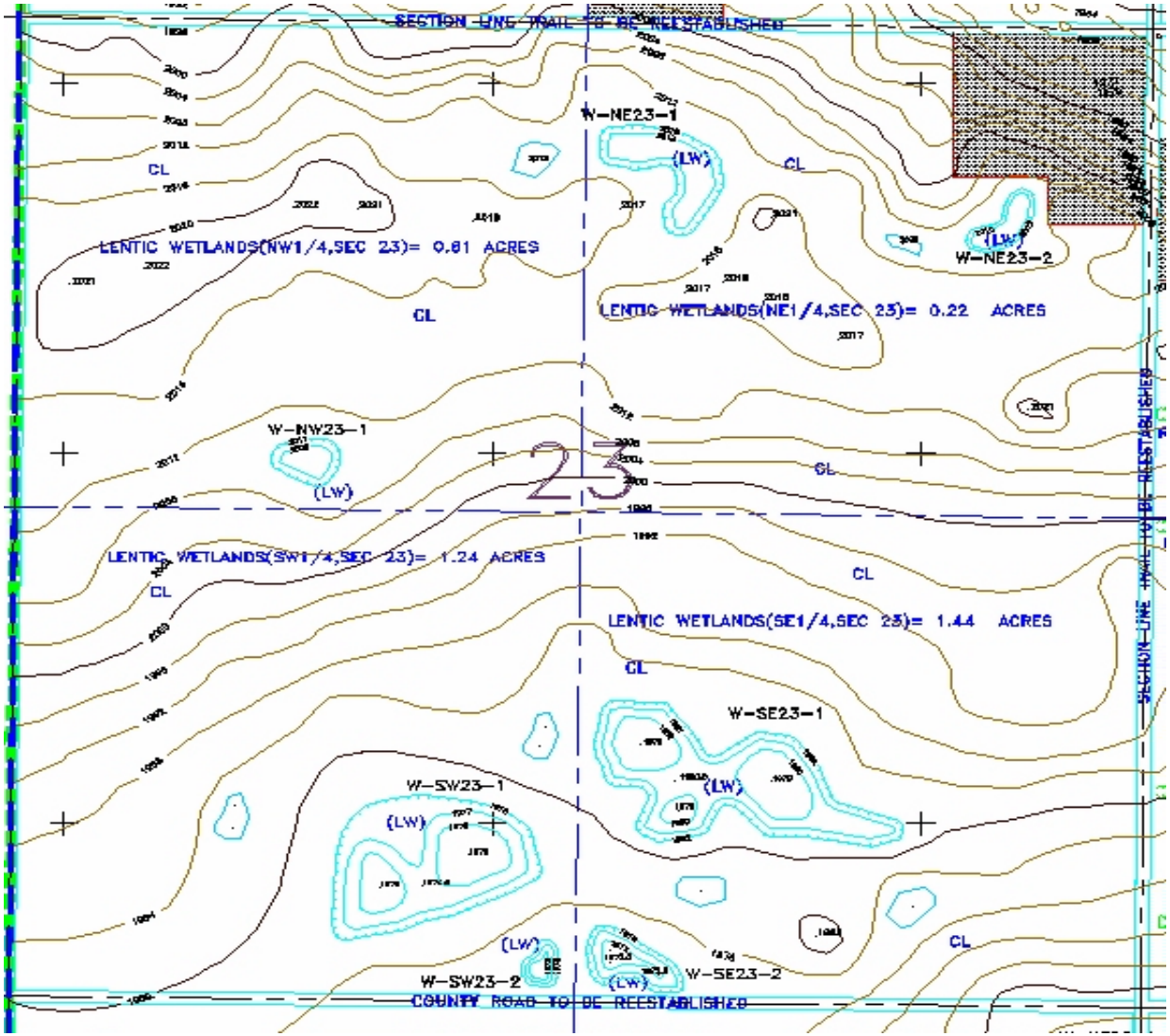
A representative number of premine wetlands are inventoried during the premining inventory process. A line drawing of the wetland is prepared. Dominant species and a species list is prepared. Water quality is sampled.

Post Mine Wetland Map

Seasonal and semi-permanent wetlands are mitigated on an acre for acre basis.

In many instances wetlands are recreated in there approximate premine locations.

Wetlands cannot be located on prime cropland.

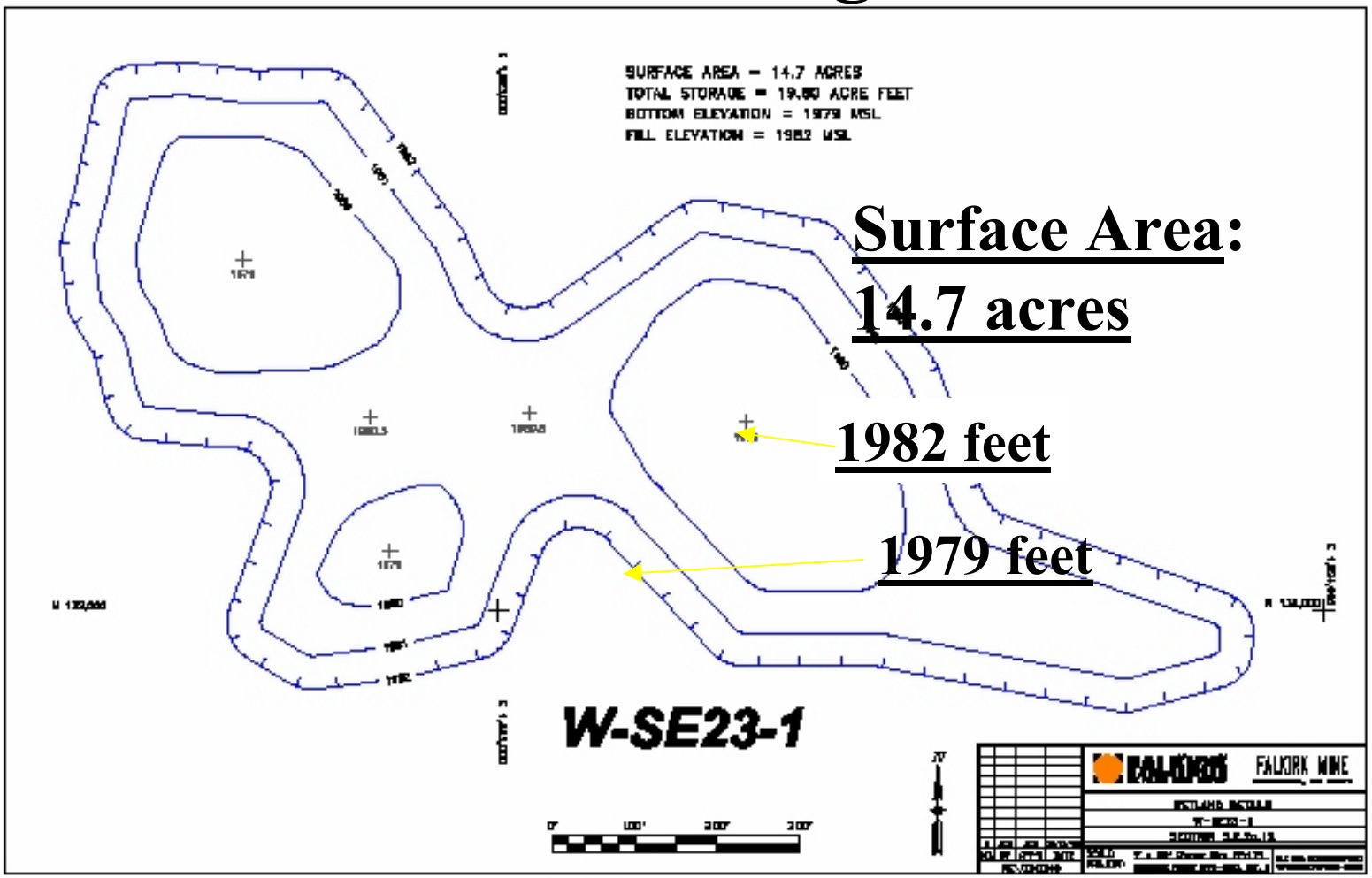


Falkirk Mine

Wetland Designs

Design plans are prepared for Seasonal and Semi-permanent wetlands.

Wetlands are designed to ensure that their watersheds will provide enough runoff for the desired degree of permanence.



Seasonal wetlands are typically designed so that the deepest portion of the basin is about 3 feet deep.

Semi-permanent wetlands are designed to be about 5 feet deep.

Temporary wetlands may be field engineered during the reclamation process or subsidence features may be retained to serve as temporary wetlands.

Constructed Seasonal Wetland Basin

This is a photo of a two acre seasonal wetland that is in the process of being constructed at the North American Coal's Falkirk Mine. The wetland basin is shaped into the graded spoil at the time of grade approval.

Falkirk Mine

Wetland Soils

- Salvaged and respread in created wetland basins
- Contain seeds and propagules

Experience has shown that reconstucted wetland basins will revegetate themselves with propagates and seed from salvaged wetland soils.

Falkirk Mine

Constructed Seasonal Wetland Basin

Wetland soil not respread

This is a photo of a 25 acre seasonal wetland basin at the Falkirk Mine. The areas adjacent the wetland has been respread with SPGM and seeded to a precropland mixture of grasses and legumes. Wetland soils will not be respread in the basin until the watershed is established with a vegetative cover.

Falkirk Mine

Buffer Zones and Wildlife Enhancement Features

- Buffer zones trap sediment and create habitat
- Enhancement features include
  - Irregular shorelines
  - Islands
  - Deep water zones

Wetland may be designed to include enhancement features such as islands, irregular shore lines and deep water zones.

Coteau Mine

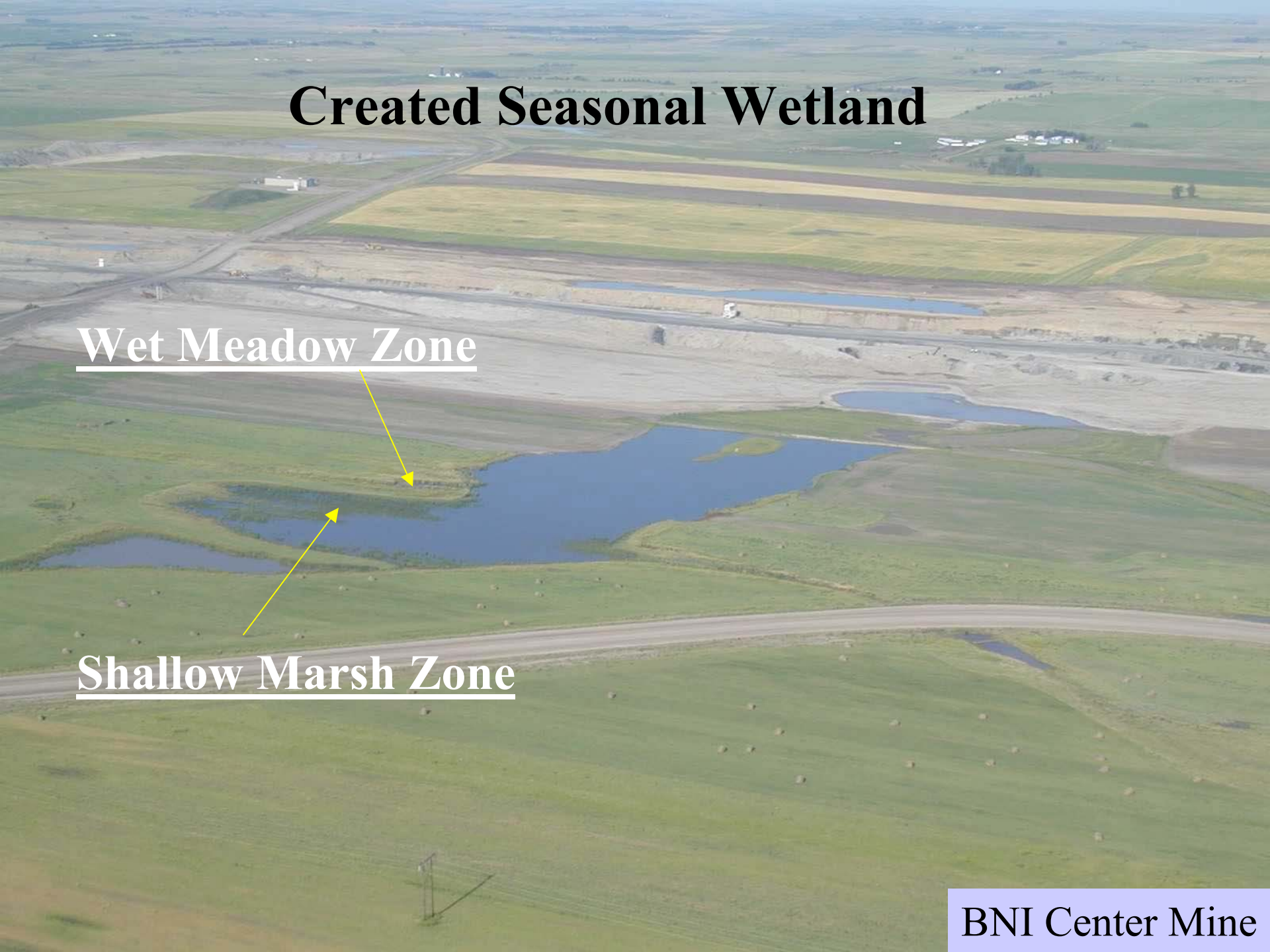
There are no specific performance standards
for ephemeral and temporary wetlands
Coteau Mine

Recreated Seasonal Wetland

For final bond release reclaimed wetlands must hold water and be established with the desired vegetation

Coteau Mine

Created Seasonal Wetland



BNI Center Mine

Reclaimed Seasonal Wetland at the Falkirk Mine

Vegetation zones are mapped and a species list is prepared during the last 3 years of the liability period.

The wetland must exhibit characteristics of the wetland class it was designed to become.

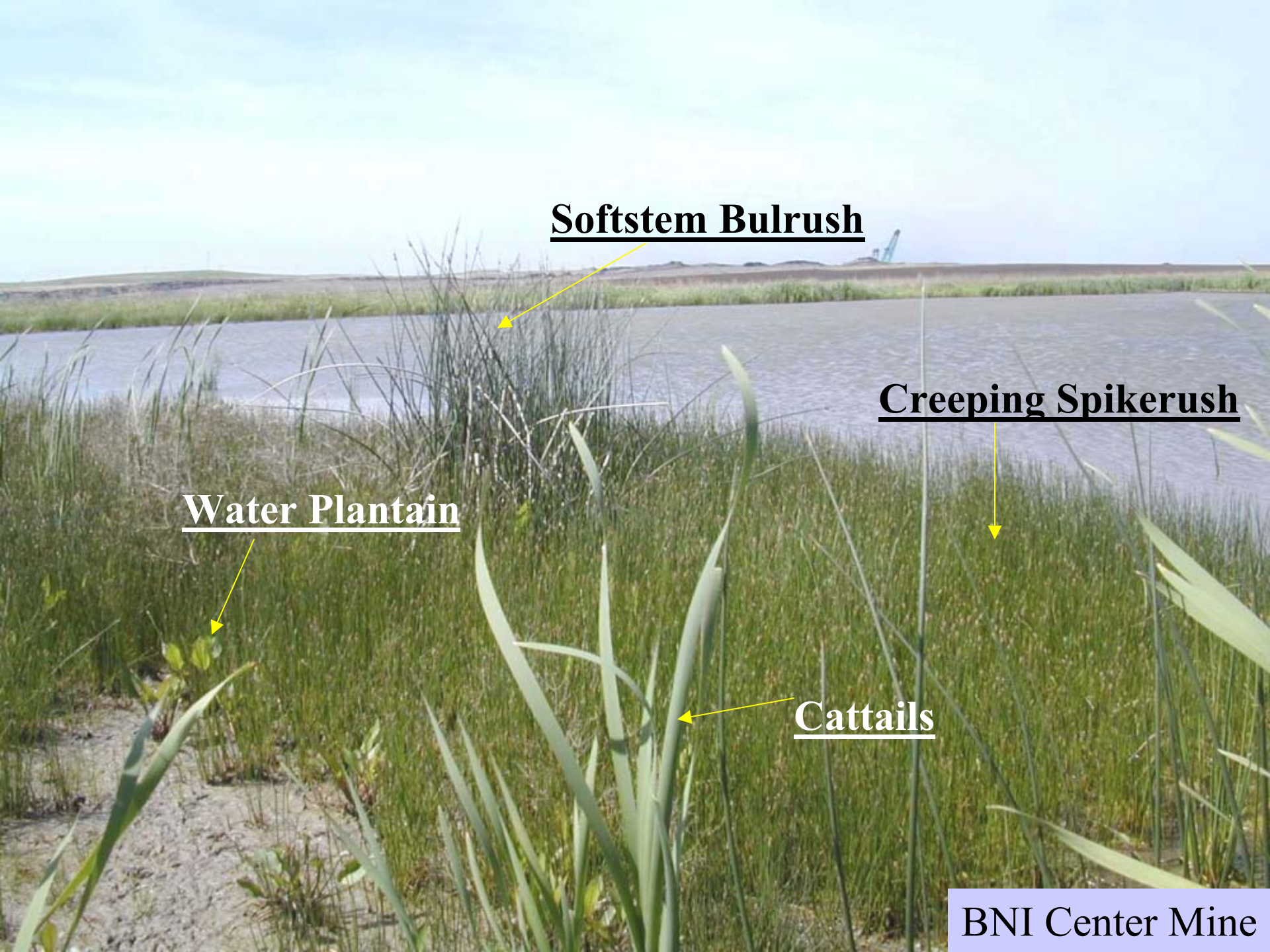
The wetland must be operating as a natural system.

Falkirk Mine

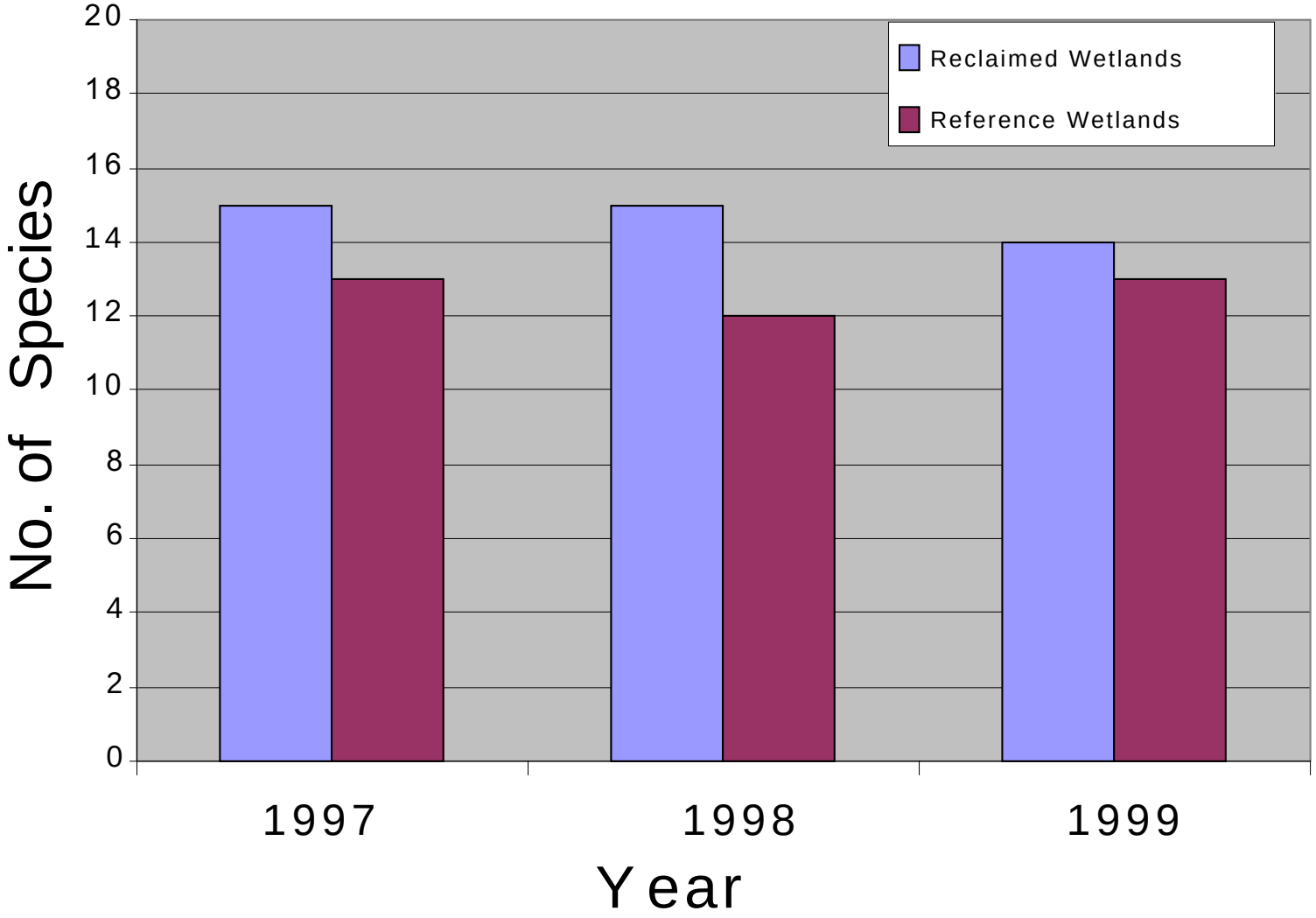
From my observations, re-created wetlands are becoming successfully revegetated.

Seasonal wetland: Cattails and bulrush establishing.

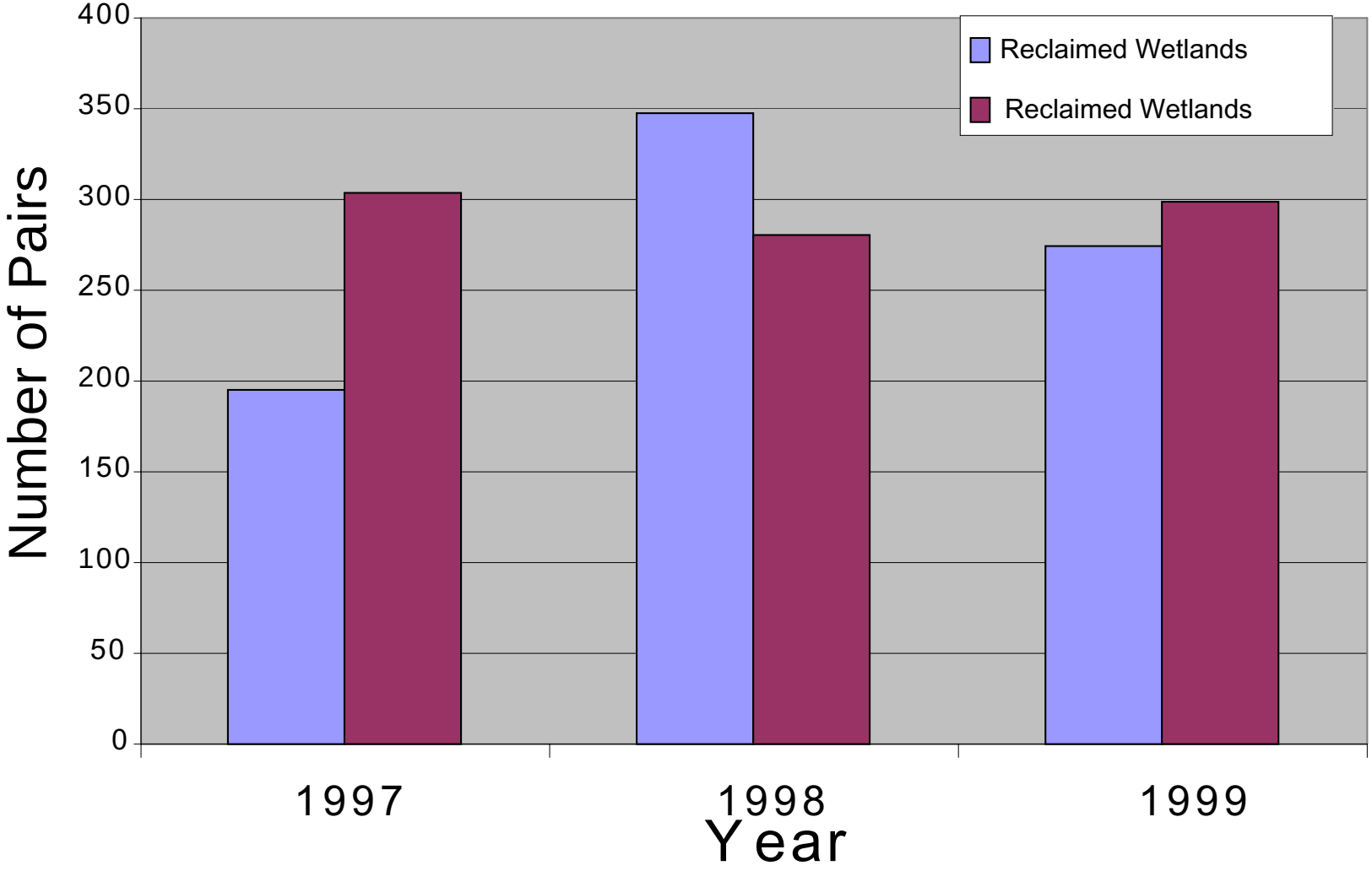
BNI Center Mine


Softstem Bulrush
Creeping Spikerush
Water Plantain
Cattails
BNI Center Mine

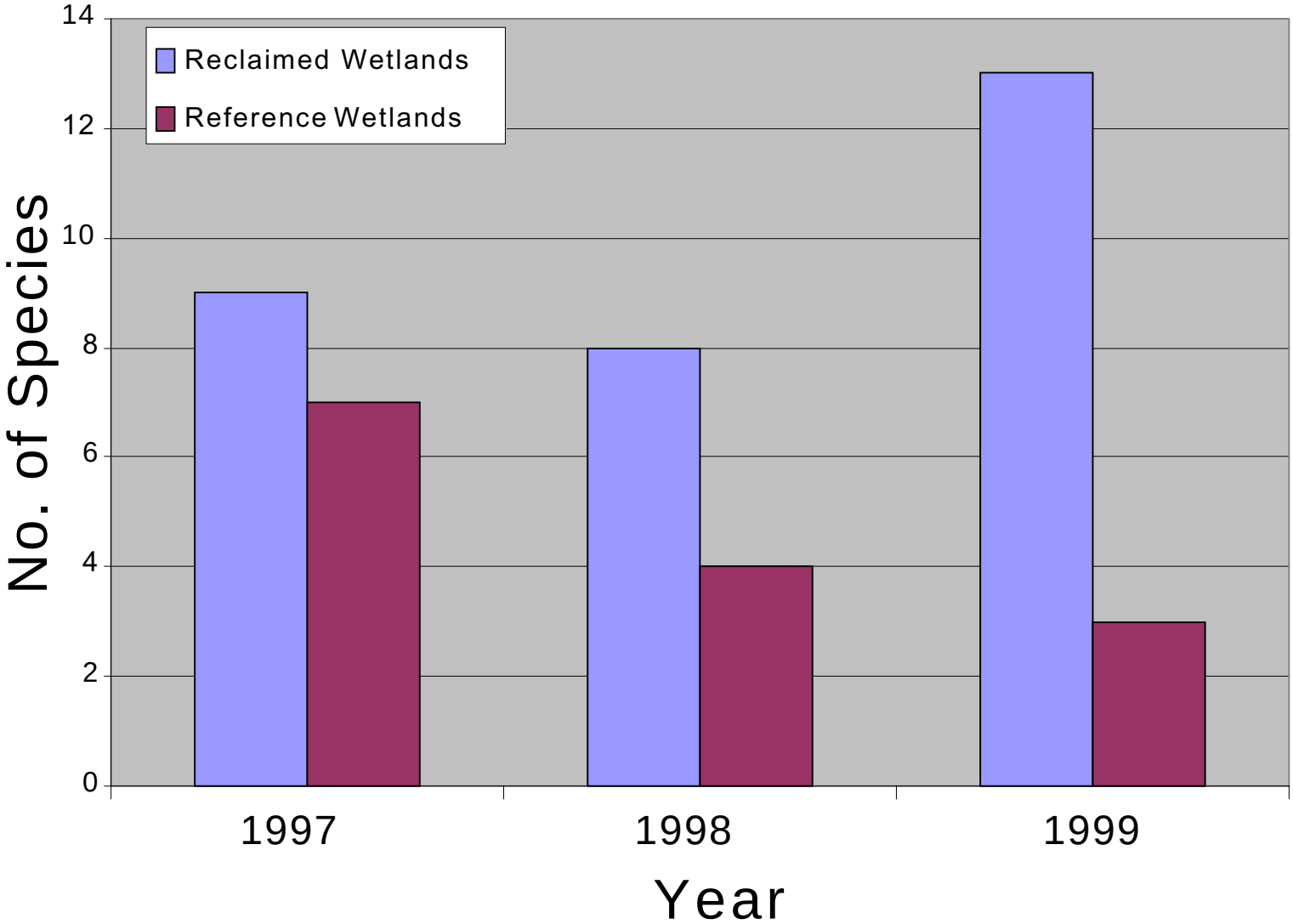
Waterfowl Observations at the Falkirk Mine



Waterfowl Observations at the Falkirk Mine

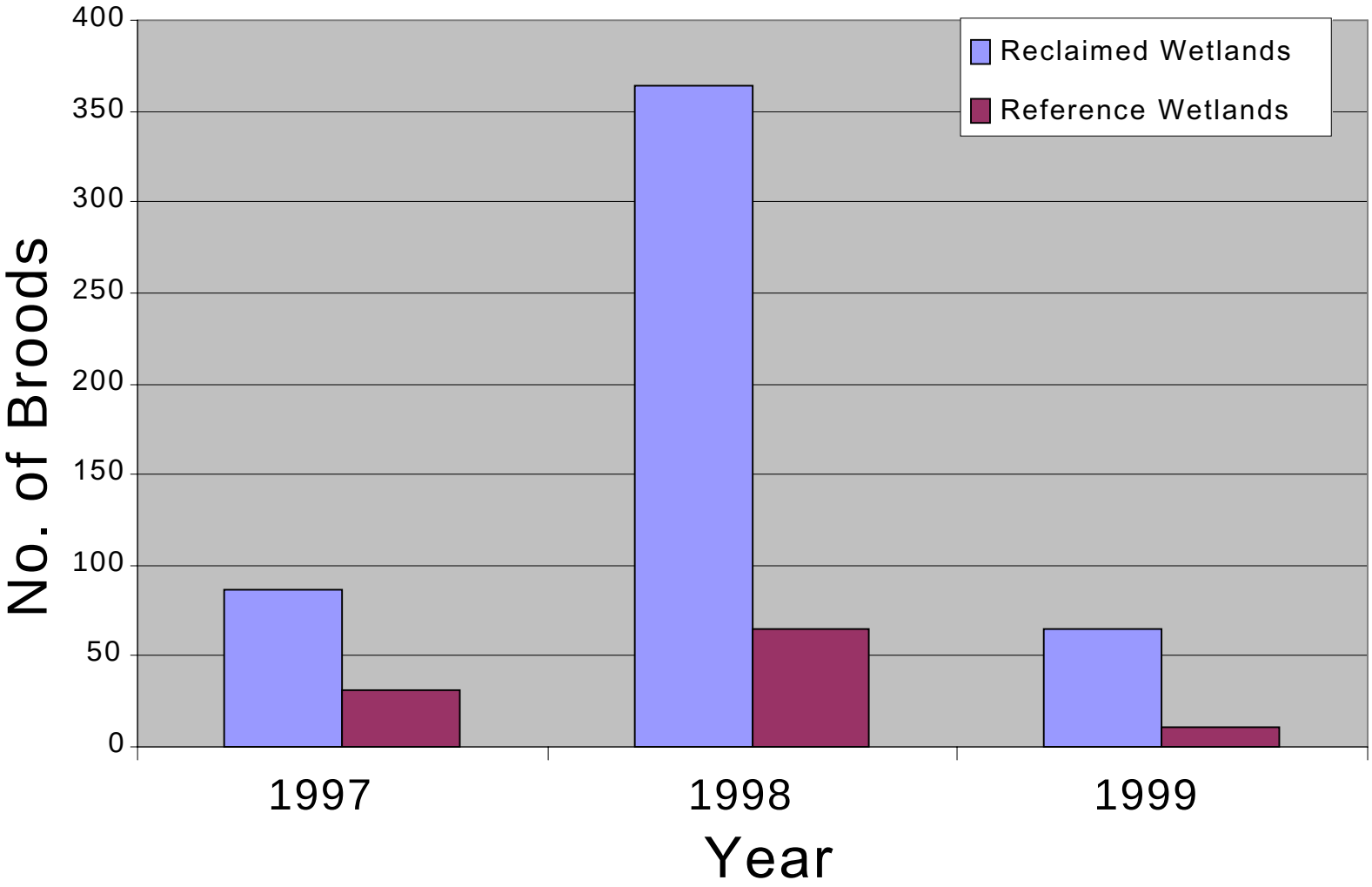


Brood Observations at the Falkirk Mine



On average there were twice as many species with broods on the reclaimed wetlands compared to the reference wetlands.

Brood Observations at the Falkirk Mine



There were nearly 5 times as many broods observed on reclaimed wetlands.

Brood success may be attributed to the high quality habitat surrounding the wetlands - precropland, buffer zone, properly managed.

Wetlands provide protection and winter habitat for other species of wildlife.

Other wetland species, such as leopard frogs,are observed
in recreated wetlands.

The End

Glenharold Mine

Decker Reclamation

By: John D. Berry
Decker Coal Company

Presented at OSM Bond Release Forum
August 2001

Special Features in Reclamation

or

"If You Build It, They Will Come"

By: John D. Berry
Decker Coal Company

Presented at OSM Bond Release Forum
August 2001

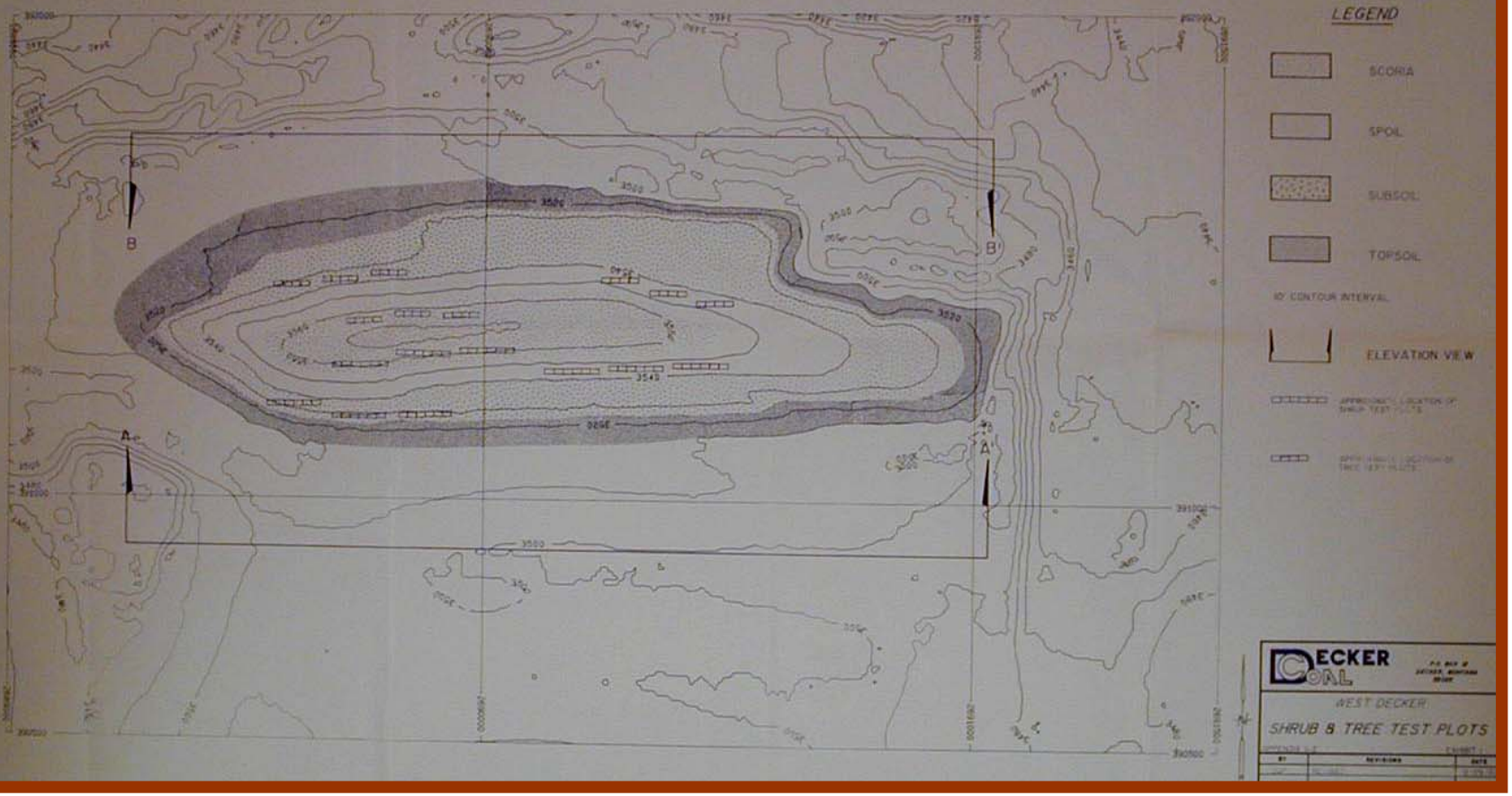
Two Approaches to Creating Special Features

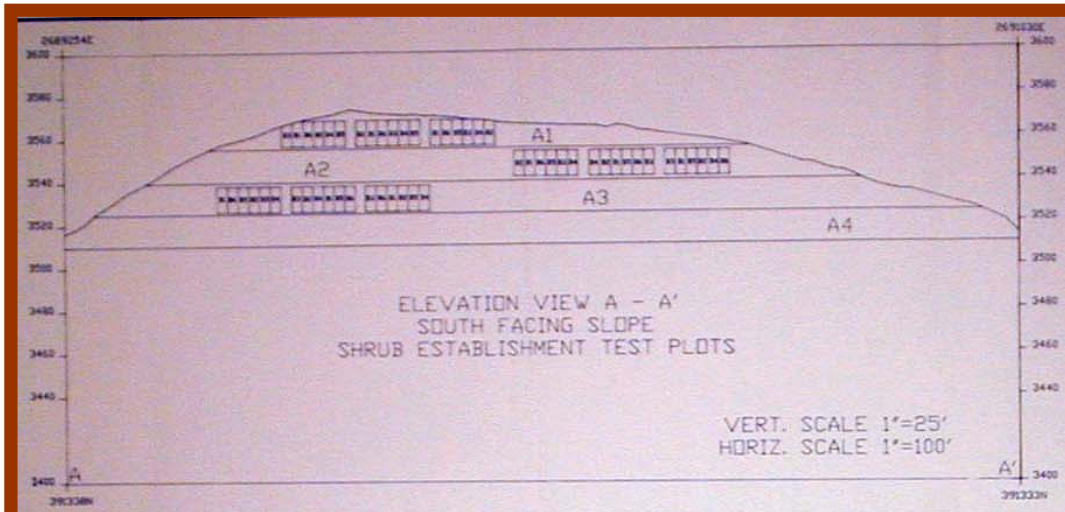
- Vegetation
- Topography

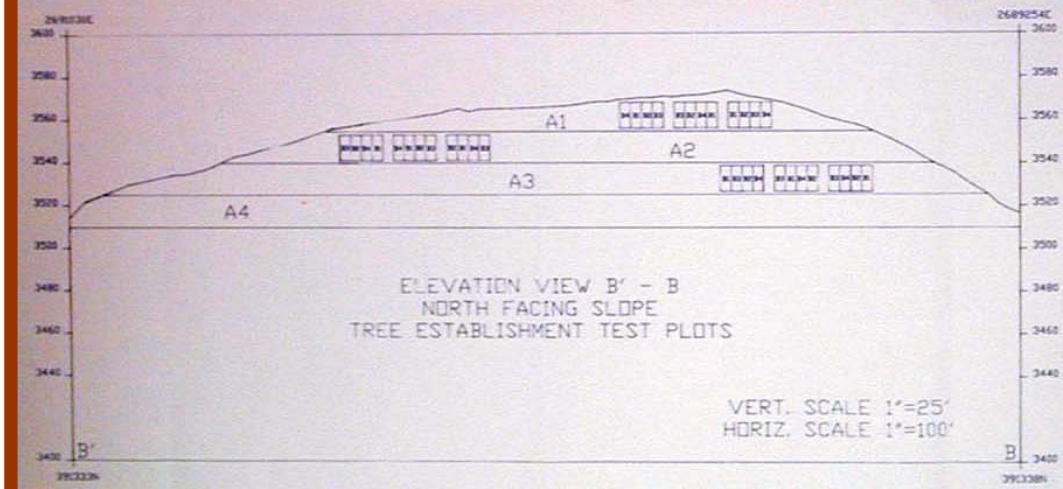
Vegetation and Special Features

- Can be features themselves
- Enhance topographic features

Critical Mule Deer Winter Range


LEGEND
SCORIA
SPOIL
SUBSOIL
TOPSOIL
10' CONTOUR INTERVAL
ELEVATION VIEW
DECKER COAL
WEST DECKER
SHRUB & TREE TEST PLOTS
A
A'
B
B'





LEGEND

A1	SCORIA GROWTH MEDIUM (24" DEPTH)
A2	SPOIL GROWTH MEDIUM
A3	SUBSOIL GROWTH MEDIUM (24" DEPTH)
A4	TOPSOIL GROWTH MEDIUM (15" DEPTH)

*** NOTE *** THIS GROWTH MEDIUM DOES NOT HAVE TEST PLOTS

SHRUB TEST PLOT TREATMENT

- B1 - BIG SAGEBRUSH SEED
- B2 - RUBBER RABBITBRUSH SEED
- B3 - SKUNKBUSH SUMAC SEED
- B4 - BIG SAGEBRUSH TRANSPLANTS
- B5 - RUBBER RABBITBRUSH TRANSPLANTS
- B6 - SKUNKBUSH SUMAC TRANSPLANTS

TREE TEST PLOT TREATMENT

- B1 - PONDEROSA PINE SEED
- B2 - ROCKY MTN. JUNIPER SEED
- B3 - PONDEROSA PINE TRANSPLANTS
- B4 - ROCKY MTN. JUNIPER TRANSPLANTS

TEST PLOT AND TREATMENT

*** NOTE *** EACH TREATMENT IS REPLICATED THREE TIMES IN EACH GROWTH MEDIUM

DECKER COAL

WEST DECKER

SHRUB & TREE TEST PLOTS

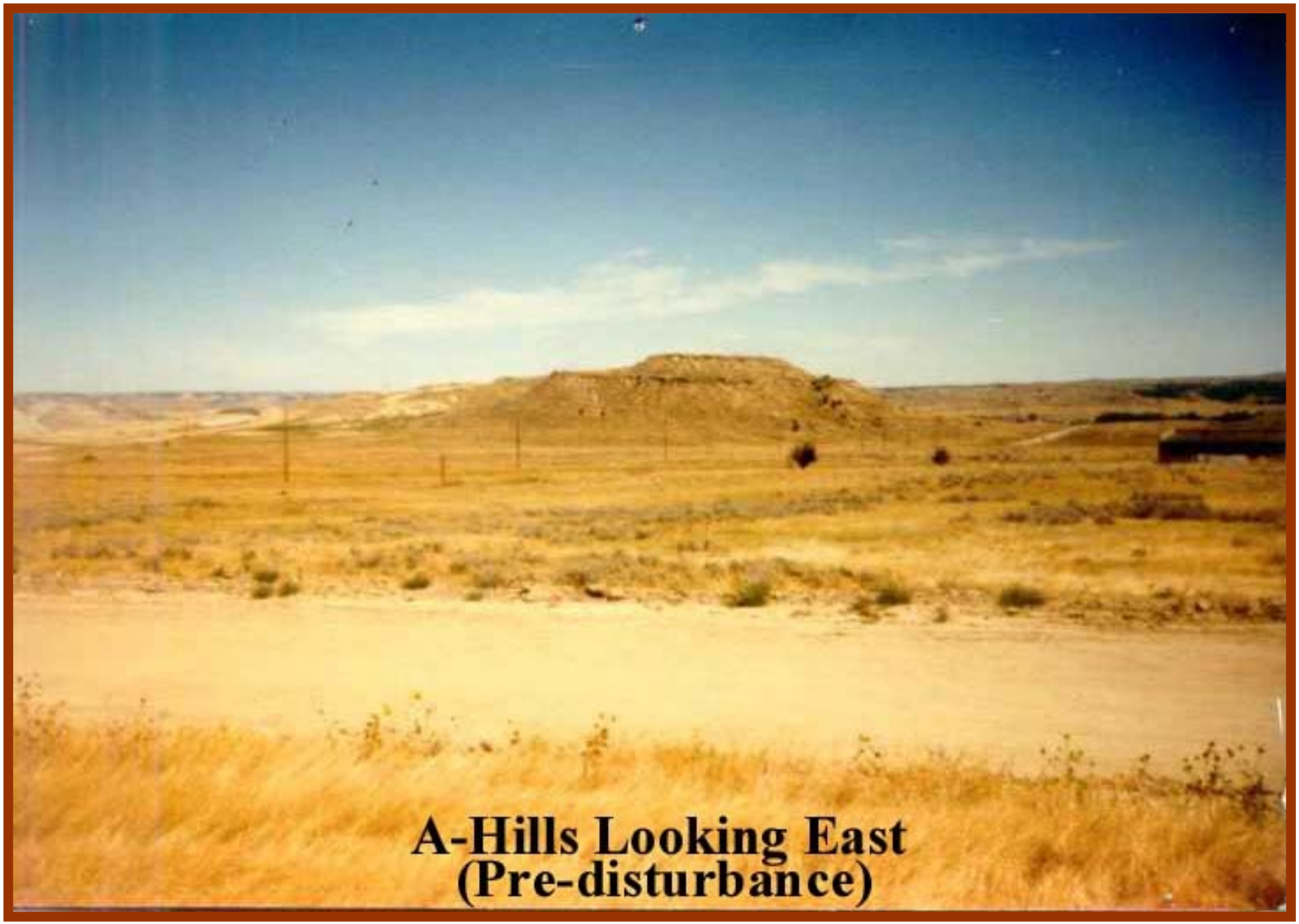
Mule Deer Test Plot Results

- Spoil worked well for juniper and shrub species transplants.
- Subsoil was too much like soil.
- Seed treatments were not successful (this time).
- Scoria worked well for all transplants.

Two Approaches to Creating Special Features

- Vegetation

- Topography

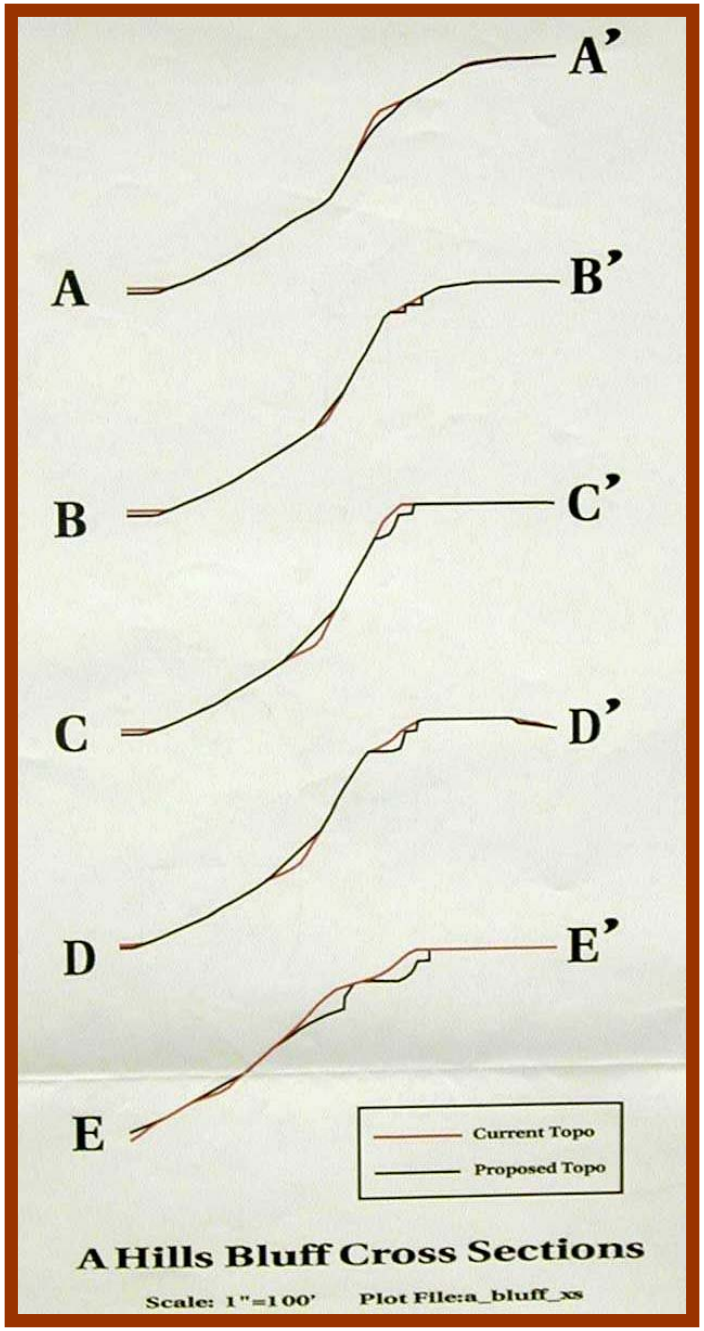


A-Hills Looking East
(Pre-disturbance)

A-Hills Looking East
(Prior to Reclamation)

A-Hills Bluff Special Feature

- Show that the concept was viable.
- Show that pre-mine features existed.
- Show that the feature blended in with native.
- Build the feature.


A'
A
B'
B
C'
C
D'
D
E'
E
Current Topo
Proposed Topo
A Hills Bluff Cross Sections
Scale: 1"=100'
Plot File:a_bluff_xs

A-Hills Bluff Special Feature

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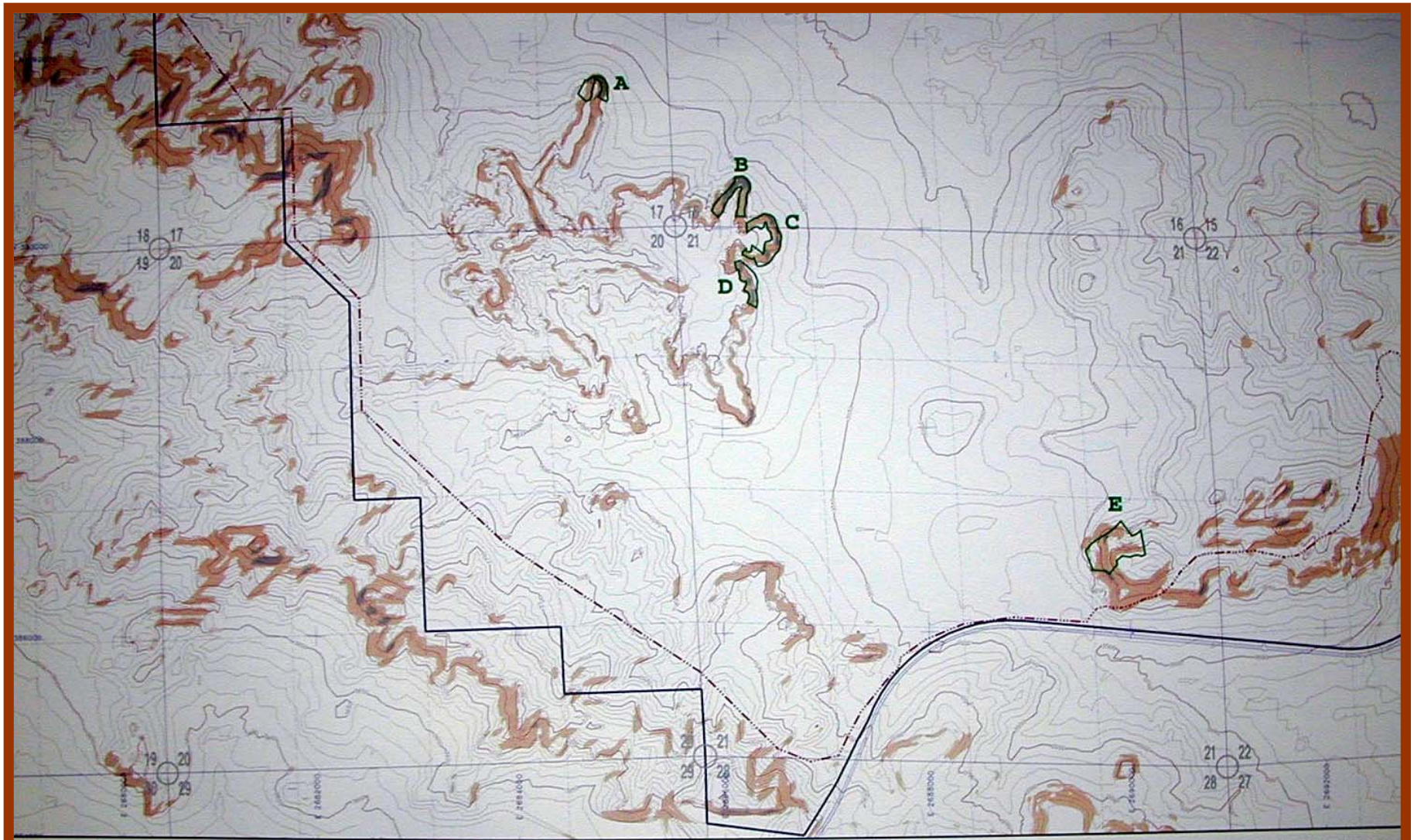

Permit Boundary

Disturbance Limit

	Acres	Average Gradient
Slopes Flat to 3:1	695.84	15.5 : 1
Slopes 3:1 to 1.5:1	196.69	2.3 : 1
Slopes 1.5:1 to 1:1	11.52	1.3 : 1
Slopes 1:1 and Steeper	2	0.9 : 1

7207.37 Total Permitted Acres (W of West Pit)

Specific Steep Slope Areas

Map ID	Slope Acres			Average Gradient			Feature Length			Average Vertical Height		
	1.5:1-3:1	1.3:1-1.5:1	1:1 and Steeper	1.5:1-3:1	1.3:1-1.5:1	1:1 and Steeper	1.5:1-3:1	1.3:1-1.5:1	1:1 and Steeper	1.5:1-3:1	1.3:1-1.5:1	1:1 and Steeper
A	.33	.25	0.17	1.8:1	1.3:1	0.9:1	160	80	176	50	50	57
B	.63	.82	0.05	1.8:1	1.3:1	0.9:1	250	455	50	45	47	50
C	1.15	.58	0.02	2.0:1	1.3:1	1.0:1	560	380	---	43	44	---
D	.54	.55	---	2.0:1	1.3:1	---	140	320	---	46	50	---
E	1.91	.26	0.04	2.1:1	1.3:1	0.9:1	445	20	30	38	30	30

I, THE UNDERSIGNED, HEREBY CERTIFY THAT THIS MAP IS CORRECT AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY THE MINING LAWS OF THE STATE OF MONTANA.

T.C. Reg. No. _____

NOTARY PUBLIC

SUBSCRIBED AND SWORN TO BEFORE ME THIS

_____ DAY OF _____

NOTARY PUBLIC FOR THE STATE OF MONTANA
RESIDING AT SHERIDAN, MONTANA
MY COMMISSION EXPIRES _____

T.R.S. R.W.E. I.R.S. R.W.E.

Big Horn County, MT

Precision Topographic Contour Interval = 10

FEET

A-Hills Bluff Special Feature

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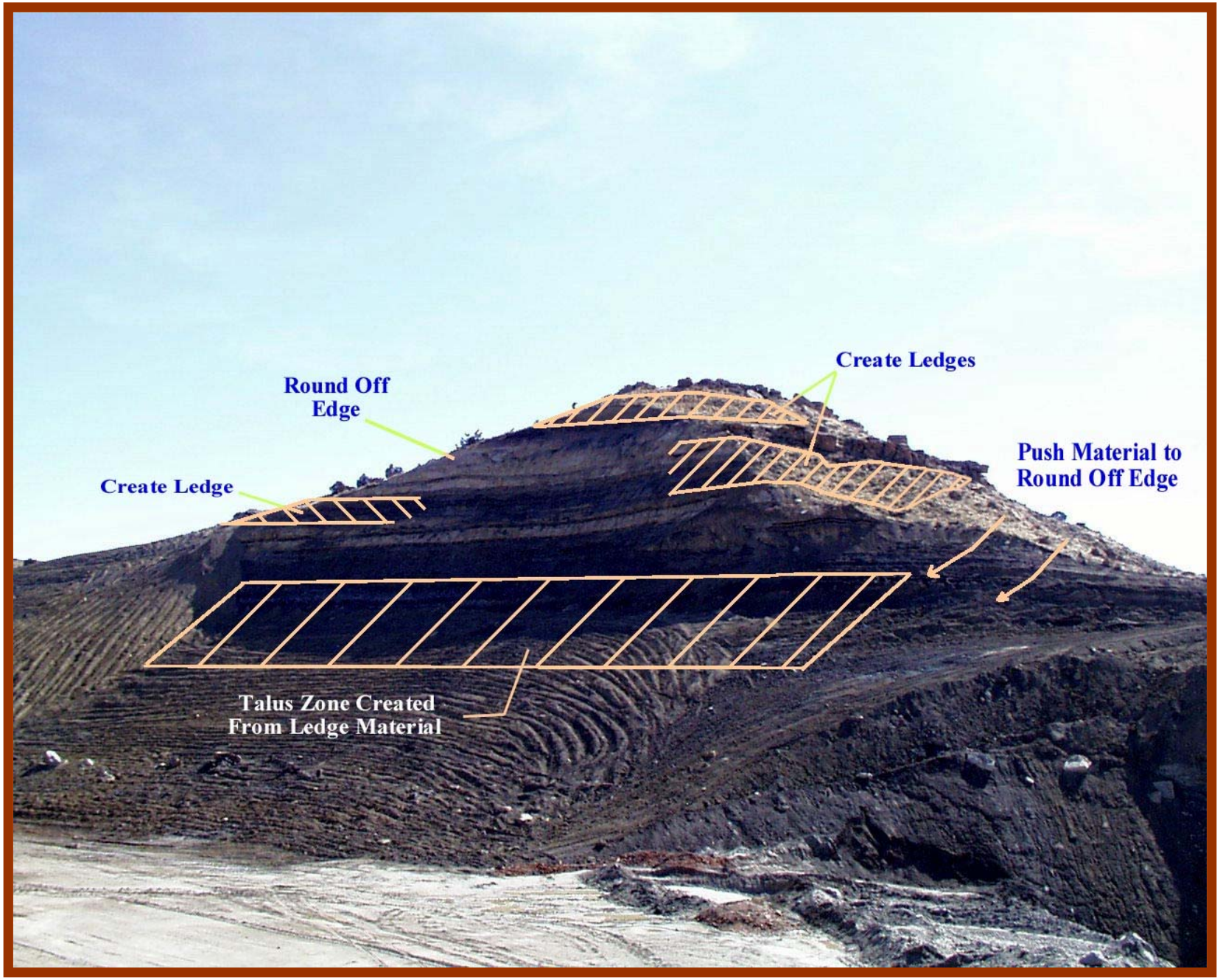
Create Ledges
Round Off Edge
Push Material to Round Off Edge
Create Ledge
Talus Zone Created From Ledge Material

A-Hills Bluff Special Feature

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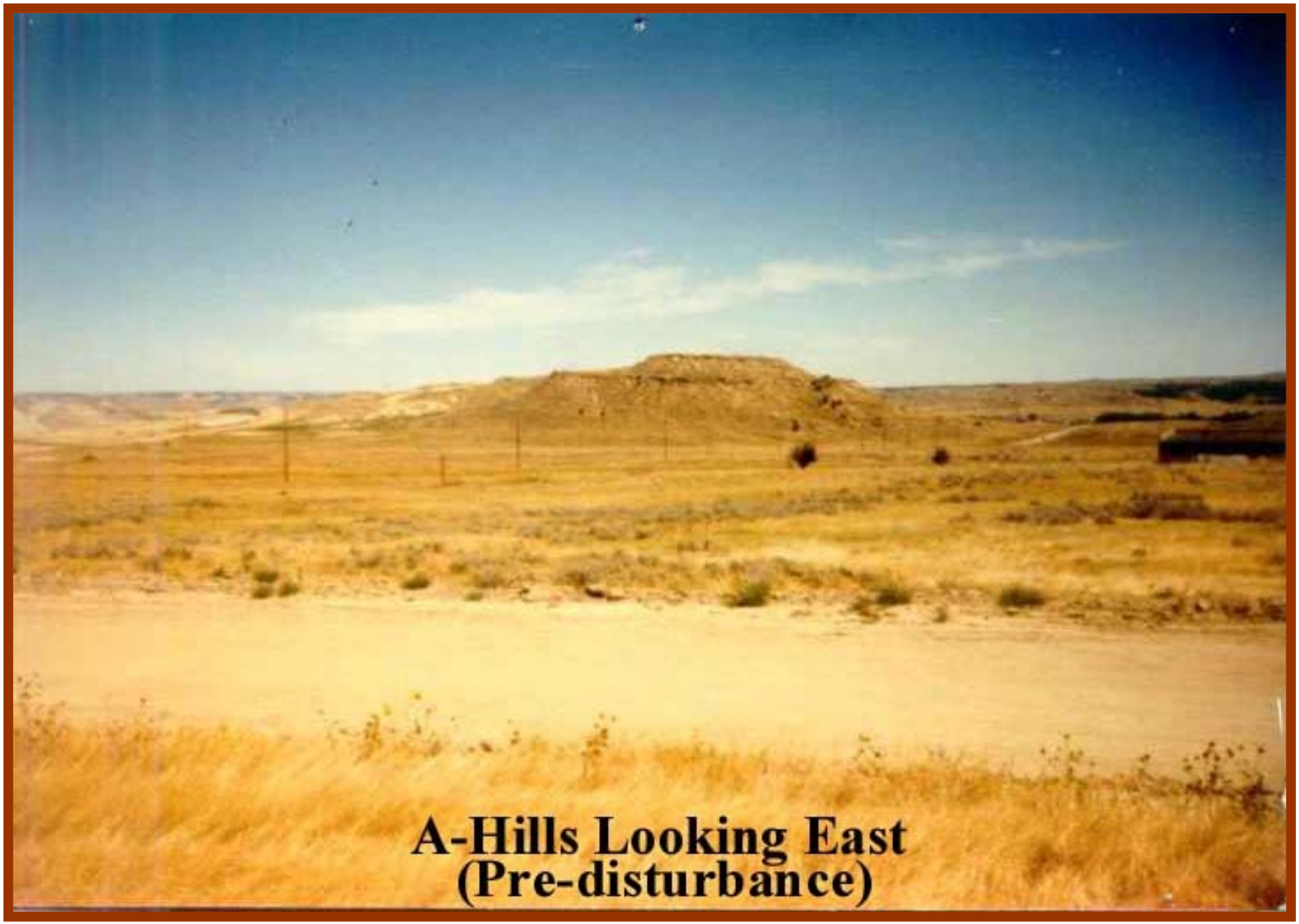

A-Hills Looking East
(Pre-disturbance)

A-Hills Looking East
(Prior to Reclamation)

New Special Feature Creation Techniques

NAVY