Outline

Troy

Part 1 Introduction

- Site Description/background
- Reclamation Plan and Goals
- Soils

Part 2 Results summary

- Plant survival and percent cover
- amendments and challenges

400 Pile

Part 1 Introduction

- Site Description
- Soil Characteristics
- Design goals – geomorph
- Salvage soil and borehole plan
- Residual impact on soils

Part 2 soils and amendments

Progress Towards Restoring Native Land From Tailings Storage at Troy Mine and Shirley Basin

Herrera Environmental Consultants

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Science + Planning + Design

Troy Mine – Background

- Copper and silver mining from 1979-1993
- Returned production from 2004-2015
- Adjacent to the Kootenai National Forest
- ~300 acre Tailings Storage Facility (TSF)

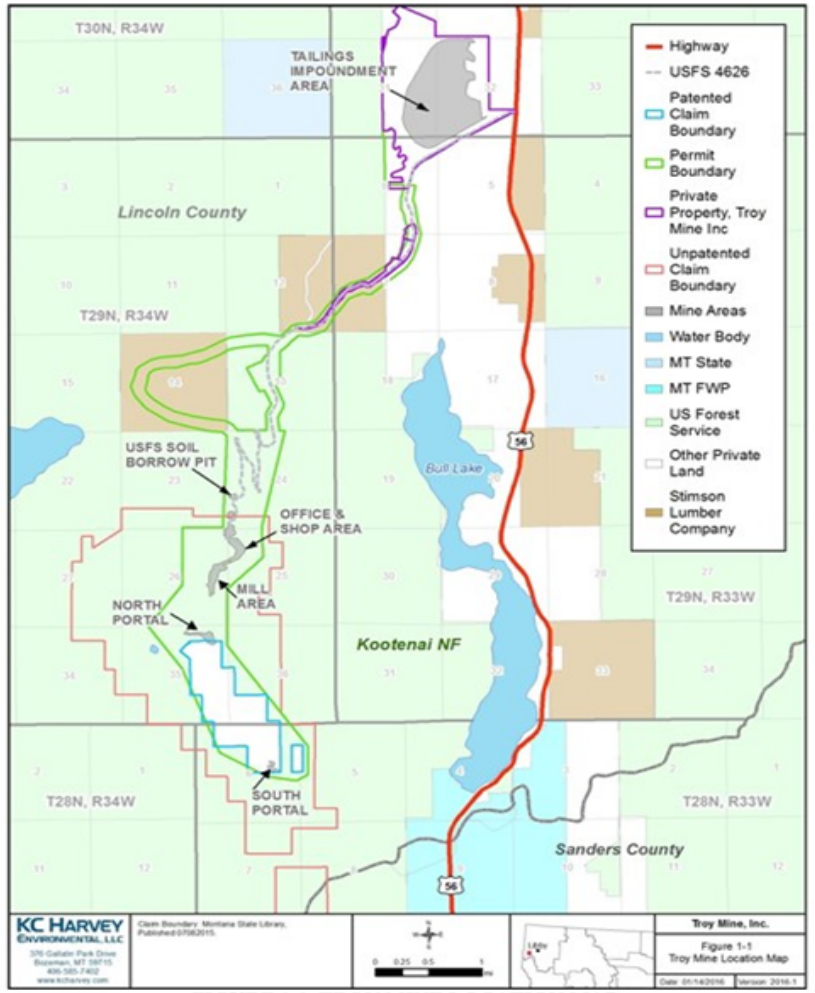

FIGURE 1-1. TROY MINE LOCATION MAP

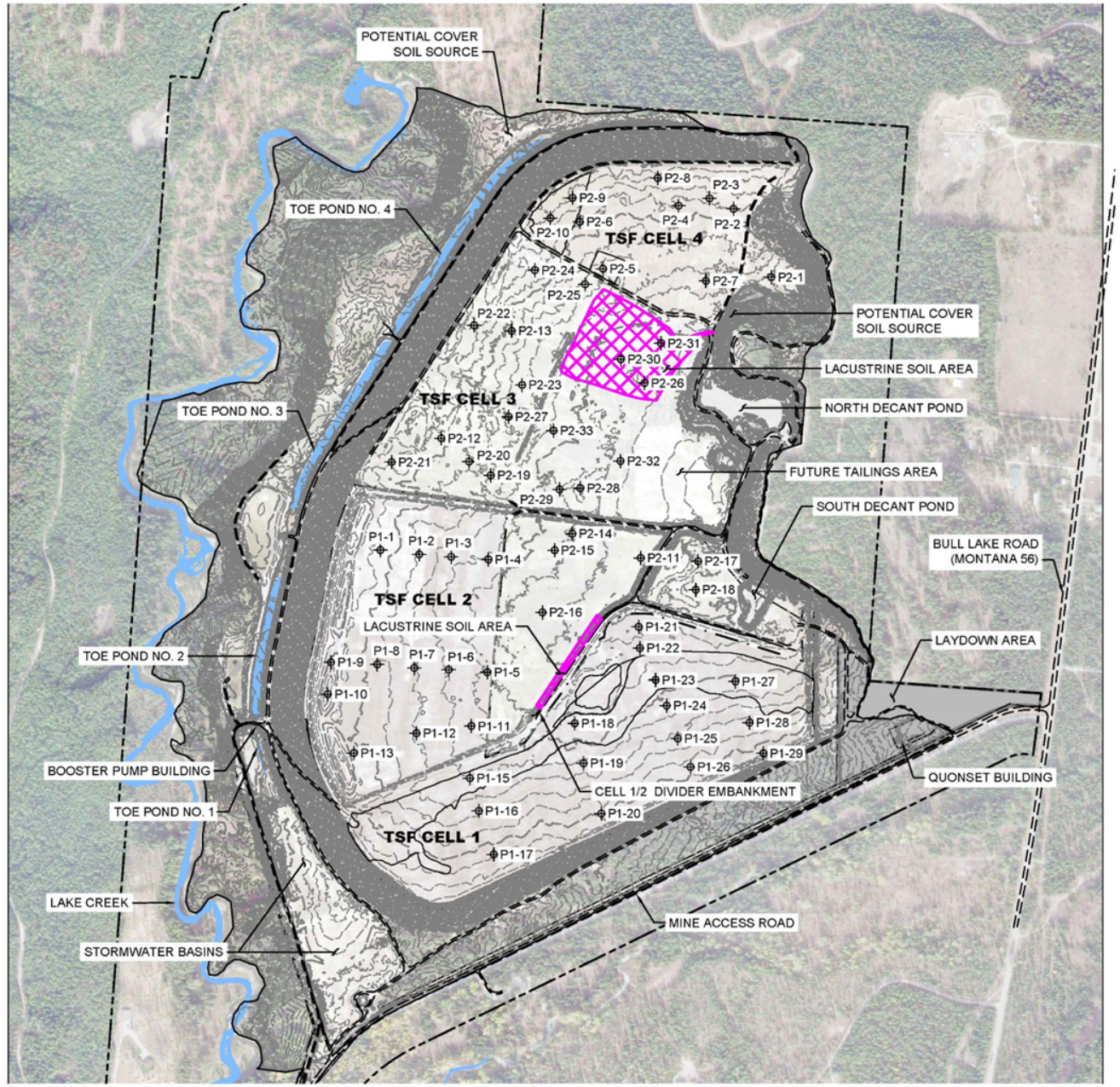

Figure 1.
Troy Mine Tailings Storage Facility.

Legend

P#-# Monitoring plots

N

0 400 800 1,600

Scale in Feet

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O:\proj\Y2020\20-07375-002\CAD\Sheet\Fig 1_Troy Mine storage facility.dwg

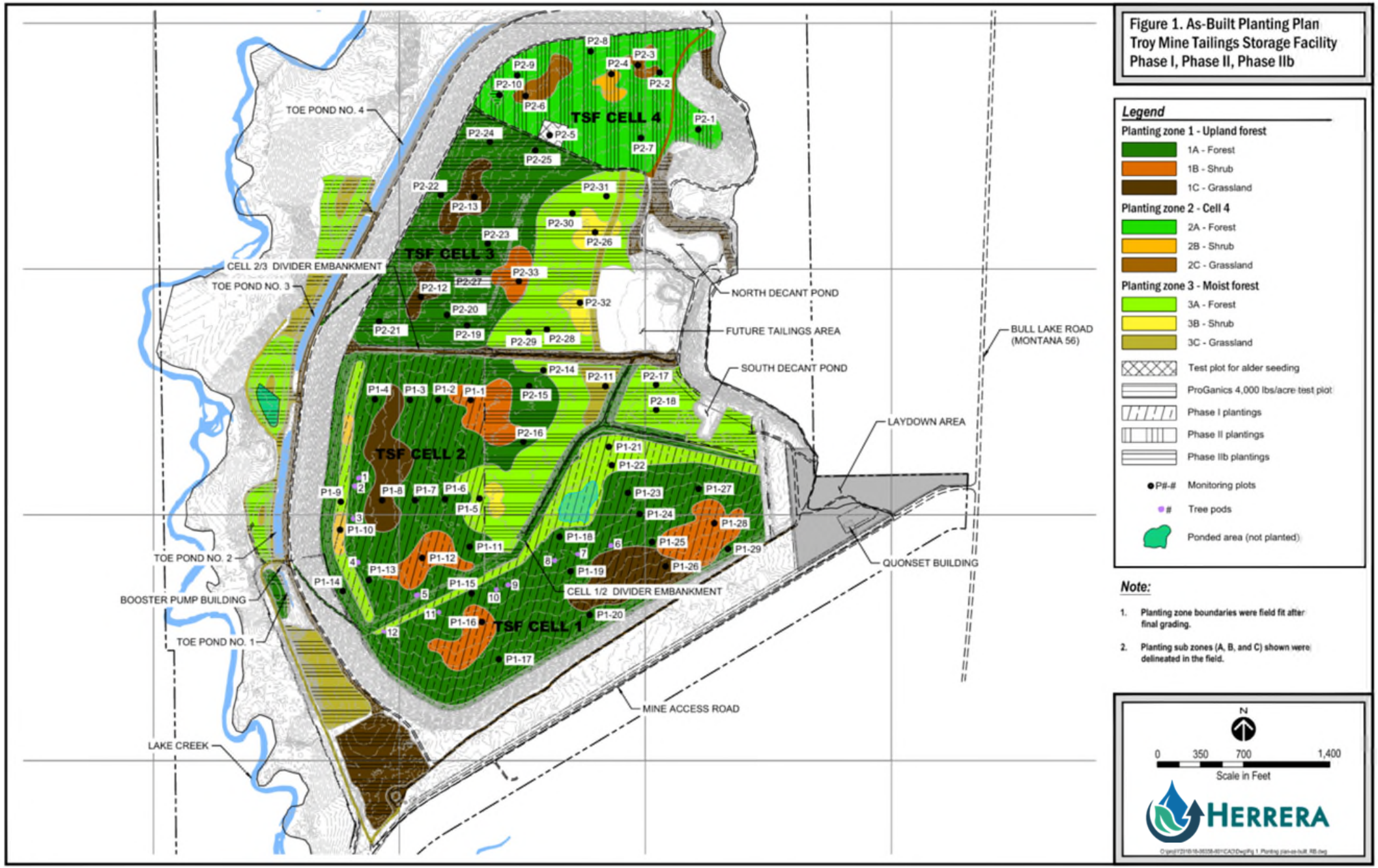

Figure 1. As-Built Planting Plan
Troy Mine Tailings Storage Facility
Phase I, Phase II, Phase IIb

Legend

Planting zone 1 - Upland forest
- 1A - Forest
- 1B - Shrub
- 1C - Grassland

Planting zone 2 - Cell 4
- 2A - Forest
- 2B - Shrub
- 2C - Grassland

Planting zone 3 - Moist forest
- 3A - Forest
- 3B - Shrub
- 3C - Grassland

- Test plot for alder seeding
- ProGanics 4,000 lbs/acre test plot
- Phase I plantings
- Phase II plantings
- Phase IIb plantings
- P#-# Monitoring plots
- # Tree pods
- Ponded area (not planted)

Note:

1. **Planting zone boundaries were field fit after final grading.**
2. **Planting sub zones (A, B, and C) shown were delineated in the field.**

N

0 350 700 1,400

Scale in Feet

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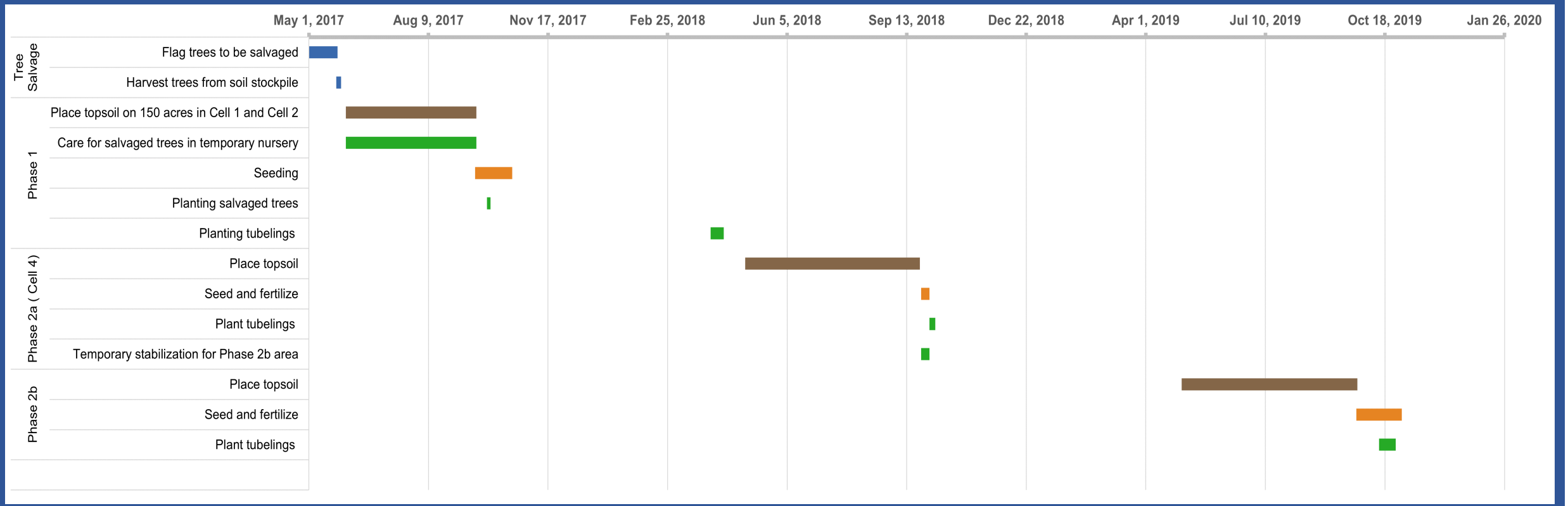
Timeline


May 1, 2017
Aug 9, 2017
Nov 17, 2017
Feb 25, 2018
Jun 5, 2018
Sep 13, 2018
Dec 22, 2018
Apr 1, 2019
Jul 10, 2019
Oct 18, 2019
Jan 26, 2020
Tree Salvage
Flag trees to be salvaged
Harvest trees from soil stockpile
Phase 1
Place topsoil on 150 acres in Cell 1 and Cell 2
Care for salvaged trees in temporary nursery
Seeding
Planting salvaged trees
Planting tubelings
Phase 2a (Cell 4)
Place topsoil
Seed and fertilize
Plant tubelings
Temporary stabilization for Phase 2b area
Phase 2b
Place topsoil
Seed and fertilize
Plant tubelings

Tree Salvage

Fall 2018

Harvesting trees from soil stockpiles

Hauling trees to temporary nursery

Phase 1 Planting Salvaged Trees

Tree wells constructed around each tree, filled twice with water, topped with cedar mulch

Tree Pods

Tree Salvage

- Tree pod 6
- July 2021

Tree Salvage

- Tree pod 7
- July 2022

Phase 1 Seeding

November 2017
Site prep “Rough and loose”

John Deere tractor and Brillion drop seeder implement

TSF Cell 1 site conditions on first day of seeding

Phase 1 Tree and Shrub Planting

Phase 1

- Plants held at CSKT nursery through winter 2017/2018
- Planted April 2018

Phase 2a Fertilizing and Seeding

Fall 2018

Broadcast seeding final seed mix/applying soil amendment

Delineated soil amendment application line

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Phase 2a Planting

Fall 2018

Looking southeast across Cell 4 planted area

Nursery plant staging/holding area at quonset hut

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Seeding, Placing Woody Debris, Planting

- Fall 2019
  - Cell 3 and Portions of Cells 1 and 2
  - Toe ponds

TSF Soils - Quantity

Source: Troy Mine
Final Environmental Assessment for
Amendment 006 to Operating Permit No. 00093
(MT DEQ 2018)

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Lacustrine Soil at TSF

Cell 3 Lacustrine Soil

Sample from NE Corner Cell 3

Showing Poorly Developed Fine Root Systems

Sample from Area of Better Growth in Cell 3 Showing Better Developed Fine Root System

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Phase 2b – Soil Amendments

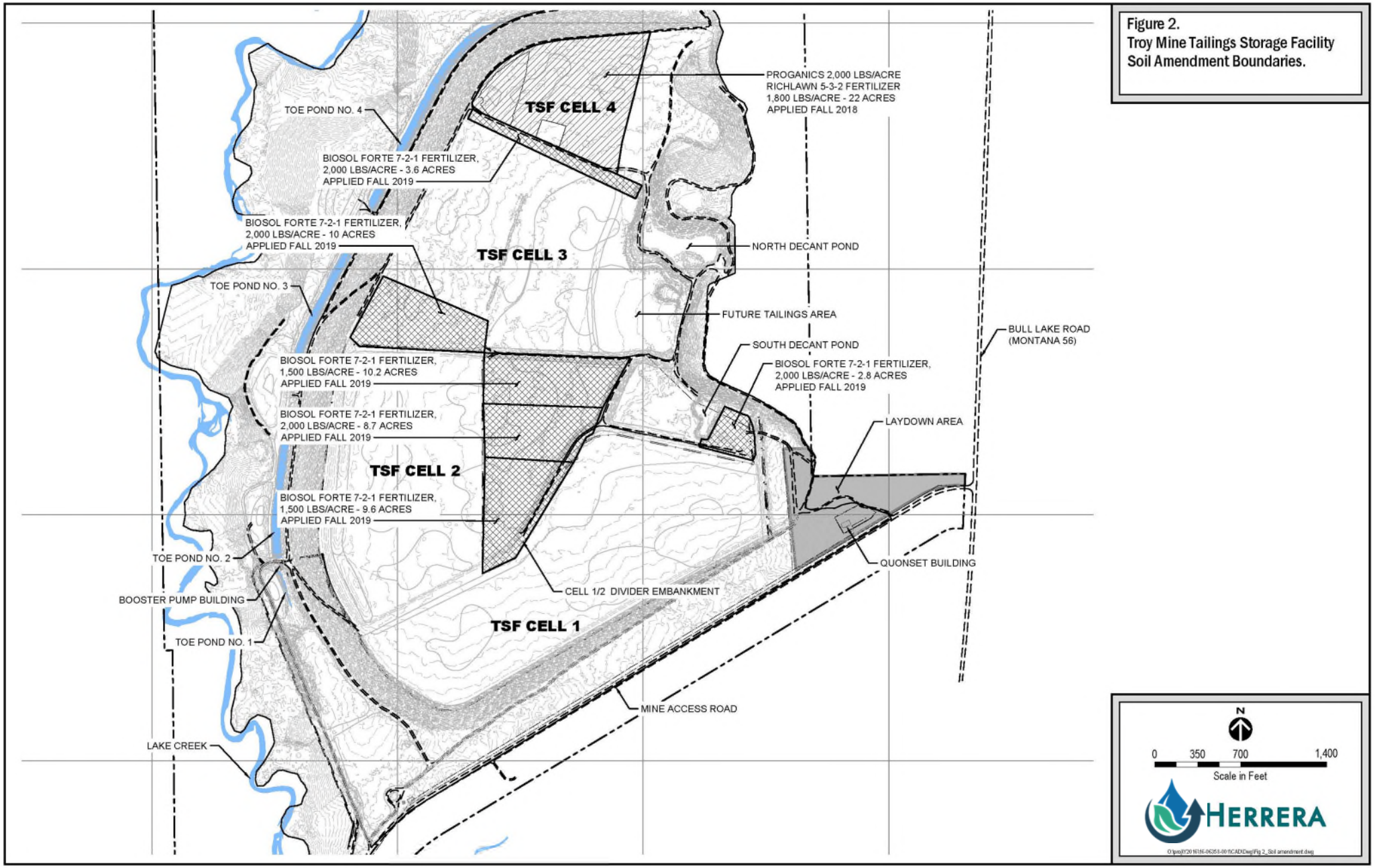


Figure 2.
Troy Mine Tailings Storage Facility
Soil Amendment Boundaries.

Amendments 2019

P2-7 Year One Not fertilized

P2-9 Year One

Proganics 2,000 lb/acre

Richlawn 1,800 lb/acre

P2-10 Year One

Proganics 4,000 lb/acre

Richlawn 1,800 lb/acre

Amendments 2019 Phase 2a

P2-7 Year Two

Not fertilized

P2-9 Year Two

Proganics 2,000 lb/acre

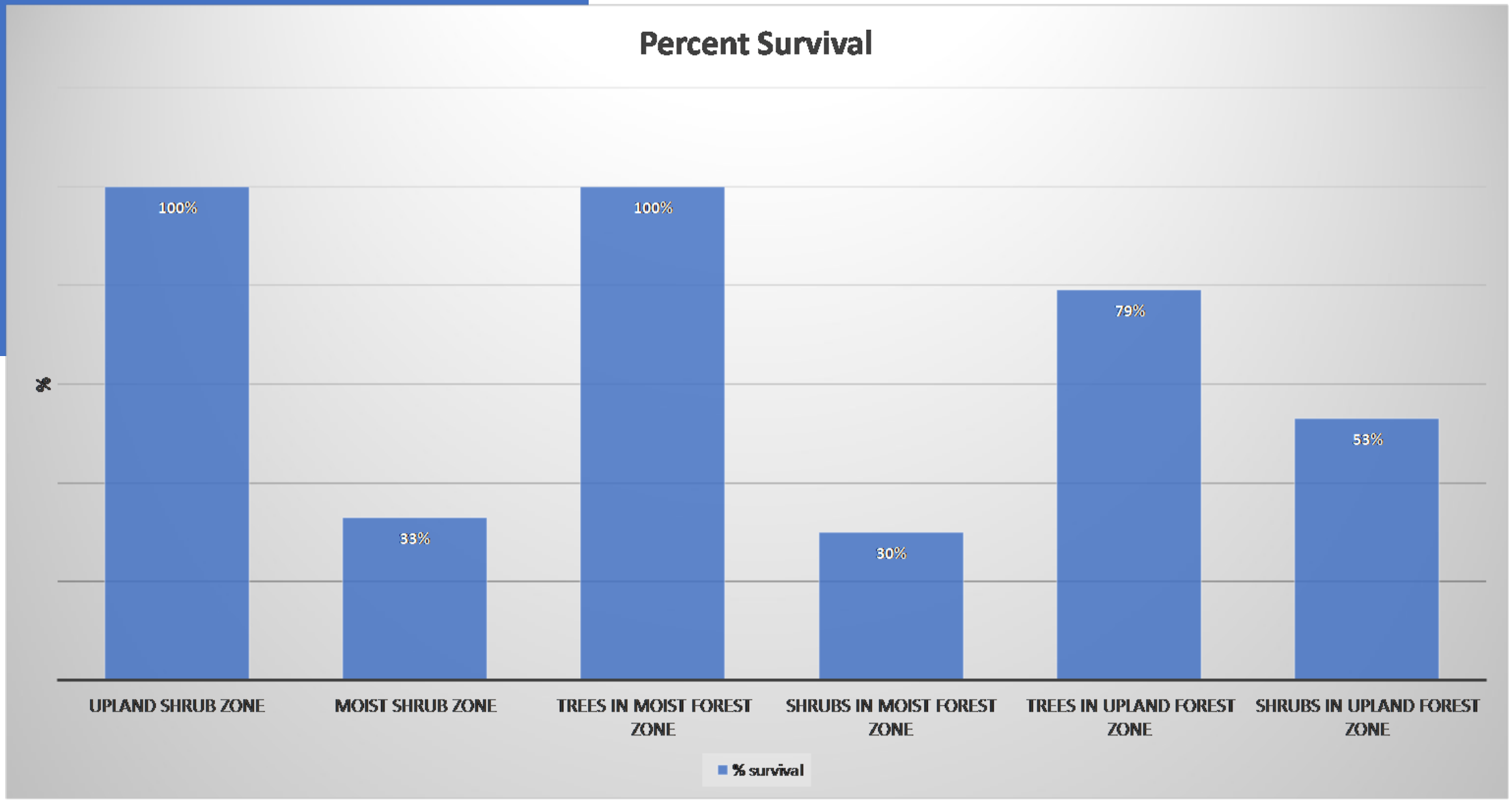
Richlawn 1,800 lb/acre

P2-10 Year Two

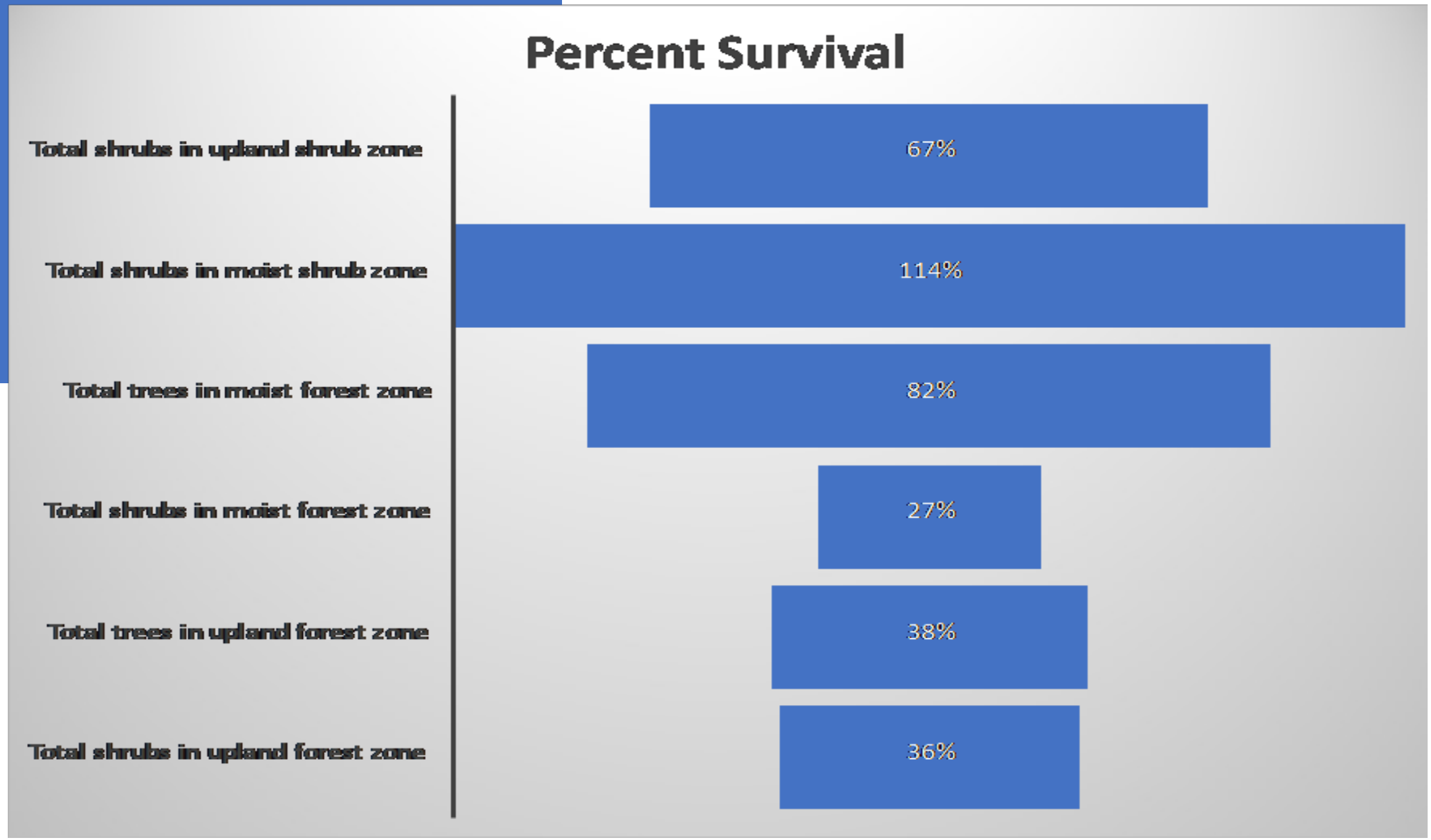
Proganics 4,000 lb/acre

Richlawn 1,800 lb/acre

Phase 1


Percent Survival
%
100%
33%
100%
30%
79%
53%
UPLAND SHRUB ZONE
MOIST SHRUB ZONE
TREES IN MOIST FOREST ZONE
SHRUBS IN MOIST FOREST ZONE
TREES IN UPLAND FOREST ZONE
SHRUBS IN UPLAND FOREST ZONE
% survival

Phase 2b


Percent Survival
Total shrubs in upland shrub zone
67%
Total shrubs in moist shrub zone
114%
Total trees in moist forest zone
82%
Total shrubs in moist forest zone
27%
Total trees in upland forest zone
38%
Total shrubs in upland forest zone
36%

Moist Forest Zone
P1-9

Baseline - 2018

Year 4 - 2022

Moist Forest Zone
P1-21

Baseline (2018)

Herbicide applied
following site visit

Year 4 (2022)

Year 1 (2019) with Clover and Daisy

Year 2 (2020)

Year 3 (2021)

Grassland Area
Upland Forest Zone
P1-19

Baseline 2018

Year 4 2022

10% noxious weeds

Year 1 2019

Year 2 2020

Year 3 2021

Forest Area
Upland Forest Zone
P1-17

Baseline 2018

10% noxious weeds

Year 4 2022

Year 1 2019

Year 2 2020

Year 3 2021

Shirley Basin– Background

- Uranium mining (1970-1980's)
- Multiple Tailings Piles
- Rerouted Little Medicine Bow River

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Shirley Basin Reclamation Goals

- Establishment of a diverse native plant community
- Establishment of a geomorphically stable landscape in line with the native adjacent landscapes
- Improve soil acidity to the degree necessary to support persistent native perennial vegetation
- Develop sage grouse habitat for mating, nesting, and brood rearing activities.
- Development of a native vegetation community that is resilient to invasive species establishment

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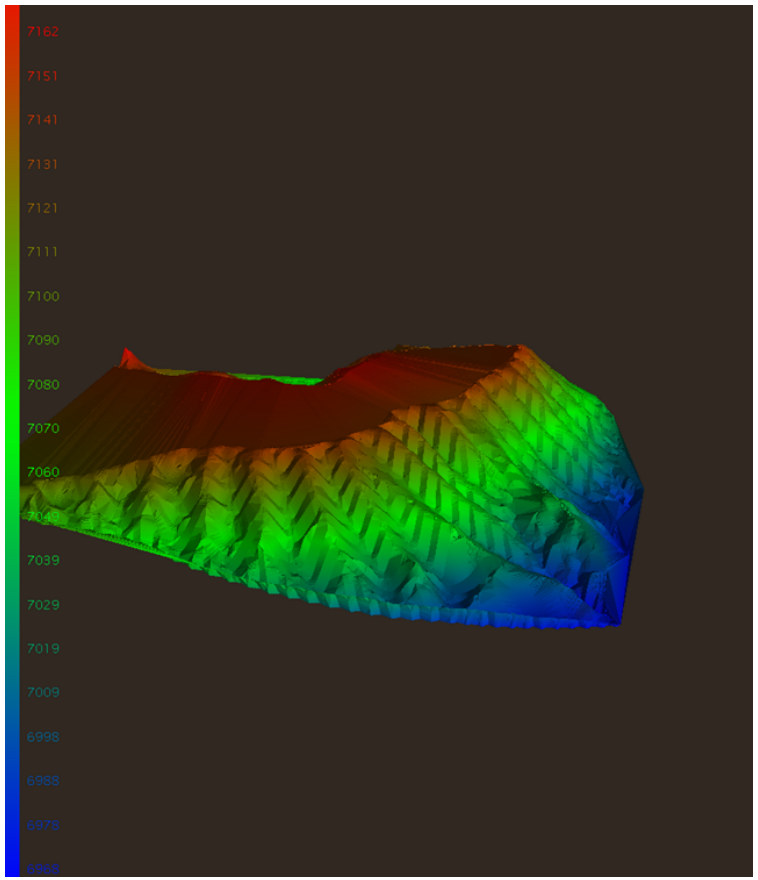
Previous Reclamation

New Design Reclamation

- Carlson Natural Regrade
- Low Tech Mesic Water Retention Features
- Viewshed Analysis



Local Soil Characteristics

Test Pothole

Subgrade Excavation

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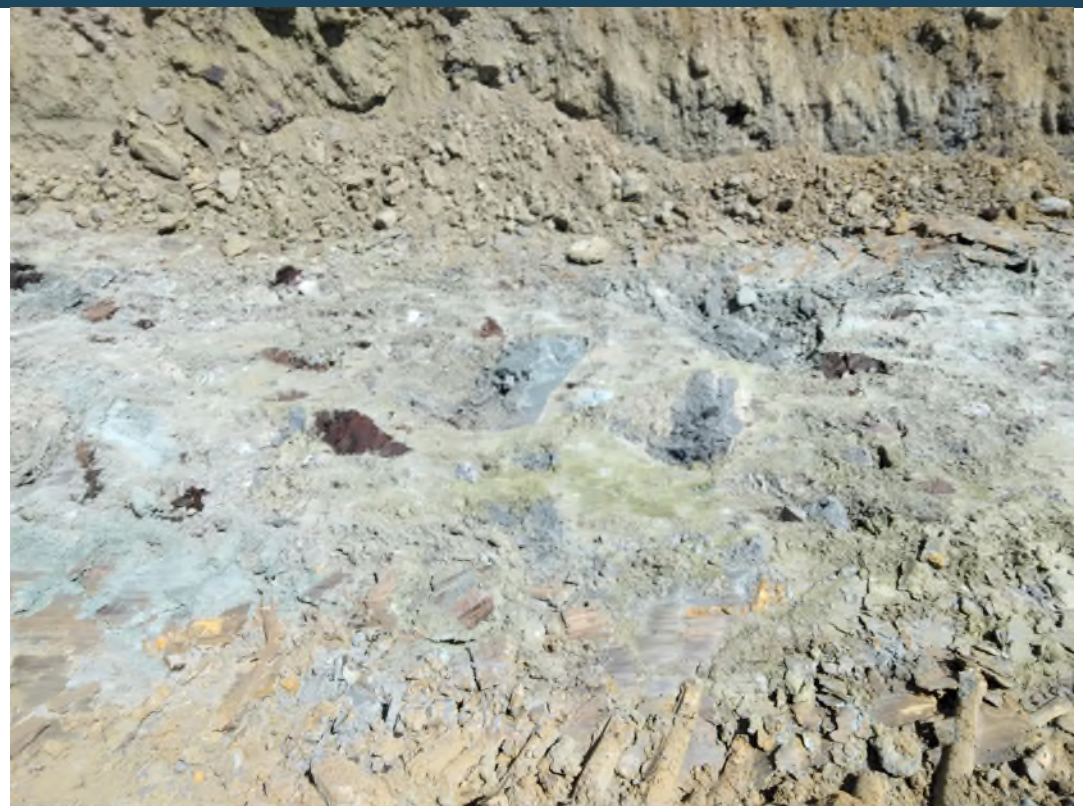
Local Soil Characteristics



Soil Composition Variability

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Soil and Seed Bed Preparation

Discing Amendments

SCARIFIER

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Shirley Basin Soil Amendments

- Agricultural Lime
- Mycorrhiza Innoculant
- Humic Acid
- Sustane Organic Compost

SUSTÅNE Naturally...

Wyoming Sugar Company

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Lime Application

- Subgrade Lime Application

- Surface Lime Application

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Other Amendment Applications

Amendments Applied in Shirley Basin

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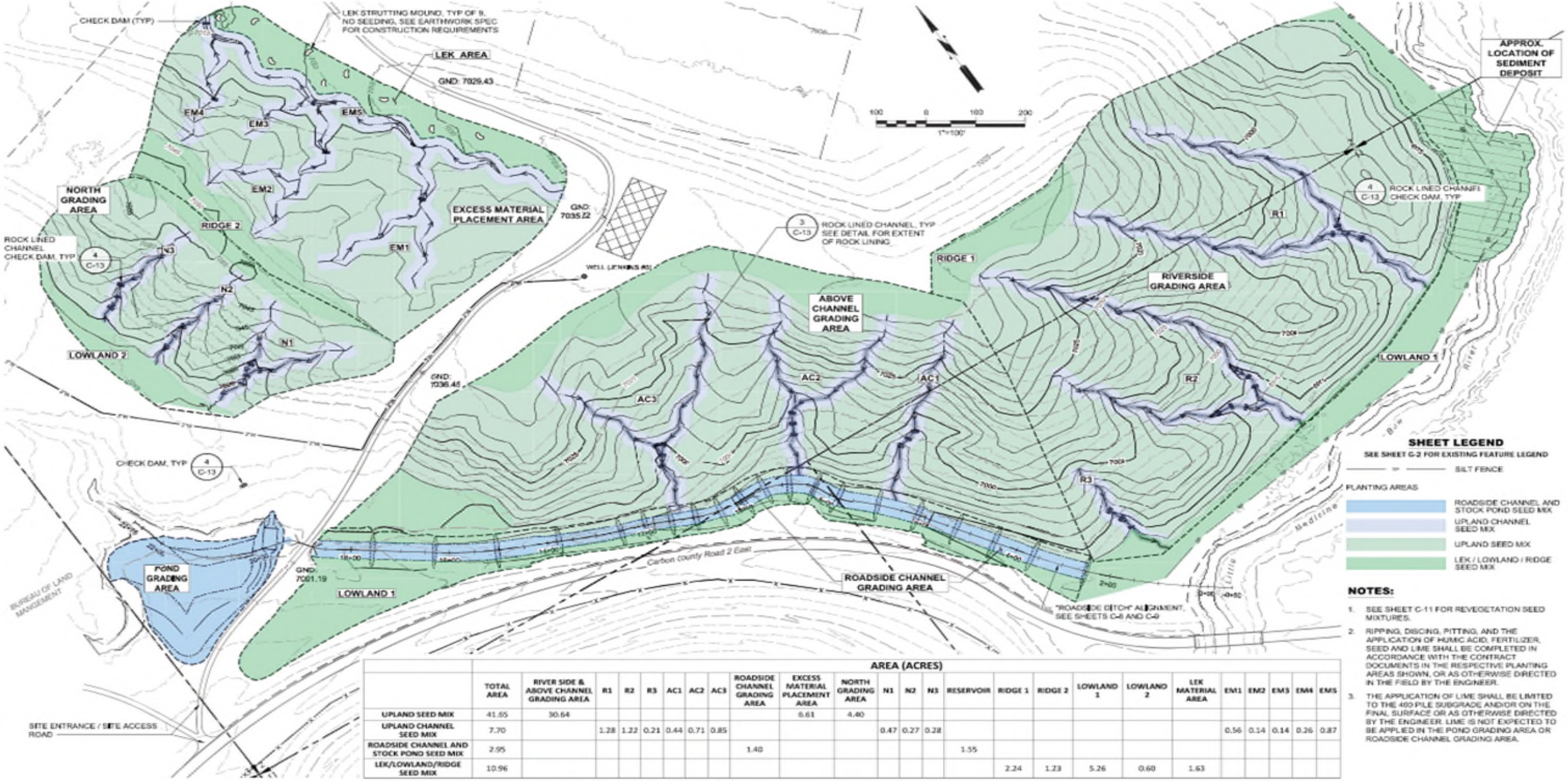

SHEET LEGEND

SEE SHEET G-2 FOR EXISTING FEATURE LEGEND

SILT FENCE

PLANTING AREAS

- ROADSIDE CHANNEL AND STOCK POND SEED MIX
- UPLAND CHANNEL SEED MIX
- UPLAND SEED MIX
- LEK / LOWLAND / RIDGE SEED MIX

NOTES:

1. SEE SHEET C-11 FOR REVEGETATION SEED MIXTURES.
2. RIPPING, DISCING, PITTING, AND THE APPLICATION OF HUMIC ACID, FERTILIZER, SEED AND LIME SHALL BE COMPLETED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS IN THE RESPECTIVE PLANTING AREAS SHOWN, OR AS OTHERWISE DIRECTED IN THE FIELD BY THE ENGINEER.
3. THE APPLICATION OF LIME SHALL BE LIMITED TO THE 400 PILE SUBGRADE AND/OR ON THE FINAL SURFACE OR AS OTHERWISE DIRECTED BY THE ENGINEER. LIME IS NOT EXPECTED TO BE APPLIED IN THE POND GRADING AREA OR ROADSIDE CHANNEL GRADING AREA.

AREA (ACRES)

	TOTAL AREA	RIVER SIDE & ABOVE CHANNEL GRADING AREA	R1	R2	R3	AC1	AC2	AC3	ROADSIDE CHANNEL GRADING AREA	EXCESS MATERIAL PLACEMENT AREA	NORTH GRADING AREA	N1	N2	N3	RESERVOIR	RIDGE 1	RIDGE 2	LOWLAND 1	LOWLAND 2	LEK MATERIAL AREA	EM1	EM2	EM3	EM4	EM5
UPLAND SEED MIX	41.65	30.64								6.61	4.40														
UPLAND CHANNEL SEED MIX	7.70		1.28	1.22	0.21	0.44	0.71	0.85				0.47	0.27	0.28							0.56	0.14	0.14	0.26	0.87
ROADSIDE CHANNEL AND STOCK POND SEED MIX	2.95								1.40						1.55										
LEK/LOWLAND/RIDGE SEED MIX	10.96															2.24	1.23	5.26	0.60	1.63					

100% DESIGN - ISSUED FOR BID

No.	REVISION	BY	APP'D	DATE

ONE INCH AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

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DEQ WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

Professional Engineer — Blaine C. Dale — WYOMING

DESIGNED: B. DALE	DRAWN: T. BRADLEY
DESIGNED: T. WRIGHT	DRAWN:
DESIGNED:	CHECKED: M. SPELLANE
SCALE: AS NOTED	APPROVED: M.SPELLANE

SHIRLEY BASIN: 400 PILE
(North Walker Waste Pile)

AML SITE NUMBER 063295 - CARBON COUNTY, WY
RESTORATION PROJECT

PLANTING PLAN

DATE:	MARCH, 2021
PROJECT NO:	12-06298-008
DRAWING NO:	C-10
SHEET NO / OF:	12 / 16

Revegetation Pitting and Drill Seeding

Pitting

Drill Seeding

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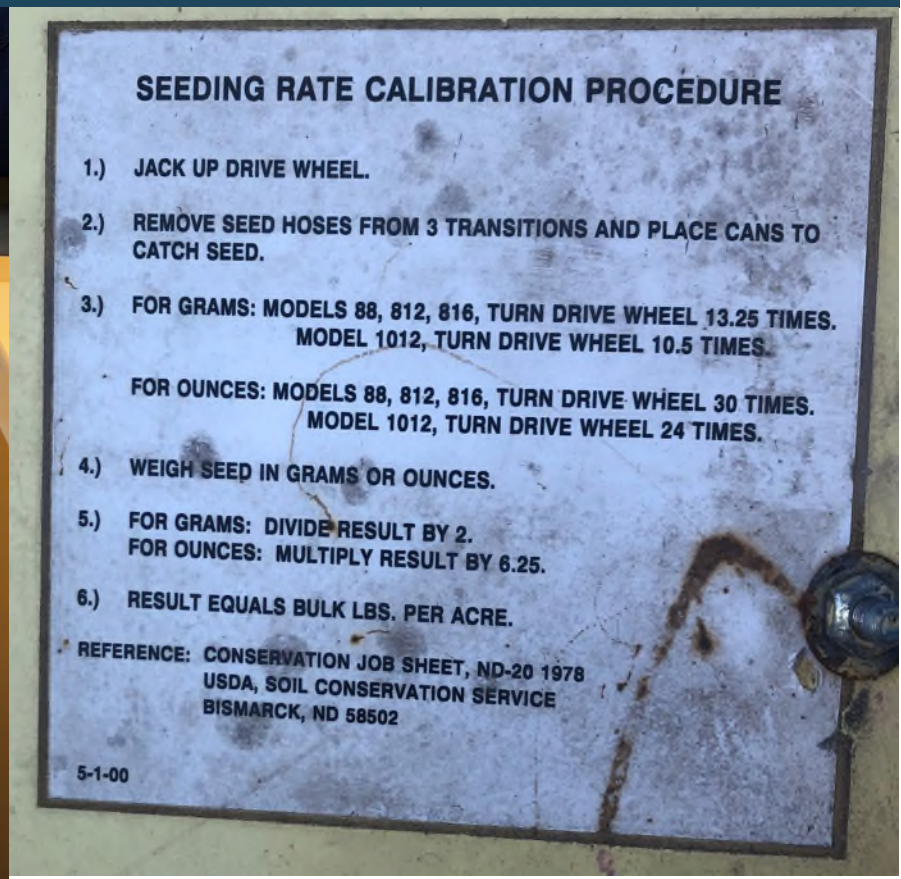
Revegetation Calibration



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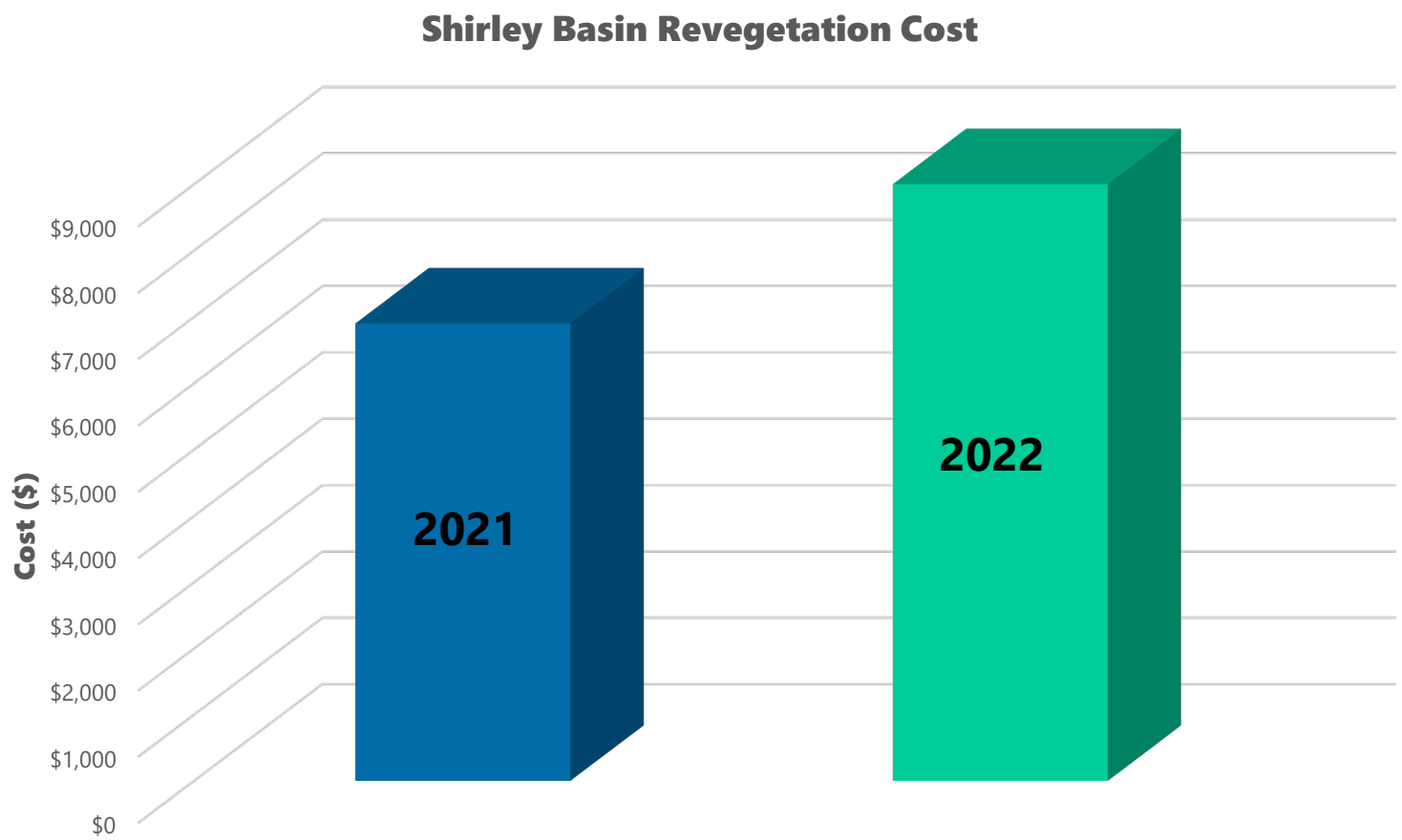
Revegetation Economics



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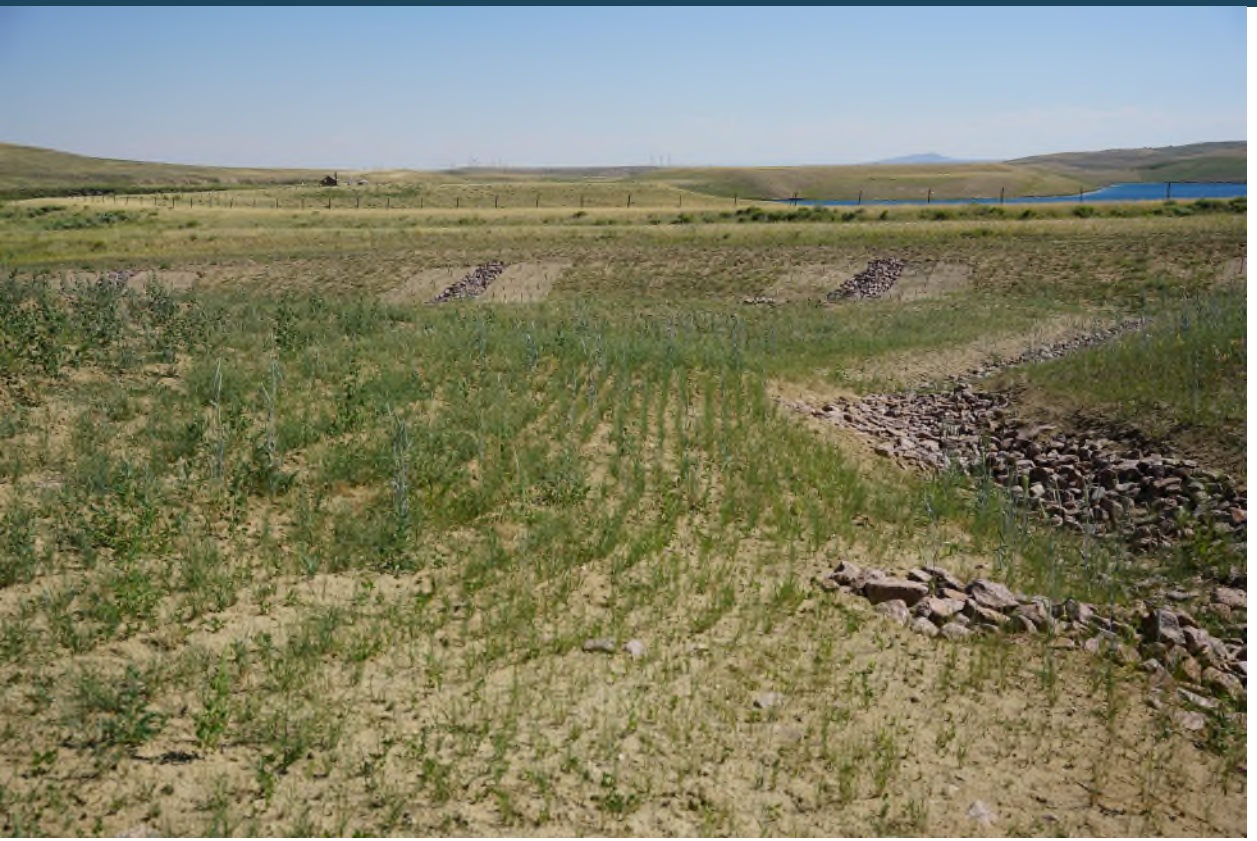
Current Results



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Current Results

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Current Results

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Challenges and Lessons Learned

- Pitting on contour around steep slopes
- Pre Order Seed mixes with carrier agents and test at seeding contractor facility before mobilization to site
- Proactive on site during seeding operations checking calibration and hopper boxes throughout operations
- Allocate enough time for seeding specialist / seed distributor QA/QC process

Where's Mr. and Mrs. Sage Grouse?

Questions?

Taylor Cross

tcross@Herrerainc.com

Mark Gentry

mgentry@Herrerainc.com