

Sage-Grouse R & R



Sage-Grouse Habitat Reclamation and Restoration Project
Wyoming Department of Environmental Quality, Abandoned Mine Land Division



Wyoming Abandoned Mine Land Division

- It is the mission of the Abandoned Mine Land Division to remediate safety hazards and environmental degradation resulting from past mining activities.
 - The Surface Mining and Reclamation Act of 1977, (SMCRA) created the Office of Surface Mining Reclamation and Enforcement (OSMRE) in the Department of the Interior.
 - OSMRE oversees and provides federal funding for the Wyoming Abandoned Mine Land Division (AML).



- The Restoration of Land and water resources and the environment previously degraded by adverse effects of coal mining practices including measures for the conservation and development of soil, water (excluding channelization), woodland, fish and wildlife, recreation resources, and agricultural productivity. (SMCRA, Title IV)

Wyoming AML Accomplishments

- 24,980 acres reclaimed as habitat and rangeland.
- 2,452 mine openings closed.
- 619,000 linear feet of high walls remediated.
- 195 acres of impaired stream land restored.
- Innovative reclamation approaches.
 - Geomorphic Reclamation.
 - Sage-Grouse Habitat Reclamation & Restoration.



Geomorphic Reclamation Vs. Traditional Reclamation

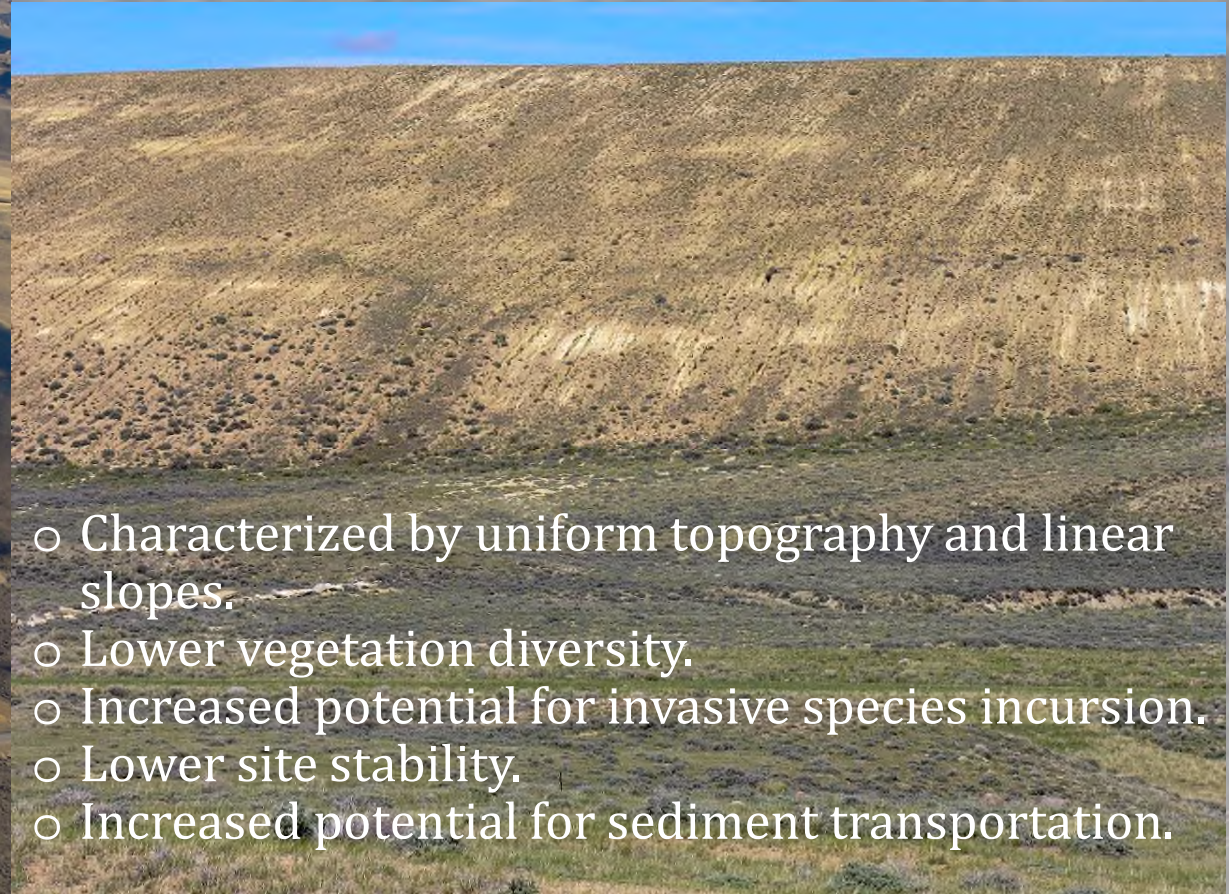
Geomorphic Reclamation

- Characterized by heterogeneous landforms that blend into surrounding landscapes.
- Increased vegetation diversity.
- Increased shrub establishment.
- Lower potential for invasive species incursion.
- Higher site stability.
- Controlled and lower sediment transportation.



Traditional Reclamation

- Characterized by uniform topography and linear slopes.
- Lower vegetation diversity.
- Increased potential for invasive species incursion.
- Lower site stability.
- Increased potential for sediment transportation.



Sage-Grouse Reclamation and Restoration

- In 2019 Governor Mark Gordon strengthened Wyoming's Sage-Grouse Core Area Management Strategy by adding habitat restoration and enhancement as a conservation priority (Exec. Order No. 2019-3).
 - AML identified this Executive Order as an opportunity to maximize reclamation outcomes by setting goals to establish functional sage-grouse breeding, brood rearing, and nesting habitats on large-scale geomorphic reclamation projects.
- AML's goal of designing and building sage-grouse breeding habitat, known as leks, on large-scale geomorphic projects is a lofty goal that requires an innovative reclamation approach.
 - Aimed at achieving objectives identified within the Governor's Executive Order, with the additional goal of expanding the greater sage-grouse range.



Existing Data

- Vegetation requirements to support the sage-grouse life cycle.
- Importance of acoustic communications of male sage-grouse and female mate selection.
- Detrimental effects of anthropogenic noise and lek population dynamics.
- Mapping functional properties of cover for prey with terrestrial LiDAR.
- Predictive modeling of sage-grouse habitat use during the breeding season.



Interdisciplinary Team

- AML Division.
- AML Native Plants Project (AML NPP).
- Dr. Matt Holloran.
 - Dr. Holloran is a research ecologist with over 20 years of experience specializing in the study of sagebrush-dependent wildlife species with an emphasis on sage-grouse, and has been instrumental in leading AML's sage-grouse habitat restoration efforts.
- Environmental Consultancies; Abnova Ecological Solutions, BRS Engineering, Herrera Environmental, Operational Conservation, Tetra Tech, & Trihydro.
- Governmental Partners; OSMRE, The Wyoming Bureau of Land Management, and The Wyoming Game and Fish Department.
- NGO's; The Institute for Applied Ecology and The Nature Conservancy in Wyoming (TNC).



Four-Phase Project Approach

Designed as a multi-phased, multi-year project to develop, implement, and record a standardized, repeatable method that AML can share with industry, land managers, and restoration ecologists throughout the sagebrush steppe.

- **Phase 1:** Lek Sampling.
- **Phase 2:** Design and construction of functional sage-grouse breeding, brood rearing, and nesting habitat on large-scale geomorphic reclamation projects.
- **Phase 3:** Site monitoring.
- **Phase 4:** Sage-grouse range expansion.



Phase 1: Lek Sampling

- Measurement of the abiotic and biotic attributes associated with the most successful leks(34) within a spatially and ecologically relevant proximity (16.6 km) to AML geomorphic reclamation projects.

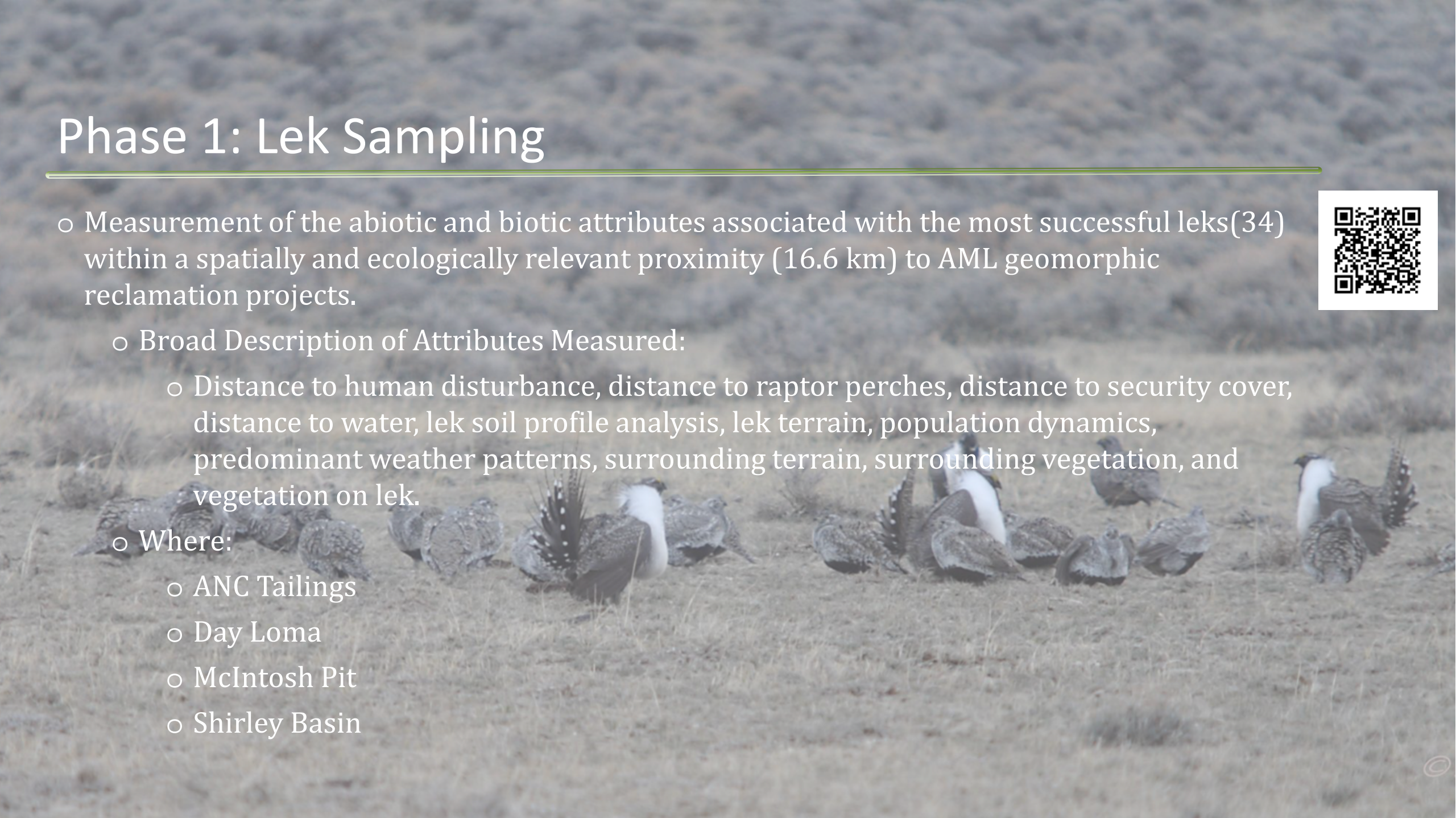


- Broad Description of Attributes Measured:

- Distance to human disturbance, distance to raptor perches, distance to security cover, distance to water, lek soil profile analysis, lek terrain, population dynamics, predominant weather patterns, surrounding terrain, surrounding vegetation, and vegetation on lek.

- Where:

- ANC Tailings
- Day Loma
- McIntosh Pit
- Shirley Basin



Phase 1: Lek Sampling

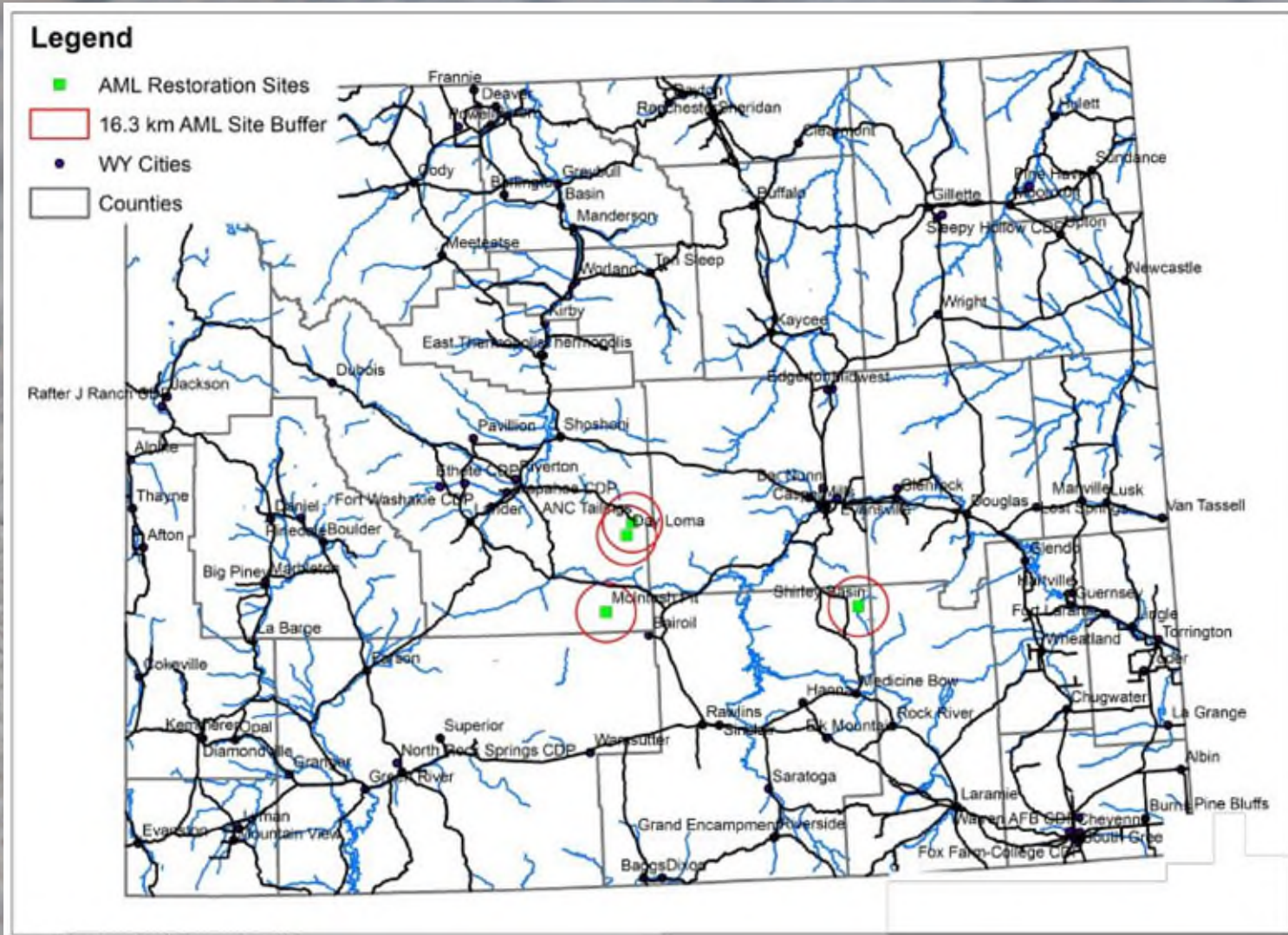
- In addition to the well documented biotic habitat requirements of sage grouse, the team theorized the most successful leks will have abiotic properties best described as a natural amphitheater or sports stadium where ambient and detrimental noise are mitigated, visibility is increased, and where male vocalizations can carry the farthest distance across the landscape.
 - It has been observed that the dominant males will occupy the most prominent locations within a lek such as raised mounds.



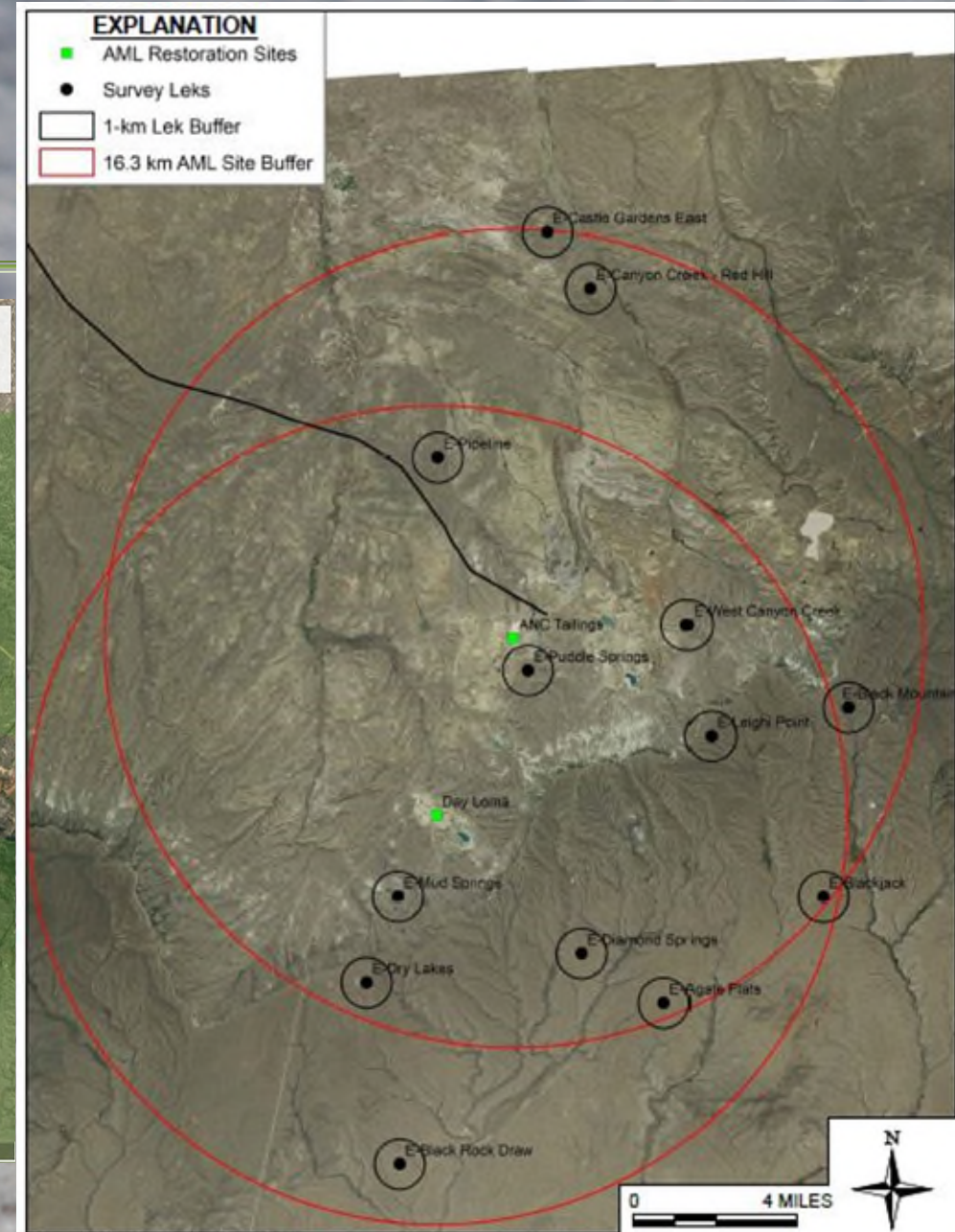
- Performers are lighted with natural lighting (male grouse).
- Sound propagates from the stage (Lek).
- The fans watch from sagebrush bleachers (female grouse).



Phase 1: Lek Sampling

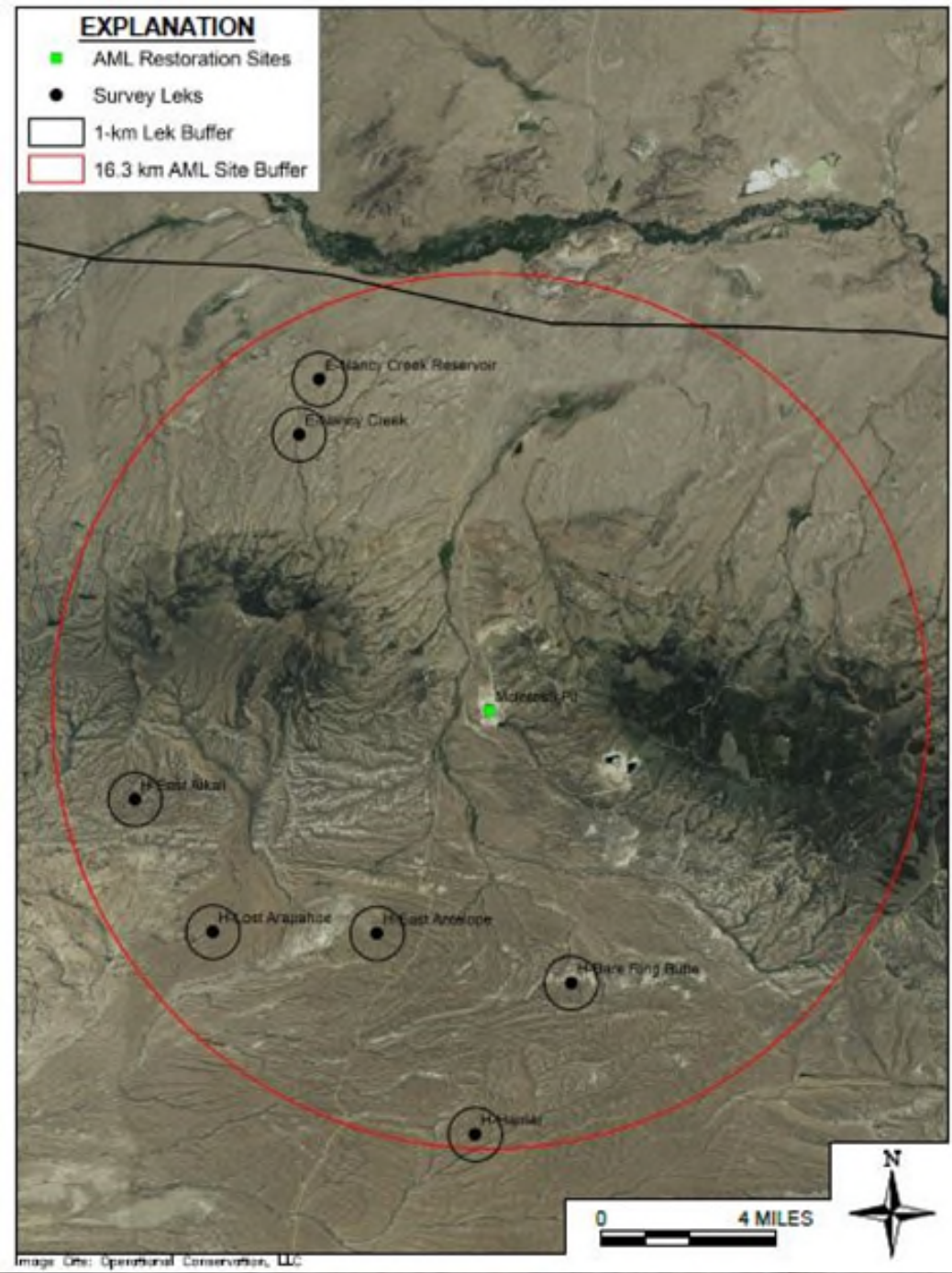


Phase 1: Lek Sampling: Gas Hills

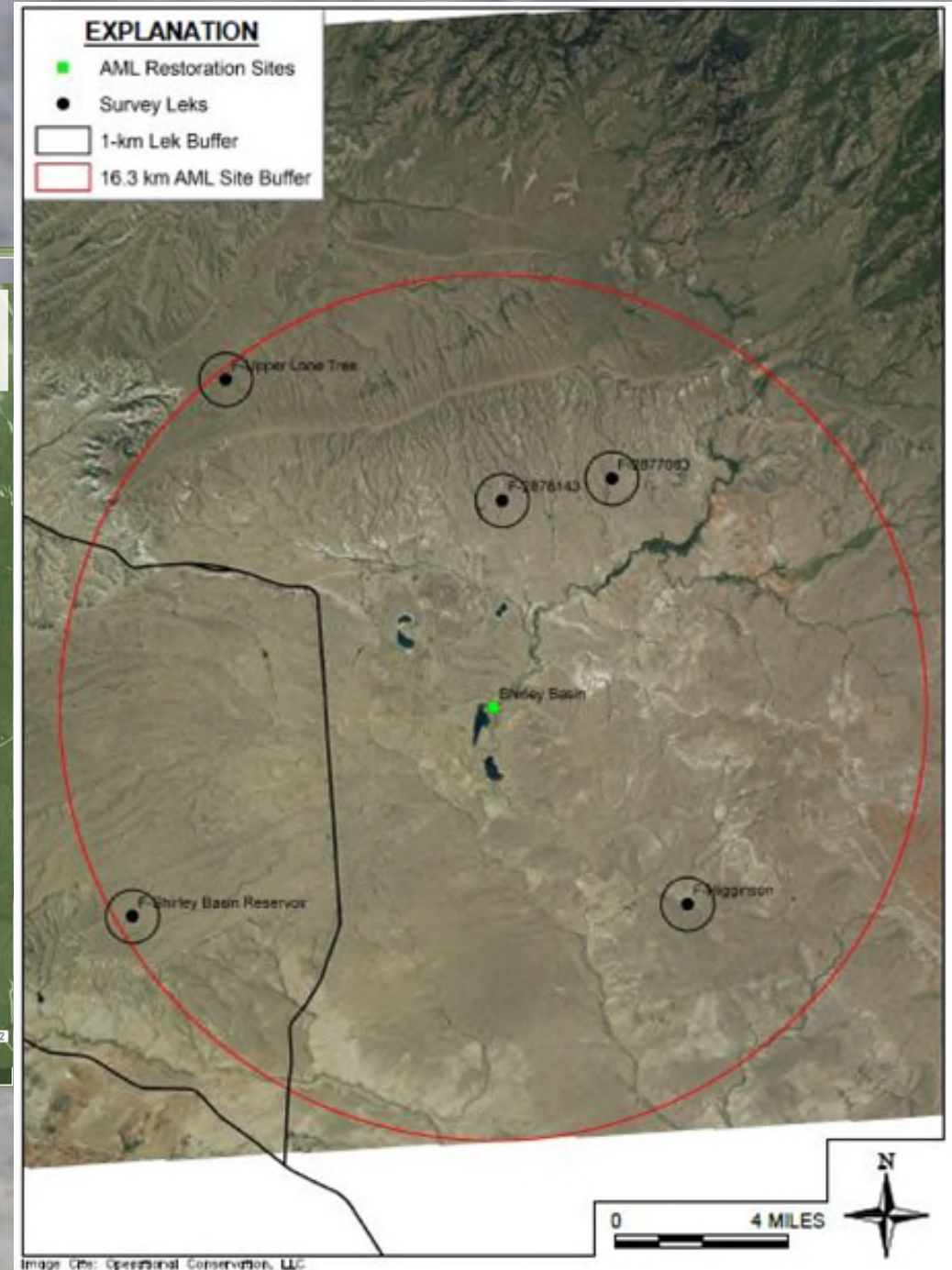


DETAILED MAP OF AREA WITHIN 16.3 KM OF ANC TAILINGS AND DAY LOMA AML RESTORATION SITES IN CENTRAL WYOMING. BASE IMAGERY IS 2017 NAIP DIGITAL ORTHO PHOTOS.

Phase 1: Lek Sampling: Green Mountain



Phase 1: Lek Sampling: Shirley Basin



General Characteristics of Greater Sage-Grouse Leks Within 16.3 km of AML Geomorphic Project Sites

Variable	Full Data Set
Size of Strutting Area	15 Acres
Slope	100%, 0-5% Slope
Aspect	36% N (NW, N, NE), 32% E (SE, E, NE), 16% S (SW, S, SE), 20% W (SW, W, NW)
Lek Location	40% Ridge, 28% Flats, 12% Slope, 8% Bowl, 12% Bottom
Lek Description	36% Shrub Dominated, 36% Small Clearing (≤ 25 m Diameter), 28% Large Clearing (≥ 25 m Clearing)
Level of Lek Convex	56% Slightly Raised , 12% Raised, 32% Level
Lek Surface Vegetation	60% Low Herbaceous , 20% Low Shrub, 16% Tall Shrub, 4% Dirt
Distance to Security Cover	54 M
Water Within 1 km	84% Ephemeral , 16% Open Water
Distance to Closest Water	419 m

General Characteristics of Greater Sage-Grouse Leks Within 16.3 km of AML Geomorphic Project Sites

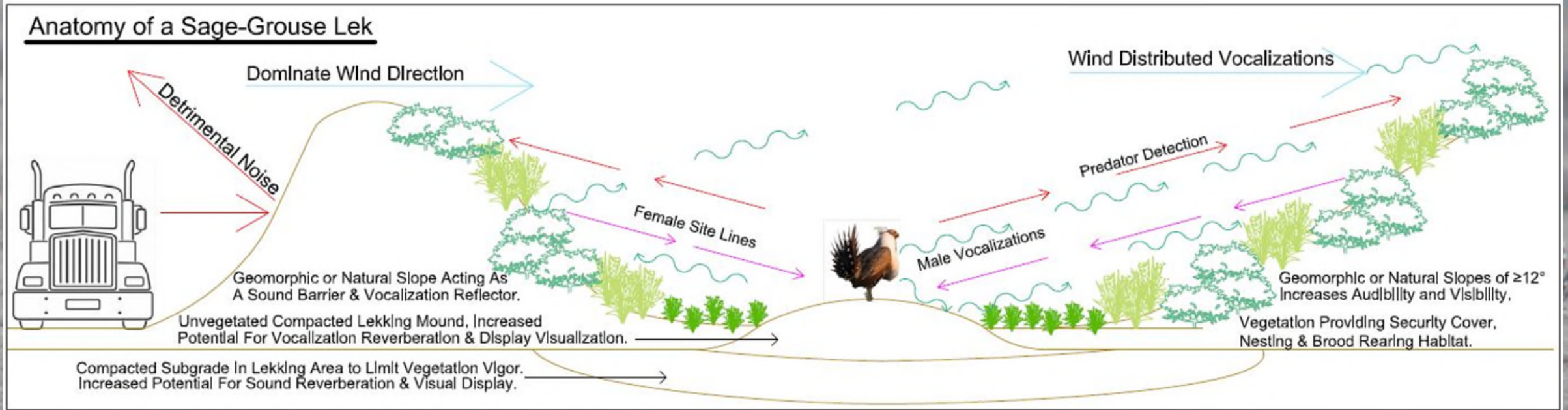
Detrimental Variable	Full Data Set
Raptor Perch Within 1 km	56% Man-Made , 44% Natural
Distance to Raptor Perch	527 m
Fence Within 1 km	775 4-Wire Metal Posts, 15% Electric Metal Posts, 8% 4-Wire Wood Posts
Distance to Fence	519 m
Human Activity Within 1 km	67% Mine, 33% agricultural infrastructure
Distance to Closest Human Activity	584 m
Road Within 1 KM	95% 2-Track, 5% Improved Surface Gravel
Distance to Closest Road	189 m
High Use Road Within 1 KM	100% Improved Surface Gravel
Distance to Closest High Use Road	589 m

General Characteristics of Greater Sage-Grouse Leks Within 16.3 km of AML Geomorphic Project Sites

Variable	Full Data Set
Sagebrush Within 1 km	89%
Dense/Tall Sagebrush Within 1 km	63%
Terrain Above Level of Lek Within 1 km	55% N (NW, N, NE), 25% E (SE, E, NE), 50% S (SW, S, SE), 80% W (SW, W, NW)
Terrain Below Level of Lek Within 1 km	19% N (NW, N, NE), 52% E (SE, E, NE), 48% S (SW, S, SE), 33% W (SW, W, NW)



General Characteristics of A Greater Sage-Grouse Lek



Phase 2: Design and Construction of Functional Sage-Grouse Habitat. Shirley Basin 400 Pile and Beyond



Phase 2: Design and Construction of Functional Sage-Grouse Habitat. Shirley Basin 400 Pile

- Pilot project.
- Sage-grouse core area.
- Large open-pit uranium mining from 1960-1980.
- Historic contributor to sage-grouse habitat fragmentation.
- Private landowner partnership. Todd Heward and the 7E Ranch
- Four primary goals.
 - Reduce hazards.
 - Reduce environmental degradation.
 - Increase livestock and wildlife forage.
 - Establish functional sage-grouse breeding, brood rearing, and nesting habitats on large-scale geomorphic reclamation projects.



Phase 2: Design and Construction of Functional Sage-Grouse Habitat. Shirley Basin 400 Pile

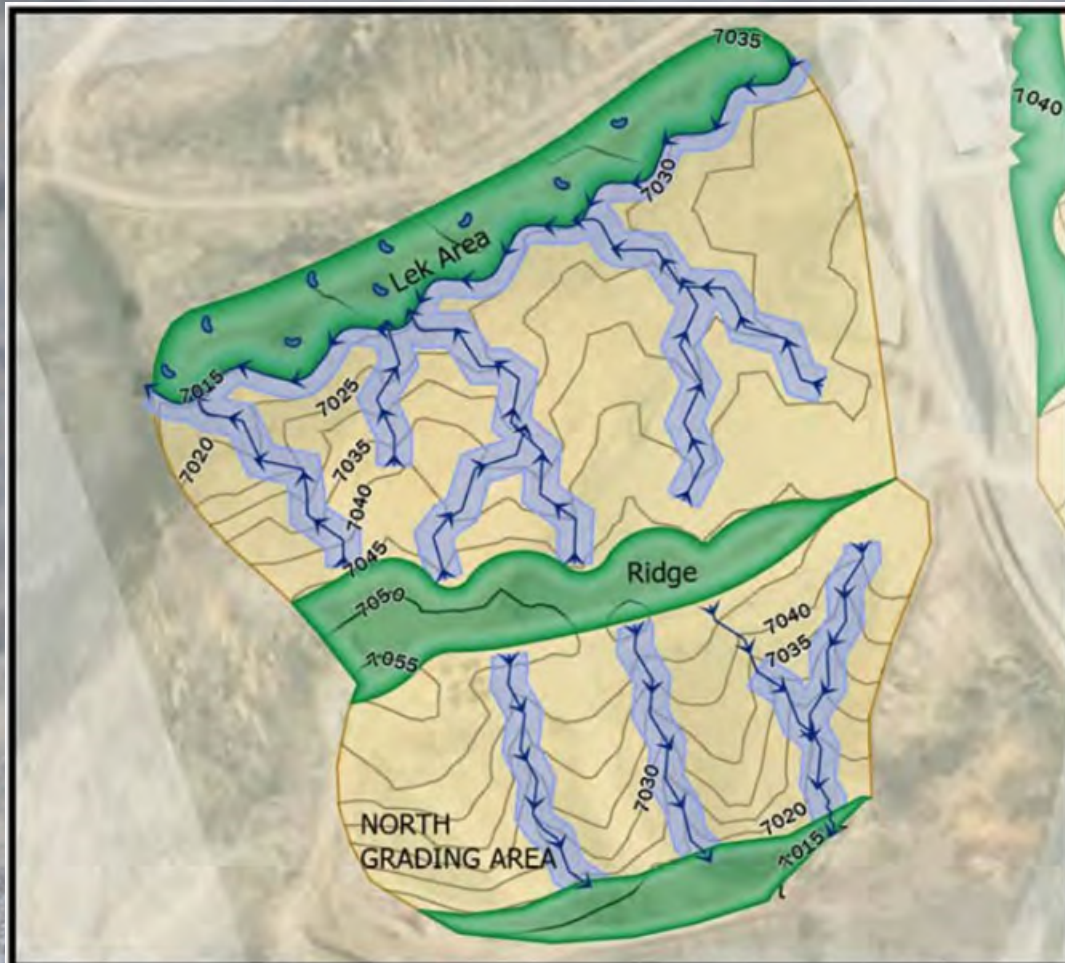
- Overall plan to realize objectives identified within AML's Sage-Grouse Habitat Implementation Plan and lek sampling efforts.
 - Establish tall (≥ 18 cm), dense ($\geq 20\%$ canopy) sagebrush dominated security cover.
 - Western terrain above lek elevation.
 - Southern terrain below lek elevation.
 - Eastern terrain below lek elevation.
- Locate lek on a slight ridge, broad flat, or gentle slope.
- Size lek ≥ 2 acres with strutting mounds.
- Establish security cover within 156 m of lek.
- 60% herbaceous vegetation canopy cover within 30 m of lek, ≤ 18 cm in height.
- $\leq 18\%$ bare ground within 30 m of lek.



Phase 2: Design and Construction of Functional Sage-Grouse Habitat. Shirley Basin 400 Pile

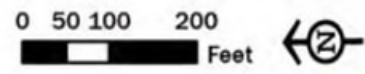
- Geomorphic design establishing landscape heterogeneity.
- Geomorphic design establishing the ecological soundscape.
- Vegetation plan to establish functional sage-grouse breeding, brood rearing, and nesting habitats.
 - Success hinges on detailed execution of the vegetation plan and site monitoring.
 - Wyoming AML Vegetation & Evaluation Standards (WAVES).





-  Lek mounds - No vegetation
-  Drainage path
-  5 ft Design Contour
- Planting Areas**
-  Lek/Lowland/Ridge Planting Mix
-  Upland Channel Planting Mix
-  Upland Planting Mix

Planting Plan and Grading Areas.



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Aerial: MAXAR 2020

Shirley Basin Lek Seed Mix, ESDs RO34AY304WY, RO34AY312WY

Species	Scientific Name	Seeds/ft ² @ 1lbs/ac	Target Seeds/ft ²	% of Mix Planned	PLS/ft ²	Target PLS lbs/ac	Application , Slope & Soil Factor	Acres	Total PLS Lbs/Ac	Seed Size & Type	Hopper Box	Carrier Agent	Carrier to Bulk Seed Ratio	Target Seed Depth Inches
Bluebunch Wheatgrass	Pseudoroegneria spicata	3.2	22.0	10.0%	2.2	0.69	2	1	1.38	Medium	Drill	Rice Hulls	1:1	≤1/2
Western Wheatgrass	Pascopyrum smithii	2.5	22.0	7.0%	1.5	0.62	2	1	1.23	Medium	Drill	Rice Hulls	1:1	≤1/2
Green Needlegrass	Nassella viridula	4.2	22.0	13.0%	2.9	0.68	2	1	1.36	Medium	Drill	Rice Hulls	1:1	≤1/2
Bottlebrush Squirreltail	Elymus elmoides	4.4	23.0	13.0%	3.0	0.68	2	1	1.36	Medium	Drill	Rice Hulls	1:1	≤1/2
Blue Gramma	Bouteloua gracilis	18.9	30.0	10.0%	3.0	0.16	2	1	0.32	Small	Fluffy	Rice Hulls	3:1	≤1/4
Sandberg Bluegrass	Poa Secunda	24.0	45.0	7.0%	3.2	0.13	2	1	0.26	Small	Legume	Kitty Litter	2:1	≤1/4
QuickGuard Sterile Triticale	Triticale	0.3	15.0	4.0%	0.6	2.00	2	1	4.00	Medium	Drill	Rice Hulls	1:1	≤1/2
Candian Milkvetch	Astragalus canadensis	5.2	23.0	9.0%	2.1	0.40	2	1	0.80	Medium	Drill	Rice Hulls	1:1	≤1/2
White Clover	Trifolium repens	19.5	30.0	9.0%	2.7	0.14	2	1	0.28	Small	Legume	Kitty litter	2:1	≤1/4
Sulphur Buckwheat	Eriogonum umbellatum	3.9	22.0	9.0%	2.0	0.51	2	1	1.02	Medium	Drill	Rice Hulls	1:1	≤1/2
Scarlet Globemallow	Sphaeralcea coccinea	11.5	26.0	9.0%	2.3	0.20	2	1	0.41	Medium	Drill	Rice Hulls	1:1	≤1/2
Totals				100.0%	25.4	6.20	2	1	12.40					

SEEDING RATE NOTES: RATE ADJUSTMENTS HAVE BEEN ACCOUNTED FOR

A. PLS/Ft² is designed for a full drill seeding based on a 12 inch row spacing.

B. Total PLS Lbs /Ac Needed must be adjusted when drill spacing is not equal to 12 inches apart.

C. PLS/Ft² shall be doubled when a broadcast or hydro-seeding is implemented.

D. PLS/Ft² shall be doubled when germination is inhibited by low soil quality.

E. PLS/Ft² shall be quadrupled when a broadcast or hydro-seed application is done in a critical area.

Shirley Basin Upland Seed Mix, ESDs RO34AY304, RO34AY312, RO34AY326

Species	Scientific Name	Seeds/ft ² @ 1lbs/ac	Target Seeds/ft ²	% of Mix Planned	PLS/ft ²	Target PLS lbs/ac	Application , Slope & Soil Factor	Acres	Total PLS Lbs/Ac	Seed Size & Type	Hopper Box	Carrier Agent	Carrier to Bulk Seed Ratio	Target Seed Depth Inches
Bluebunch Wheatgrass	Pseudoroegneria spicata	3.2	22.0	15.0%	3.3	1.03	3	1	3.09	Medium	Drill	Rice Hulls	1:1	≤1/2
Western Wheatgrass	Pascopyrum smithii	2.5	22.0	8.0%	1.8	0.70	3	1	2.11	Medium	Drill	Rice Hulls	1:1	≤1/2
Green Needlegrass	Nassella viridula	4.2	22.0	8.0%	1.8	0.42	3	1	1.26	Medium	Drill	Rice Hulls	1:1	≤1/2
Needle and Thread Grass	Hesperostipa comata	2.6	22.0	8.0%	1.8	0.68	3	1	2.03	Medium	Drill	Rice Hulls	1:1	≤1/2
Basin Wildrye	Leymus cinereus	3.0	22.0	8.0%	1.8	0.59	3	1	1.76	Medium	Drill	Rice Hulls	1:1	≤1/2
Bottlebrush Squirreltail	Elymus elmoides	4.4	23.0	7.0%	1.6	0.37	3	1	1.10	Medium	Drill	Rice Hulls	1:1	≤1/2
Blue Gramma	Bouteloua gracilis	18.9	30.0	7.0%	2.1	0.11	3	1	0.33	Small	Fluffy	Rice Hulls	3:1	≤1/4
Sandberg Bluegrass	Poa Secunda	24.0	45.0	5.0%	2.3	0.09	3	1	0.28	Small	Legume	Kitty Litter	2:1	≤1/4
QuickGuard Sterile Triticale	Triticale	0.3	15.0	4.0%	0.6	2.00	3	1	6.00	Medium	Drill	Rice Hulls	1:1	≤1/2
Beardtongue	Penstemon grandiflorus	12.6	26.0	5.0%	1.3	0.10	3	1	0.31	Medium	Drill	Rice Hulls	3:1	≤1/8
Plains Aster	Dieteria bigelovii	35.6	38.0	5.0%	1.9	0.05	3	1	0.16	Small	Fluffy	Rice Hulls	3:1	≤1/8
Western Yarrow	Achillea millefolium	63.6	50.0	5.0%	2.5	0.04	3	1	0.12	Small	Legume	Kitty Litter	2:1	≤1/8
Fringed Sage	Artemisia ludoviciana	104.1	110.0	5.0%	5.5	0.05	3	1	0.16	Small	Fluffy	Rice Hulls	3:1	≤1/8
Winterfat	Karscheninnikovia lanata	2.8	22.0	5.0%	1.1	0.39	3	1	1.18	Medium	Fluffy	Rice Hulls	3:1	≤1/8
Wyoming Big Sagebrush	Artemisia tridentata, Wy	57.4	975.0	5.0%	48.8	0.85	3	1	2.55	Small	Fluffy	Rice Hulls	3:1	≤1/8
Totals				100.0%	78.0	7.48	3	1	22.44					

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- D. PLS/Ft² shall be doubled when germination is inhibited by low soil quality. (Application Factor Adjustment Accounted For)
- E. PLS/Ft² shall be quadrupled when a broadcast or hydro-seed application is done in a critical area. (Application Factor Adjustment Accounted For)

Shirley Basin Primary Channel Seed Mix, ESDs RO34AY304WY, RO34AY312WY, RO34AY326WY, RO34AY374WY

Species	Scientific Name	Seeds/ft ² @ 1lbs/ac	Target Seeds/ft ²	% of Mix Planned	PLS/ft ²	Target PLS lbs/ac	Application , Slope & Soil Factor	Acres	Total PLS Lbs/Ac	Seed Size & Type	Hopper Box	Carrier Agent	Carrier to Bulk Seed Ratio	Target Seed Depth Inches
Alkali Sacaton	Puccinellia nuttalliana	64.0	50.0	20.0%	10.0	0.16	4	1	0.63	Small	Legume	Kitty Litter	2:1	≤1/8
Basin Wildrye	Leymus cinereus	3.0	22.0	10.0%	2.2	0.73	4	1	2.93	Medium	Drill	Rice Hulls	1:1	≤1/2
Green Needlegrass	Nassella viridula	4.2	22.0	7.5%	1.7	0.39	4	1	1.57	Medium	Drill	Rice Hulls	1:1	≤1/2
Bottlebrush Spuirreltail	Elymus elymoides	4.4	23.0	7.5%	1.7	0.39	4	1	1.57	Medium	Drill	Rice Hulls	1:1	≤1/2
Western Wheatgrass	pascopyrum smithii	2.6	22.0	7.5%	1.7	0.63	4	1	2.54	Medium	Drill	Rice Hulls	1:1	≤1/2
Slender Wheatgrass	Elymus trachycaulus	3.6	22.0	7.5%	1.7	0.46	4	1	1.83	Medium	Drill	Rice Hulls	1:1	≤1/2
Sanberg Bluegrass	Poa secunda	24.0	45.0	5.0%	2.3	0.09	4	1	0.38	Small	Legume	Kitty Litter	2:1	≤1/8
QuirGuard Sterile Triticale	Triticale	0.3	15.0	3.0%	0.5	1.50	4	1	6.00	Large	Drill	Rice Hulls	1:1	≤1/2
Plains Aster	Dieteria bigelovii	35.6	38.0	7.5%	2.9	0.08	6	1	0.48	Small	Fluffy	Rice Hulls	3:1	≤1/8
Fernleaf Biscuitroot	Lomatium dissectum	1.0	17.0	7.5%	1.3	1.28	6	1	7.65	Large	Fluffy	Rice Hulls	3:1	≤1/8
Yarrow	Achillea millefolium	63.6	50.0	7.0%	3.5	0.06	6	1	0.33	Small	Legume	Kitty Litter	2:1	≤1/8
Wyoming Big Sagebrush	Artemisia tridentata	57.4	1000.0	5.0%	50.0	0.87	4	1	3.48	Small	Fluffy	Rice Hulls	3:1	≤1/8
Mountain Snowberry	Symphoricarpos oreophilus	1.3	18.0	5.0%	0.9	0.69	4	1	2.77	Large	Drill	Rice Hulls	1:1	≤1/2
Totals				100.0%	80.1	7.33	NA	1	32.16					



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Shirley Basin Upland Channel Seed Mix, ESDs RO34AY304WY, RO34AY312WY, RO34AY326WY, RO34AY374WY

Species	Scientific Name	Seeds/ft ² @ 1lbs/ac	Target Seeds/ft ²	% of Mix Planned	PLS/ft ²	Target PLS lbs/ac	Application , Slope & Soil Factor	Acres	Total PLS Lbs/Ac	Seed Size & Type	Hopper Box	Carrier Agent	Carrier to Bulk Seed Ratio	Target Seed Depth Inches
Bluebunch Wheatgrass	Pseudoroegneria spicata	3.2	22.0	10.0%	2.2	0.69	3	1	2.06	Medium	Drill	Rice Hulls	1:1	≤1/2
Slender Wheatgrass	Elymus trachycaulus	3.6	22.0	7.0%	1.5	0.43	3	1	1.28	Medium	Drill	Rice Hulls	1:1	≤1/2
Green Needlegrass	Nassella viridula	4.2	22.0	7.0%	1.5	0.37	3	1	1.10	Medium	Drill	Rice Hulls	1:1	≤1/2
Needle and Thread Grass	Hesperostipa comata	2.6	22.0	7.0%	1.5	0.59	3	1	1.78	Medium	Drill	Rice Hulls	1:1	≤1/2
Basin Wildrye	Leymus cinereus	3.0	22.0	10.0%	2.2	0.73	3	1	2.20	Medium	Drill	Rice Hulls	1:1	≤1/2
Bottlebrush Squirreltail	Elymus elmoides	4.4	23.0	6.0%	1.4	0.31	3	1	0.94	Medium	Drill	Rice Hulls	1:1	≤1/2
Blue Gramma	Bouteloua gracilis	18.9	30.0	6.0%	1.8	0.10	3	1	0.29	Small	Fluffy	Rice Hulls	3:1	≤1/4
Sandberg Bluegrass	Poa Secunda	24.0	45.0	5.0%	2.3	0.09	3	1	0.28	Small	Legume	Kitty Litter	2:1	≤1/4
Alkali Sacaton	Puccinellia nuttalliana	64.0	50.0	8.0%	4.0	0.06	3	1	0.19	Small	Legume	Kitty Litter	2:1	≤1/8
QuirGuard Sterile Triticale	Triticale	0.3	15.0	4.0%	0.6	2.00	3	1	6.00	Medium	Drill	Rice Hulls	1:1	≤1/2
Candian Milkvetch	Astragalus canadensis	5.2	23.0	5.0%	1.2	0.22	6	1	1.33	Medium	Drill	Rice Hulls	1:1	≤1/2
Fernleaf Biscuitroot	Lomatium dissectum	1.0	17.0	5.0%	0.9	0.85	6	1	5.10	Large	Fluffy	Rice Hulls	3:1	≤1/4
Beardtongue	Penstemon grandiflorus	12.6	26.0	5.0%	1.3	0.10	6	1	0.62	Medium	Drill	Rice Hulls	2:1	≤1/8
Mountain Snowberry	Symphoricarpos oreophilus	1.3	18.0	5.0%	0.9	0.69	4	1	2.77	Large	Drill	Rice Hulls	1:1	≥1/2
Skunkbush Sumac	Rhus trilobata	0.5	16.0	5.0%	0.8	1.60	4	1	6.40	Large	Drill	Rice Hulls	1:1	≥1/2
Wyoming Big Sagebrush	Artemisia tridentata	57.4	1250.0	5.0%	62.5	1.09	4	1	4.36	Small	Fluffy	Rice Hulls	3:1	≤1/8
Totals				100.0%	86.6	9.93	NA	1	36.69					

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Phase 3: Site Monitoring

- Site monitoring prioritization matrix.
 - Weighted scoring based upon the following criteria.
 - Erosional features.
 - Undesirable species.
 - Desirable species establishment.
 - Proximity to sage-grouse core area.
 - Proximity to leks.
 - Date last monitored.
 - Land ownership.
 - Size of surface disturbance.
 - The Prioritization matrix effectively ranked 60 recent AML projects.
 - 12 ranked as a 1st (highest) priority and the rest were evenly distributed from 2nd through 4th (lowest) priorities.

Phase 3: Site Monitoring

- Monitoring protocols designed to dynamically evolve as sites reach ecological restoration goals.
 - Streamlined reporting of site status using visual dashboards linked to a decision management matrix consisting of the following dashboards:
 - Overall site status.
 - Invasive species management.
 - Erosion status.
 - Desirable vegetation.
 - Sage-grouse habitat.
 - Ability to assess reclamation and restoration success and failures.
 - Data supporting future monitoring prioritization matrix and management action matrix.
 - Effectively utilizes limited economic & human capital.
 - Ability to share data associated with sage-grouse habitat reclamation and restoration efforts.



Phase 4: Sage-grouse Range Expansion

- Entice sage-grouse to occupy and utilize the created leks, brood rearing, and nesting habitats on AML geomorphic reclamation projects.
- Hasn't this been done before?
 - Once that we know of.
 - Utilizing data and technologies dating back nearly half a century ago.
- Will only occur:
 - With approval and in very close coordination with Federal and State wildlife biologists.
 - On sites where AML habitat restoration goals established in Phases 1 through 3 have been obtained.
 - Where there is documented sage-grouse use of the project site or nearby areas.
- Methods:
 - Yet to be defined.
 - Conceptual use of recorded male sage-grouse vocalizations and decoys.
 - Aimed at lek establishment by juvenile sage-grouse.



Questions?



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