PEABODY WESTERN
COAL COMPANY
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7116

March 6, 2025

Ms. Amy Ryser
Western Region Office
Office of Surface Mining
Reclamation and Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065

RE: Phase I and II Bond Release Application; Peabody Western Coal Company; Kayenta Mine Permit AZ-0001F; N9 Permanent Program Area

Dear Ms. Ryser:

Peabody Western Coal Company (PWCC) submits to the Office of Surface Mining Reclamation and Enforcement (OSMRE) the enclosed application materials in accordance with 30 CFR 800.40 for phase I release of bond on 328 acres and Phase II release of 289 acres of mined and reclaimed lands in the permanent program area of N9 at Kayenta Mine. The N9 reclaimed lands described within this Bond Release Application are subject to the Permanent Program Performance Standards at 30 CFR 816 and the requirements of the OSMRE issued Kayenta Mine Permit AZ-0001F permit application package approved October 3, 2017.

Attached, please find one electronic file of the Bond Release Application. PWCC understands that OSMRE will complete a bond release application review and will provide PWCC a response that will include details of information required so that OSMRE can deem the application complete. Once OSMRE has deemed the application complete, PWCC will submit a complete official application with signed documents to OSMRE electronically on the share drive provided by OSMRE and provide one copy of the application on USB drive for Forest Lake Chapter.

Please direct any questions and correspondence to me at 928.280.7091 or by email at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

Phase I and II Bond Release Application

N9 Coal Resource Areas, Kayenta Mine

TABLE OF CONTENTS

Section 1. Phase I Bond Release Supporting Information – Administrative, Permit, and Bond Summary Data

Section 2. Phase I & II Bond Release Supporting Information – Backfilling, Grading, Suitable Material, Soil, and Surface Water Data

List of Tables

List of Attachments

List of Maps

Section 3. Phase II Bond Release Supporting Information

Page

List of Tables

List of Figures

List of Attachment

List of Maps

Section 4. Phase II Bond Release Supporting Information – Suspended Solids Outside of the Permit Area

List of Tables

List of Figures

List of Attachments

VERIFICATION

I verify under oath that the information contained in this application for a permit, revision, renewal, bond release, or transfer, sales or assignments of permit rights is true and correct to the best of my information and belief.

Signature of Responsible Official [signature]

Title Director, Operation Support Date 3/5/2025

SUBSCRIBED AND SWORN TO BEFORE ME BY Randy Lehn

This 5th Day of March 2025

NOTARY PUBLIC Susie Crank

MY COMMISSION EXPIRES April 5, 2028

SUSIE CRANK
Notary Public - Arizona
Navajo County
Commission # 664886
My Comm. Expires Apr 5, 2028

SECTION 1. Phase I and II Bond Release Supporting Information

Administrative, Permit, and Bond Summary Data

Introduction

Peabody Western Coal Company (PWCC) is requesting Phase I and II bond release on portions of lands within the N9 Coal Resource Area (CRA) of Kayenta Mine. The bond release application included in this submittal contains required documentation and information to support Phase I bond release for 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to the Office of Surface Mining Reclamation and Enforcement (OSMRE) in May 2024 in the permanent program areas within the N9 CRA as shown on Map 1.1. Ten proposed permanent ponds, 7.6 miles of proposed permanent two-track ranch roads, and one proposed permanent diversion are included in this release application. These features are discussed in appropriate sections of this application in relation to the final land use and customary use areas within the N9 CRA. Documentation and information to support Phase II bond release for 286 acres within the N9 CRA, as shown on Map 1.1, is included within this release application. Information such as the public notice, affidavit of publication, and copies of letters to the Tribes, government agencies, and utilities are included in Section 1 of the application. Information for the Phase I technical portions of the application are presented in Section 2 (backfilling, grading, suitable material, and soil data) of this document. Information for the Phase II technical portions of the application are contained in Section 3 (historical revegetation and vegetation sampling) and Section 4 (suspended solids outside of the permit area) of this document.

Permit and Bond Release Summary Information

The N9 CRA is located within the northwestern portion of PWCC's Kayenta Mine. The Kayenta Mine operates under Permit AZ-0001F issued by OSMRE to PWCC Kayenta Mine on October 3, 2017. The initial 5-year renewal application for Permit AZ-0001F was submitted to OSMRE on February 27, 2020. On June 25, 2020, OSMRE administratively delayed their decision to renew Permit AZ-0001F due to COVID-19 pandemic closures and stay-at-home orders. On February 27, 2025, PWCC requested Permit AZ-0001F be renewed for an additional five-year term (July 6, 2025 through July 5, 2030). Coal production at Kayenta Mine ceased on August 26, 2019; reclamation activities continue under Permit AZ-0001F.

The Kayenta mine permit area is located approximately 18 miles south southwest of Kayenta, Arizona (USGS 7.5-minute quadrangle maps Longhouse Valley, Marsh Pass S.E., Shonto S.E., Yucca Hill, and Cliff Rose Hill). The permit area for the N9 Phase I and II bond release is located within the following lands of Navajo County, Arizona that are described relative to the Gila and Salt River Base Meridian as:

A total of 834 acres of Phase I and 286 acres of Phase II mined and reclaimed land located within the N9 CRA. The computer-generated centroid location is Latitude 36º 34’ 14.6” N and Longitude 110º 24’ 50.7” W.

The type of bond and the amount of bond filed for Kayenta Mine Permit AZ-0001F are described in Table 1.1. The portion requested for release in the N9 CRA includes $18,129,230 for Phase I and II. Justification for the release dollars is explained in the following section.

Table 1.1. Bond Information for Kayenta Mine.

Bond Surety	**Bond Number**	**Bond Amount**
Liberty Mutual	60S003887	$20,329,521.92
SiriusPoint America Insurance	SBP150171_003	$27,911,895.61
Zurich American	8940860	$22,457,881.46
Goldeman Sachs Bank, USA	Letter of Credit	$36,471,839.00
TOTAL		**$107,171,138.00**

<u>Phase I and II Bond Reduction Cost</u>

PWCC is seeking a reduction in the general grading, suitable material replacement, and soil material replacement bond for Phase I in the amount of $11,655,771. This amount was determined using direct and indirect unit costs calculated for 834 acres in N9 as documented in Permit AZ-0001F, Chapter 24, Table 24-1-4. Reclamation cost estimates as of January 2024 (“worst case” or “highest liability” as approved in Permit AZ-0001F by OSMRE on January 23, 2024) were used and these rates were adjusted for inflation through July 2025. Reduction in bond at the N9 CRA was based upon the final pit being 100% backfilled, completion of Phase I reclamation activities including general grading on 328 acres, and replacing four feet of suitable plant growth material including one foot of suitable soil on the surface of 834 acres of final graded lands per Chapter 22, Minesoil Reconstruction, Volume 11, Permit AZ-0001F. Suitable plant growth material replacement areas are documented for the N9 CRA on Maps 2.1 and 2.2 in Section 2 of this document.

PWCC is seeking a reduction in the surface stabilization, proposed permanent facilities, and undisturbed areas bond for Phase II in the amount of $6,473,459. This combined total bond reduction amount was determined using direct and indirect unit costs documented in Permit AZ-0001F, Chapter 24, Table 24-1-4. PWCC is seeking this bond reduction for surface stabilization on 286 acres, 10 retained ponds, 7.6 miles of proposed permanent two-track ranch roads, and 56 acres of surrounding facilities including one permanent diversion. Lastly, the final part of this reduction in bond is for undisturbed areas in the N9 CRA that were included for “worst case” or “highest liability” as approved by OSMRE for the 5-

year renewal of Permit AZ-0001F on October 3, 2017. Reclamation cost estimates as of January 2024 ("worst case" or "highest liability" as approved in Permit AZ-0001F by OSMRE on January 23, 2024) were used and these rates were adjusted for inflation through July 2025. The project categories and direct costs applicable to this Phase I and II bond release are listed in Table 1.2 for the N9 CRA. PWCC is not requesting release of the grading and ripping maintenance costs for the disturbed lands because these will be applied to future Phase II bond release areas for the N9 CRA. Similarly, no costs have been requested on the disturbed lands for the Phase III reclamation activities including revegetation and vegetation maintenance. The combined total bond reduction direct costs shown in Table 1.2 is $14,799,369.

Table 1.2

Bond Reduction of Direct Costs for Backfilling, Grading, General Grading, Suitable Material Replacement, Soil Material Replacement, and Surface Stabilization in N9 CRA.

Project Category	**Bond Reduction Amount**
Cast/blast high wall[1]	None
Doze high wall[1]	None
Doze first two spoils[1]	None
Doze back two spoils[1]	None
Backfill and grade ramps[1]	None
General grading (100% complete)[1]	$2,427,887
Suitable material replacement (100% complete)[1]	$2,052,547
Soil material replacement (100% complete)[1]	$4,171,848
Surface Stabilization (25% - 286 acres)[2]	$ 18,755
Facility pond retention (14 acres)[2]	$151,757
Facility reclamation (56 acres)[2]	$690,200
Undisturbed area reduction (100% - 262 acres)[3]	$3,229,150
Road retention culvert & surfacing removal (7.6 miles)[4]	$31,798
Road retention surface ripping (7.6 miles)[4]	$11,084
Road retention grade ripped areas (7.6 miles)[4]	$267,944
Road retention topsoil replacement (7.6 miles)[4]	$224,323
Road retention revegetation (7.6 miles)[4]	$180,349
Total Direct Cost Category I	$13,457,642
Inflation January 2024 thru July 2025 (9.97%)	$1,341,727
Total Direct Cost Category I (Inflated thru 7-2025)	**$14,779,369**

[1] Phase I bond reduction available per OSMRE documentation included with May 2024 bond release application for N9.
[2] Phase II bond reduction available per Table 24-1-4.
[3] Bond reduction available for undisturbed lands per OSMRE approval of Permit AZ-0001F on October 3, 2017. Total available is $4,613,303 per Table 24-1-8 & OSMRE's 2024 cost summary sheet.
[4] Per Permit AZ-0001F, Chapter 24, Tables 24-1-4 & 24-1-8.

Table 1.3 shows the indirect costs obtained from Permit AZ-0001F; Chapter 24 that are associated with the N9 Phase I and II direct cost as determined in January 2024. The total indirect cost reflects inflation through July 2025 (9.97%). An inflation rate of 9.97% for the January 2024 through July 2025 period was determined by OSMRE in April 2024 using RS Means Historical Cost Indexes and approved in Permit AZ-0001F by OSMRE. The total bond reduction indirect costs shown in Table 1.3 is $3,329,861.

Table 1.3

Bond Reduction of Indirect Costs for Backfilling, Grading, General Grading, Suitable Material Replacement, Soil Material Replacement, and Surface Stabilization in the N9 CRA.

Project Category	Bond Reduction Amount
Mobilization/demobilization (1.5%)	$221,991
Contingencies (2.0%)	$295,988
Engineering redesign fee (2.0%)	$295,988
Contractor profit and overhead (15.0%)	$2,219,906
Reclamation management fee (2.0%)	$295,988
Total Indirect Cost	**$3,329,861**

The total direct, indirect, and January 2024 to July 2025 inflation costs for Phase I and II bond categories in the N9 CRA are $18,129,230.

Permanent Facilities

This N9 Phase I and II bond release application does include permanent ponds, two-track ranch roads, and a permanent diversion for facilities that are proposed to be retained as permanent features within the N9 CRA. Map 1.1 shows the facilities that are proposed for retention in the postmining landscape to facilitate and enhance the postmining land uses. The current facilities located in the N9 CRA include ten proposed permanent impoundments designated N9-A, N9-B, N9-B2, N9-C, N9-C1, N9-E, N9-F, N9-G, N9-H, and N9-I, a permanent diversion to enhance surface water retention, proposed permanent ancillary roads for local residents to access grazing areas, and proposed permanent ancillary roads for local residents and visitors to utilize motor vehicles to access the residences and sites of interest surrounding the N9 CRA.

PWCC is requesting approval from OSMRE, Tribal agencies, and the local transportation committee, if applicable, to leave permanent roads for accessing residences, interior grazing areas, permanent ponds, and sites of interest surrounding the N9 CRA. The postmining access roads, left by PWCC for the purpose of accessing the postmining lands, will be maintained in the manner that other similar residential and range access roads have been traditionally maintained prior to any mining activities. All permanent facilities proposed for retention will enhance and complement the postmining land use.

PUBLIC NOTICE

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for bond release on a portion of the lands in the N9 Coal Resource Area (CRA) within the Kayenta Mine Permit AZ-0001F. PWCC is seeking a release of Phase I & II bond liability for a portion of the N9 area currently under bond with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. PWCC is seeking a reduction in bond of $18,129,230 under the Phase I application. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release application consists of information currently contained in the AZ-0001F permit application package (PAP) approved October 3, 2017. The PAP outlines PWCC's reclamation operations on Permanent Program Lands. The total area in N9 requested for Phase I release is 328 acres and for Phase II release is 286 acres. Reclamation was completed between 2012 and 2025. Reclamation activities were completed in accordance with the approved PAP and included backfilling, grading, mitigation of unsuitable material, drainage control construction, and replacement of suitable soil or plant growth media and revegetation. The Kayenta Mine permit for the release area is under Navajo Tribal Coal Lease 14-20-0603-9910 and operates pursuant to Code of Federal Regulations (CFR), Title 30; Subchapter E, Part 750; Subchapter G, Parts 773 and 774; and Subchapter K, Parts 810 and 816. This notice is hereby given that:

1. The name and business address of the applicant is:

   Peabody Western Coal Company, Kayenta Mine
   P.O. Box 650
   Kayenta, AZ 86033

2. The mine permit area is located approximately 18 miles south southwest of Kayenta, Arizona. The permit area for the Phase I bond release area is in USGS 7.5-minute quadrangle map "Long House Valley" within the following lands of Navajo County, Arizona that are described relative to the Gila and Salt River Base Meridian as:

   A total of 614 acres of land located within the N9 CRA. The computer-generated centroid location is Latitude 36° 34' 14.6" N and Longitude 110° 24' 50.7" W.

3. Locations of where copies of the application and permit are available for public review and/or inspection are:

   Navajo Nation Minerals Department
   Office of Surface Mining
   Window Rock Boulevard
   Window Rock, AZ 86515

   Forest Lake Chapter House
   Navajo Route 41
   17 Miles North of Pinon
   Pinon, AZ 86510

Peabody Western Coal Company - Kayenta Mine

Mesa Central Warehouse Office Complex

8 Miles from Hwy 160 and Route 41 Junction

Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/programs/regulating-active-coal-mines/indian-lands

4. The name and address of the OSMRE-WRO representative where written comments, objections, requests for a public hearing, or requests for an informal conference may be submitted on or before 5:00 p.m., May 30, 2025, thirty (30) days after the last publication date are:

Ms. Amy Ryser

Western Region Office

Office of Surface Mining Reclamation & Enforcement

P. O. Box 25065

One Federal Center, Building 41

Lakewood, CO 80225-0065

WR Permitting Information Line, 1-866-847-7362

5. Interested persons may obtain more information concerning the bond release by contacting Marie Shepherd, Senior Manager Environmental for PWCC at 928.280.7091.

6. The application has been filed with OSMRE and will be acted upon pursuant to the Permanent Regulatory Program (30 CFR Parts 750 and 774) approved by the Secretary of the Interior under Title V of the Surface mining Control and Reclamation Act of 1977.

PEABODY WESTERN
COAL COMPANY
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7115

March 6, 2025

Navajo Tribal Utility Authority
Mr. Walter W. Haase, P.E., General Manager
P.O. Box 170
Fort Defiance, Arizona 86504-0170

RE: Notice of Application for Phase I & II Bond Release; N9 Coal Resource Area; Kayenta Mine

Dear Mr. Haase:

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for Phase I & II bond release on portions of the N9 Coal Resource Area. The release area is in the northwestern portion of the PWCC lease area. PWCC is seeking release from Phase I & II bond liability for those surety bonds currently held with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release area is located within the Kayenta Mine Permanent Program permit area (AZ-0001F PAP) in the northwestern portion of the PWCC lease area. PWCC is seeking a reduction of the total N9 bond amount of $18,129,230 at this time by gaining regulatory approval for release of lands described in the application from Phase I & II bond liability. The total area sought for Phase I release includes 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to OSMRE in May 2024. The Phase II release includes 286 acres of mined and reclaimed land. Approval of Phases I & II for this application will allow for Phase II and III bond release to proceed on appropriate areas once all requirements for these phases are met. Phase III is the final bond release step and once approved will allow for the planned return of these lands to the Navajo Nation in the future. Until that time, PWCC will continue to control and manage reclaimed lands in the release areas described.

Reclamation of the Phase I & II release areas which includes backfilling and grading, drainage control, mitigation of unsuitable material, and topsoil replacement was completed between 2012 and 2025. Revegetation activities were initiated in 2014 and are still ongoing at this time. All reclamation activities were conducted in accordance with the Surface Mining Control and Reclamation Act (SMCRA) and the requirements of the OSMRE Permit AZ-0001F PAP approved October 3, 2017. Reclamation activities are documented in annual reports submitted previously to OSMRE.

The application and permit are available for public review and/or inspection at:

Navajo Nation Minerals Department
Office of Surface Mining
Window Rock Boulevard
Window Rock, AZ 86515

Forest Lake Chapter House
Navajo Route 41
17 miles North of Pinon
Pinon, AZ 86510

Peabody Western Coal Company
Kayenta Mine
Mesa Central Warehouse Office Complex
8 Miles from Hwy 160 and Route 41 Junction
Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/news/archive/kayentaBlackMesa

If you have questions, comments, or wish to request a hearing or informal conference regarding this bond release application, please contact:

Ms. Amy Ryser
Western Region Office
Office of Surface Mining Reclamation & Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065
WR Permitting Information Line, 1-866-847-7362

Please direct your questions about this application to me at 928.280.7091 or email them to me at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

C: Amy Ryser (OSMRE-WRO)

Peabody

PEABODY WESTERN
COAL COMPANY
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7115

March 7, 2025

Bureau of Indian Affairs
Navajo Area Office
Ms. Deborah Shirley, Acting Regional Director
P.O. Box 1060
301 West Hill Street
Gallup, New Mexico 87305-1060

RE: Notice of Application for Phase I and II Bond Release; N9 Coal Resource Area; Kayenta Mine

Dear Ms. Shirley:

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for Phase I & II bond release on portions of the N9 Coal Resource Area. The release area is in the northwestern portion of the PWCC lease area. PWCC is seeking release from Phase I & II bond liability for those surety bonds currently held with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release area is located within the Kayenta Mine Permanent Program permit area (AZ-0001F PAP) in the northwestern portion of the PWCC lease area. PWCC is seeking a reduction of the total N9 bond amount of $18,129,230 at this time by gaining regulatory approval for release of lands described in the application from Phase I & II bond liability. The total area sought for Phase I release includes 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to OSMRE in May 2024. The Phase II release includes 286 acres of mined and reclaimed land. Approval of Phases I & II for this application will allow for Phase II and III bond release to proceed on appropriate areas once all requirements for these phases are met. Phase III is the final bond release step and once approved will allow for the planned return of these lands to the Navajo Nation in the future. Until that time, PWCC will continue to control and manage reclaimed lands in the release areas described.

Reclamation of the Phase I & II release areas which includes backfilling and grading, drainage control, mitigation of unsuitable material, and topsoil replacement was completed between 2012 and 2025. Revegetation activities were initiated in 2014 and are still ongoing at this time. All reclamation activities were conducted in accordance with the Surface Mining Control and Reclamation Act (SMCRA) and the requirements of the OSMRE Permit AZ-0001F PAP approved October 3, 2017. Reclamation activities are documented in annual reports submitted previously to OSMRE.

The application and permit are available for public review and/or inspection at:

Navajo Nation Minerals Department
Office of Surface Mining
Window Rock Boulevard
Window Rock, AZ 86515

Forest Lake Chapter House
Navajo Route 41
17 miles North of Pinon
Pinon, AZ 86510

Peabody Western Coal Company
Kayenta Mine
Mesa Central Warehouse Office Complex
8 Miles from Hwy 160 and Route 41 Junction
Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/news/archive/kayentaBlack Mesa

If you have questions, comments, or wish to request a hearing or informal conference regarding this bond release application, please contact:

Ms. Amy Ryser
Western Region Office
Office of Surface Mining Reclamation & Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065
WR Permitting Information Line, 1-866-847-7362

Please direct your questions about this application to me at 928.280.7091 or email them to me at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

C: Amy Ryser (OSMRE-WRO)

**PEABODY WESTERN
COAL COMPANY**
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7115

March 6, 2025

Bureau of Land Management
Arizona State Office
Mr. Rick Selbach
Lands and Minerals Branch Chief
One North Central Ave., Suite 800
Phoenix, Arizona 85004

RE: Notice of Application for Phase I and II Bond Release; N9 Coal Resource Area; Kayenta Mine

Dear Mr. Selbach:

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for Phase I & II bond release on portions of the N9 Coal Resource Area. The release area is in the northwestern portion of the PWCC lease area. PWCC is seeking release from Phase I & II bond liability for those surety bonds currently held with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release area is located within the Kayenta Mine Permanent Program permit area (AZ-0001F PAP) in the northwestern portion of the PWCC lease area. PWCC is seeking a reduction of the total N9 bond amount of $18,129,230 at this time by gaining regulatory approval for release of lands described in the application from Phase I & II bond liability. The total area sought for Phase I release includes 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to OSMRE in May 2024. The Phase II release includes 286 acres of mined and reclaimed land. Approval of Phases I & II for this application will allow for Phase II and III bond release to proceed on appropriate areas once all requirements for these phases are met. Phase III is the final bond release step and once approved will allow for the planned return of these lands to the Navajo Nation in the future. Until that time, PWCC will continue to control and manage reclaimed lands in the release areas described.

Reclamation of the Phase I & II release areas which includes backfilling and grading, drainage control, mitigation of unsuitable material, and topsoil replacement was completed between 2012 and 2025. Revegetation activities were initiated in 2014 and are still ongoing at this time. All reclamation activities were conducted in accordance with the Surface Mining Control and Reclamation Act (SMCRA) and the requirements of the OSMRE Permit AZ-0001F PAP approved October 3, 2017. Reclamation activities are documented in annual reports submitted previously to OSMRE.

The application and permit are available for public review and/or inspection at:

Navajo Nation Minerals Department
Office of Surface Mining
Window Rock Boulevard
Window Rock, AZ 86515

Forest Lake Chapter House
Navajo Route 41
17 miles North of Pinon
Pinon, AZ 86510

Peabody Western Coal Company
Kayenta Mine
Mesa Central Warehouse Office Complex
8 Miles from Hyw 160 and Route 41 Junction
Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/news/archive/kayentaBlackMesa

If you have questions, comments, or wish to request a hearing or informal conference regarding this bond release application, please contact:

Ms. Amy Ryser
Western Region Office
Office of Surface Mining Reclamation & Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065
WR Permitting Information Line, 1-866-847-7362

Please direct your questions about this application to me at 928.280.7091 or email them to me at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

C: Amy Ryser (OSMRE-WRO)

PEABODY WESTERN COAL COMPANY
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7115

March 6, 2025

Chilchinbeto Chapter
Mr. Robert Singer, President
P.O. Box 1681
Kayenta, Arizona 86033

RE: Notice of Application for Phase I and II Bond Release; N9 Coal Resource Area; Kayenta Mine

Dear Mr. Singer:

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for Phase I & II bond release on portions of the N9 Coal Resource Area. The release area is in the northwestern portion of the PWCC lease area. PWCC is seeking release from Phase I & II bond liability for those surety bonds currently held with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release area is located within the Kayenta Mine Permanent Program permit area (AZ-0001F PAP) in the northwestern portion of the PWCC lease area. PWCC is seeking a reduction of the total N9 bond amount of $18,129,230 at this time by gaining regulatory approval for release of lands described in the application from Phase I & II bond liability. The total area sought for Phase I release includes 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to OSMRE in May 2024. The Phase II release includes 286 acres of mined and reclaimed land. Approval of Phases I & II for this application will allow for Phase II and III bond release to proceed on appropriate areas once all requirements for these phases are met. Phase III is the final bond release step and once approved will allow for the planned return of these lands to the Navajo Nation in the future. Until that time, PWCC will continue to control and manage reclaimed lands in the release areas described.

Reclamation of the Phase I & II release areas which includes backfilling and grading, drainage control, mitigation of unsuitable material, and topsoil replacement was completed between 2012 and 2025. Revegetation activities were initiated in 2014 and are still ongoing at this time. All reclamation activities were conducted in accordance with the Surface Mining Control and Reclamation Act (SMCRA) and the requirements of the OSMRE Permit AZ-0001F PAP approved October 3, 2017. Reclamation activities are documented in annual reports submitted previously to OSMRE.

The application and permit are available for public review and/or inspection at:

Navajo Nation Minerals Department
Office of Surface Mining
Window Rock Boulevard
Window Rock, AZ 86515

Forest Lake Chapter House
Navajo Route 41
17 miles North of Pinon
Pinon, AZ 86510

Peabody Western Coal Company
Kayenta Mine
Mesa Central Warehouse Office Complex
8 Miles from Hwy 160 and Route 41 Junction
Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/news/archive/kayentaBlackMesa

If you have questions, comments, or wish to request a hearing or informal conference regarding this bond release application, please contact:

Ms. Amy Ryser
Western Region Office
Office of Surface Mining Reclamation & Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065
WR Permitting Information Line, 1-866-847-7362

Please direct your questions about this application to me at 928.280.7091 or email them to me at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

C: Amy Ryser (OSMRE-WRO)

PEABODY WESTERN
COAL COMPANY
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7115

March 6, 2025

Forest Lake Chapter
Ms. Mae Gilene Begay, President
P.O. Box 441
Pinon, Arizona 86510

RE: Notice of Application for Phase I and II Bond Release; N9 Coal Resource Area; Kayenta Mine

Dear Ms. Begay:

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for Phase I & II bond release on portions of the N9 Coal Resource Area. The release area is in the northwestern portion of the PWCC lease area. PWCC is seeking release from Phase I & II bond liability for those surety bonds currently held with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release area is located within the Kayenta Mine Permanent Program permit area (AZ-0001F PAP) in the northwestern portion of the PWCC lease area. PWCC is seeking a reduction of the total N9 bond amount of $18,129,230 at this time by gaining regulatory approval for release of lands described in the application from Phase I & II bond liability. The total area sought for Phase I release includes 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to OSMRE in May 2024. The Phase II release includes 286 acres of mined and reclaimed land. Approval of Phases I & II for this application will allow for Phase II and III bond release to proceed on appropriate areas once all requirements for these phases are met. Phase III is the final bond release step and once approved will allow for the planned return of these lands to the Navajo Nation in the future. Until that time, PWCC will continue to control and manage reclaimed lands in the release areas described.

Reclamation of the Phase I & II release areas which includes backfilling and grading, drainage control, mitigation of unsuitable material, and topsoil replacement was completed between 2012 and 2025. Revegetation activities were initiated in 2014 and are still ongoing at this time. All reclamation activities were conducted in accordance with the Surface Mining Control and Reclamation Act (SMCRA) and the requirements of the OSMRE Permit AZ-0001F PAP approved October 3, 2017. Reclamation activities are documented in annual reports submitted previously to OSMRE.

The application and permit are available for public review and/or inspection at:

Navajo Nation Minerals Department
Office of Surface Mining
Window Rock Boulevard
Window Rock, AZ 86515

Forest Lake Chapter House
Navajo Route 41
17 miles North of Pinon
Pinon, AZ 86510

Peabody Western Coal Company
Kayenta Mine
Mesa Central Warehouse Office Complex
8 Miles from Hwy 160 and Route 41 Junction
Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/news/archive/kayentaBlackMesa

If you have questions, comments, or wish to request a hearing or informal conference regarding this bond release application, please contact:

Ms. Amy Ryser
Western Region Office
Office of Surface Mining Reclamation & Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065
WR Permitting Information Line, 1-866-847-7362

Please direct your questions about this application to me at 928.280.7091 or email them to me at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

C: Amy Ryser (OSMRE-WRO)

PEABODY WESTERN
COAL COMPANY
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7115

March 6, 2025

The Hopi Tribe
Office of Mining and Minerals
Attn: Dr. Carrie Joseph
P.O. Box 123
Kykotsmovi, AZ 86039

RE: Notice of Application for Phase I and II Bond Release; N9 Coal Resource Area; Kayenta Mine

Dear Dr. Joseph:

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for Phase I & II bond release on portions of the N9 Coal Resource Area. The release area is in the northwestern portion of the PWCC lease area. PWCC is seeking release from Phase I & II bond liability for those surety bonds currently held with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release area is located within the Kayenta Mine Permanent Program permit area (AZ-0001F PAP) in the northwestern portion of the PWCC lease area. PWCC is seeking a reduction of the total N9 bond amount of $18,129,230 at this time by gaining regulatory approval for release of lands described in the application from Phase I & II bond liability. The total area sought for Phase I release includes 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to OSMRE in May 2024. The Phase II release includes 286 acres of mined and reclaimed land. Approval of Phases I & II for this application will allow for Phase II and III bond release to proceed on appropriate areas once all requirements for these phases are met. Phase III is the final bond release step and once approved will allow for the planned return of these lands to the Navajo Nation in the future. Until that time, PWCC will continue to control and manage reclaimed lands in the release areas described.

Reclamation of the Phase I & II release areas which includes backfilling and grading, drainage control, mitigation of unsuitable material, and topsoil replacement was completed between 2012 and 2025. Revegetation activities were initiated in 2014 and are still ongoing at this time. All reclamation activities were conducted in accordance with the Surface Mining Control and Reclamation Act (SMCRA) and the requirements of the OSMRE Permit AZ-0001F PAP approved October 3, 2017. Reclamation activities are documented in annual reports submitted previously to OSMRE.

The application and permit are available for public review and/or inspection at:

Navajo Nation Minerals Department
Office of Surface Mining
Window Rock Boulevard
Window Rock, AZ 86515

Forest Lake Chapter House
Navajo Route 41
17 miles North of Pinon
Pinon, AZ 86510

Peabody Western Coal Company
Kayenta Mine
Mesa Central Warehouse Office Complex
8 Miles from Hwy 160 and Route 41 Junction
Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/news/archive/kayentaBlackMesa

If you have questions, comments, or wish to request a hearing or informal conference regarding this bond release application, please contact:

Ms. Amy Ryser
Western Region Office
Office of Surface Mining Reclamation & Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065
WR Permitting Information Line, 1-866-847-7362

Please direct your questions about this application to me at 928.280.7091 or email them to me at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

C: Amy Ryser (OSMRE-WRO)

PEABODY WESTERN COAL COMPANY
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7115

March 6, 2025

Kayenta Chapter
Mr. Albert Bailey, President
P.O. Box 1088
Kayenta, Arizona 86033

RE: Notice of Application for Phase I and II Bond Release; N9 Coal Resource Area; Kayenta Mine

Dear Mr. Bailey:

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for Phase I & II bond release on portions of the N9 Coal Resource Area. The release area is in the northwestern portion of the PWCC lease area. PWCC is seeking release from Phase I & II bond liability for those surety bonds currently held with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release area is located within the Kayenta Mine Permanent Program permit area (AZ-0001F PAP) in the northwestern portion of the PWCC lease area. PWCC is seeking a reduction of the total N9 bond amount of $18,129,230 at this time by gaining regulatory approval for release of lands described in the application from Phase I & II bond liability. The total area sought for Phase I release includes 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to OSMRE in May 2024. The Phase II release includes 286 acres of mined and reclaimed land. Approval of Phases I & II for this application will allow for Phase II and III bond release to proceed on appropriate areas once all requirements for these phases are met. Phase III is the final bond release step and once approved will allow for the planned return of these lands to the Navajo Nation in the future. Until that time, PWCC will continue to control and manage reclaimed lands in the release areas described.

Reclamation of the Phase I & II release areas which includes backfilling and grading, drainage control, mitigation of unsuitable material, and topsoil replacement was completed between 2012 and 2025. Revegetation activities were initiated in 2014 and are still ongoing at this time. All reclamation activities were conducted in accordance with the Surface Mining Control and Reclamation Act (SMCRA) and the requirements of the OSMRE Permit AZ-0001F PAP approved October 3, 2017. Reclamation activities are documented in annual reports submitted previously to OSMRE.

The application and permit are available for public review and/or inspection at:

Navajo Nation Minerals Department
Office of Surface Mining
Window Rock Boulevard
Window Rock, AZ 86515

Forest Lake Chapter House
Navajo Route 41
17 miles North of Pinon
Pinon, AZ 86510

Peabody Western Coal Company
Kayenta Mine
Mesa Central Warehouse Office Complex
8 Miles from 160 and Route 41 Junction
Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/news/archive/kayentaBlackMesa

If you have questions, comments, or wish to request a hearing or informal conference regarding this bond release application, please contact:

Ms. Amy Ryser
Western Region Office
Office of Surface Mining Reclamation & Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065
WR Permitting Information Line, 1-866-847-7362

Please direct your questions about this application to me at 928.280.7091 or email them to me at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

C: Amy Ryser (OSMRE-WRO)

PEABODY WESTERN
COAL COMPANY
Kayenta Mine
Highway 160, Navajo Route 41
P.O. Box 650
Kayenta, Arizona 86033
928.280.7115

March 6, 2025

Navajo Nation
Minerals Department
Ms. Rowena L. Cheromiah
P.O. Box 1910
Window Rock, AZ 86515

RE: Notice of Application for Phase I and II Bond Release; N9 Coal Resource Area; Kayenta Mine

Dear Ms. Cheromiah:

Peabody Western Coal Company (PWCC) has filed an application with the Office of Surface Mining Reclamation and Enforcement (OSMRE) for Phase I & II bond release on portions of the N9 Coal Resource Area. The release area is in the northwestern portion of the PWCC lease area. PWCC is seeking release from Phase I & II bond liability for those surety bonds currently held with Zurich American, Liberty Mutual, and SiriusPoint America Insurance and one Letter of Credit with Goldeman Sachs Bank, USA. The total combined bond for Kayenta Mine is $107,171,138.

The Phase I & II bond release area is located within the Kayenta Mine Permanent Program permit area (AZ-0001F PAP) in the northwestern portion of the PWCC lease area. PWCC is seeking a reduction of the total N9 bond amount of $18,129,230 at this time by gaining regulatory approval for release of lands described in the application from Phase I & II bond liability. The total area sought for Phase I release includes 328 acres of mined and reclaimed lands and 506 acres where soil and suitable soil was replaced since a previous Phase I bond release application was submitted to OSMRE in May 2024. The Phase II release includes 286 acres of mined and reclaimed land. Approval of Phases I & II for this application will allow for Phase II and III bond release to proceed on appropriate areas once all requirements for these phases are met. Phase III is the final bond release step and once approved will allow for the planned return of these lands to the Navajo Nation in the future. Until that time, PWCC will continue to control and manage reclaimed lands in the release areas described.

Reclamation of the Phase I & II release areas which includes backfilling and grading, drainage control, mitigation of unsuitable material, and topsoil replacement was completed between 2012 and 2025. Revegetation activities were initiated in 2014 and are still ongoing at this time. All reclamation activities were conducted in accordance with the Surface Mining Control and Reclamation Act (SMCRA) and the requirements of the OSMRE Permit AZ-0001F PAP approved October 3, 2017. Reclamation activities are documented in annual reports submitted previously to OSMRE.

The application and permit are available for public review and/or inspection at:

Navajo Nation Minerals Department
Office of Surface Mining
Window Rock Boulevard
Window Rock, AZ 86515

Forest Lake Chapter House
Navajo Route 41
17 miles North of Pinon
Pinon, AZ 86510

Peabody Western Coal Company
Kayenta Mine
Mesa Central Warehouse Office Complex
8 Miles from Hwy 160 and Route 41 Junction
Kayenta, Arizona 86033

OSMRE Website: https://www.osmre.gov/news/archive/kayentaBlackMesa

If you have questions, comments, or wish to request a hearing or informal conference regarding this bond release application, please contact:

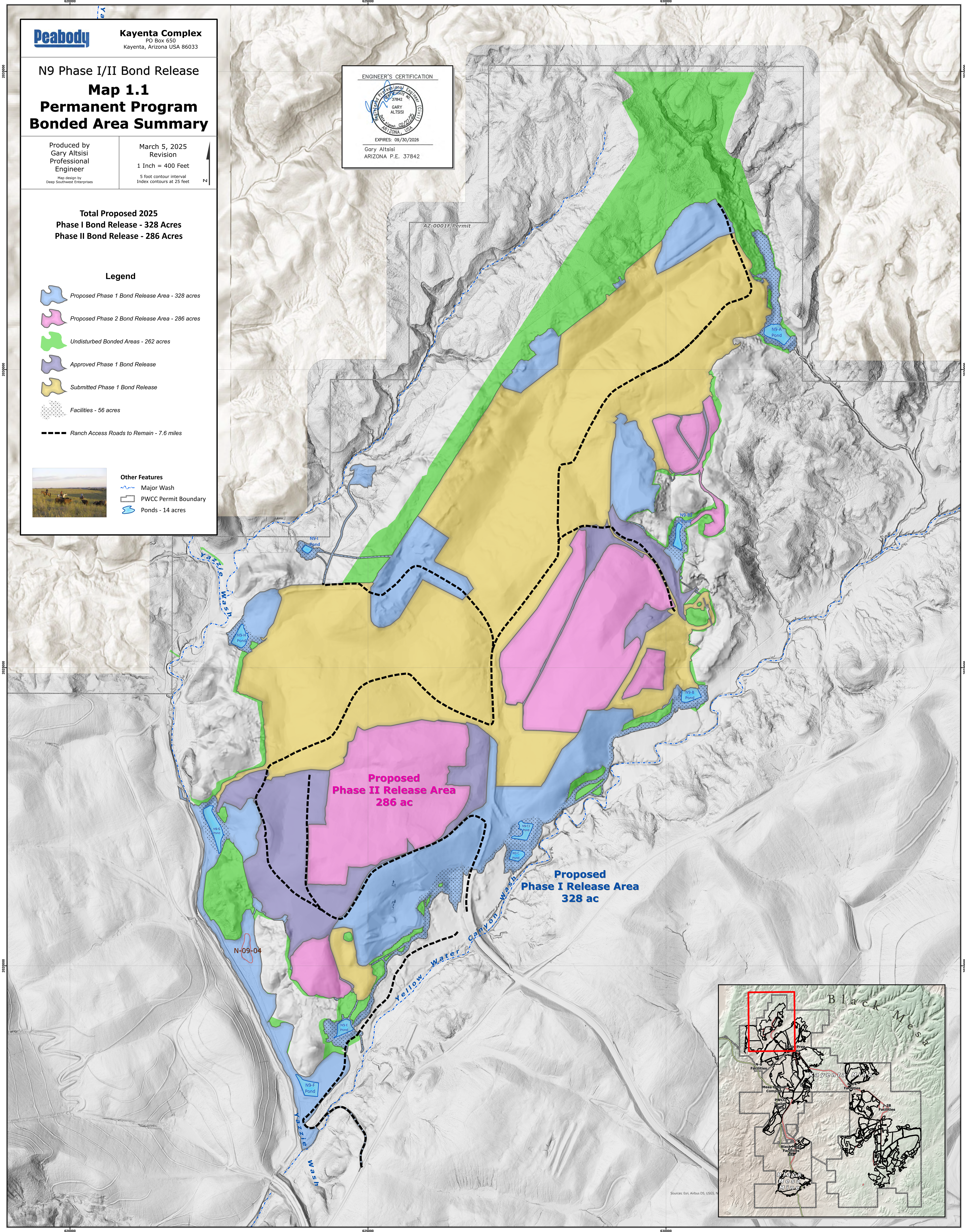
Ms. Amy Ryser
Western Region Office
Office of Surface Mining Reclamation & Enforcement
P. O. Box 25065
One Federal Center, Building 41
Lakewood, CO 80225-0065
WR Permitting Information Line, 1-866-847-7362

Please direct your questions about this application to me at 928.280.7091 or email them to me at mshepherd2@peabodyenergy.com.

Respectfully,

Marie Shepherd
Senior Manager Environmental
Kayenta Mine

C: Amy Ryser (OSMRE-WRO)


Peabody
Kayenta Complex
PO Box 650
Kayenta, Arizona USA 86033
N9 Phase I/II Bond Release
Map 1.1
Permanent Program
Bonded Area Summary
Produced by
Gary Altsisi
Professional
Engineer
Map design by
Deep Southwest Enterprises
March 5, 2025
Revision
1 Inch = 400 Feet
5 foot contour interval
Index contours at 25 feet
N
Total Proposed 2025
Phase I Bond Release - 328 Acres
Phase II Bond Release - 286 Acres
Legend
Proposed Phase 1 Bond Release Area - 328 acres
Proposed Phase 2 Bond Release Area - 286 acres
Undisturbed Bonded Areas - 262 acres
Approved Phase 1 Bond Release
Submitted Phase 1 Bond Release
Facilities - 56 acres
Ranch Access Roads to Remain - 7.6 miles
Other Features
Major Wash
PWCC Permit Boundary
Ponds - 14 acres
ENGINEER'S CERTIFICATION
Registered Professional Engineer (Civil)
37842
GARY
ALTSISI
ARIZONA, USA
EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842
AZ-0001F Permit
N9-A Pond
N9-B2 Pond
N9-B Pond
N9-H Pond
N9-I Pond
N9-CI Pond
N9-F Pond
N-09-04
Yazzie Wash
Yellow Water Canyon Wash
Proposed
Phase II Release Area
286 ac
Proposed
Phase I Release Area
328 ac
Black Mesa
620000
625000
630000
Sources: Esri, Airbus DS, USGS

Phase I and II Bond Release Application

N9 Coal Resource Areas, Kayenta Mine

TABLE OF CONTENTS

Section 2. Phase I & II Bond Release Supporting Information – Backfilling, Grading, Suitable Material, Soil, and Surface Water Data

SECTION 2. Phase I & II Bond Release Supporting Information

Backfilling, Grading, Suitable Material, Soil, and Surface Water Data

Introduction

The Phase I & II Bond Release information contained in this application for the N9 Coal Resource Area (CRA) consists primarily of backfilling, grading, soil and suitable plant growth material replacement, drainage channel as-builts, surface water description, and slope analysis.

Backfilling and Grading

Permanent support facilities are discussed in Section 1 of this N9 Phase I & II Bond Release Application. Final grading of permanent program lands within the N9 areas occurred from 2012 to 2025. Final grading status for the release areas shown on Map 1.1 through 2023 were previously reported and submitted with supporting maps to the regulatory authority in the following annual monitoring reports. Final grading status for Years 2024 and 2025 will be submitted in the May 2025 and May 2026 annual monitoring reports.

Peabody Western Coal Company (PWCC). 2013-2024. 2012-2023 Minesoil Reconstruction and Revegetation Activities Reports, Black Mesa and Kayenta Mines, Flagstaff and Kayenta, Arizona. Reports Prepared for: The Office of Surface Mining Reclamation and Enforcement, Western Service Center, Denver, Colorado.

The pre-mining and post-mining topography consists of rolling hills dissected by ephemeral drainage channels. The regulations require the post-mining graded slopes must approximate the pre-mining natural slopes. Approximate original contour means that surface configuration is achieved by backfilling and grading of the mined area so that the reclaimed area resembles the general surface configuration of the surrounding terrain with all final highwall and spoil piles eliminated. To perform a realistic comparison of the pre-mining and post-mining slope measurements, PWCC utilized ESRI ArcGIS 10 Spatial Analyst software to generate slope measurement polygons within the entire N9 reclamation areas included in this submittal. The N9 release areas included with this Phase I & II bond release application are all Permanent Program Lands. The N9 reclamation areas were evaluated to compare the slope stability of the pre- and post-mining landforms and general surface configuration.

The slope polygons were grouped into slope measurement ranges based on the following six slope measurement classifications:

1. <9%
2. 9% to 13%
3. 13% to 18%
4. 18% to 25%
5. 25% to 33%
6. >33%

These slope measurement classifications are like the classifications utilized in the AZ-0001F Permit, Chapter 26, Surface Stabilization. The location of the area associated with each of the pre- and post-mine slope measurement classes for the N9 reclamation areas can be found on Map 2.3 (Post-Mine) and Map 2.4 (Pre-Mine). Table 2.1 provides a summary of the area in each slope measurement classification before mining and after mining for the N9 release areas, respectively:

Table 2.1. Pre- and Post-Mining Slope Analysis for N9 Permanent Program Reclaimed Areas.

POST - MINING SLOPE ANALYSIS:

RANGE	BEGINNING (%)	END (%)	AREA (Ac.)	PERCENT of TOTAL AREA	POST - MINING SLOPE AREA vs. PRE - MINING SLOPE AREA (%)
1	0	9	115	35	-11%
2	9	13	54	17	-4%
3	13	18	50	15	-1%
4	18	25	65	20	+8%
5	25	33	33	10	+6%
6	33	+	12	4	+3%

PRE - MINING SLOPE ANALYSIS:

RANGE	BEGINNING (%)	END (%)	AREA (Ac.)	PERCENT of TOTAL AREA
1	0	9	150	46
2	9	13	70	21
3	13	18	53	16
4	18	25	39	12
5	25	33	14	4
6	33	+	2	1

As illustrated above, the post-mine topography has very similar slope gradient percentages in each of the six range categories compared with the original pre-mine topography. Overall, the N9 post-mine topography has approximately 11% less 0-9% slopes and approximately 8% more 18-25% slopes and 6% more 25-33% slopes than the pre-mine topography. The as-built post-mine surface shown on Map 2.3 was compared to the Estimated Post-mining Topographic (PMT) Map, Drawing 85352, Sheets K6 and K7, Volume 29 of Permit AZ-0001F. The reclaimed surface was within +/- 20 feet of the estimated post-mine contours on more than 94% of the area as shown on Map 2.5. The outlier areas shown on Map 2.5 are +/-20 to 40 feet on 6% and are mainly related to the highwall reduction and topsoil pile removal once mining and reclamation operations end. These areas all blend with the adjacent PMT and overall surface configuration.

Attachment 2.1 includes the as-built information for the N9 reclamation drainage channels shown on Map 2.6 (Sheets 1, 2, and 3 of 3). This is similar to the map submitted previously in the Annual Surface Stabilization Reports. Based on the information in Attachment 2.1 and a field inspection of the area, PWCC has demonstrated the post-mining reclamation drainage structures are stable and can safely pass the design runoff. The locations of these drainage structures are shown on Map 2.6 (3 sheets).

In conclusion, the N9 reclamation areas have been graded to very similar overall slopes compared to pre-mine topography. Grading was completed to eliminate final highwalls and spoil piles, to ensure stability, to blend post-mining and undisturbed pre-mining slopes, to reestablish a positive stable drainage network, and to facilitate the livestock grazing, wildlife habitat, and cultural plant post-mining land uses. The N9 backfilling, grading, and drainage system construction was conducted in conformance with the applicable regulatory requirements and approved reclamation plans.

Surface Water Data

There have been no NPDES discharges from any pond in the N9 Phase I and II bond release watersheds for the period of record (2005-2025). One (1) complete water quality sample was collected from Pond N9-C1 in 2022. This was done at the request of the Navajo Nation. Laboratory data for the one (1) sample collected indicate all analytes met applicable livestock water quality standards.

Spoil Sampling and Suitable Material Replacement

Final graded spoil for the N9 CRA permanent program lands was sampled during nine (9) years during 2014, 2015, 2016, 2017, 2018, 2021, 2022, 2023, and 2024 (as documented in Attachment 2.3) to comprehensively evaluate suitability and determine suitable plant growth material replacement requirements per Chapter 22, Volume 11, Permit AZ-0001F. All spoil sampling and data evaluations were completed using procedures and suitability criteria presented in Chapter 22, Volume 11, Permit AZ-0001F. Spoil sampling results were previously reported and submitted with supporting maps to OSMRE in eight (8) annual monitoring reports as referenced below and documented in Attachment 2.3. Spoil sampling results from 2024, included in Attachment 2.3, will be submitted to OSMRE in 2025.

Peabody Western Coal Company (PWCC). 2015, 2016, 2017, 2018, 2019, 2022, 2023, 2024. 2012, 2014, 2016, 2017, 2018, 2021, 2022, 2023 Minesoil Reconstruction and Revegetation Activities Reports, Black Mesa and Kayenta Mines, Flagstaff and Kayenta, Arizona. Reports Prepared for: The Office of Surface Mining Reclamation and Enforcement, Western Service Center, Denver and Lakewood, Colorado.

Spoil sample laboratory data from the reports listed above that is pertinent to the Phase I & II bond release areas is included in Attachment 2.3 for the N9 CRA. A total of one hundred thirteen (113) sites were located on final graded spoil slopes as shown on Map 2.2 and sampled within the designated Phase I & II release areas. The coal removal boundary which corresponds closely with the spoil grading limit is shown on Map 2.2 where needed to identify where sampling was required to ensure all final graded spoil areas were sampled per Chapter 22, Volume 11, Permit AZ-0001F. Seventy one (71) of the 113 sites sampled (63%) as listed in Attachment 2.3 and shown on Map 2.2 had suitable spoil characteristics from the surface to three (3) feet and required no additional suitable subsoil and substratum material to be replaced before applying one foot of suitable surface soil. Seventy-five (75) midpoint sample sites as listed in Attachment 2.3 and shown on Map 2.2 were sampled to verify the lateral extent of spoil suitability. Fifty-eight (58) of these midpoint sample sites are located within the previous Phase I bond release application area that was submitted to OSMRE in May 2024. Topsoil, suitable residual soils, and weathered overburden derived from mostly scoria, sandstone, and siltstone were used to bury unsuitable spoil at N9 when 2, 3, or 4 feet of suitable mitigation material was required as shown on Map 2.2. Three (3) sample sites as listed in Attachment 2.3 and shown on Map 2.2 had marginally suitable test criterion(s) within threshold standards approved by OSMRE in Permit AZ-0001F. Four feet or more of suitable residual soils and weathered overburden were used in three (3) cultural planting areas that totaled ten (10) acres. Occasionally, topsoil was used in N9 as mitigation material as observed by the field supervisors during reclamation work and as noted by the suitable plant growth material thickness survey. An average of 0.6 feet of mitigation material was required for the entire Phase I release area (328 acres) based on the comprehensive graded spoil sampling suitability analysis presented in Attachment 2.3. The fifty-eight (58) additional midpoint sites placed within the 506 acre parcel that had not yet been topsoiled for the May 2024 Phase I bond release application still required an average of 0.7 feet of mitigation material. As documented in the next section titled Suitable Plant Growth Material Thickness, the mean thickness of mitigation material replaced for the 834-acre combined areas shown on Map 2.2 equaled 1.3 feet (excluding one (1) foot of topsoil, suitable soil, suitable residual soils, and weathered scoria overburden at the surface).

Suitable Plant Growth Material Thickness

Four feet of suitable plant growth material as defined in Chapter 22, Volume 11, Permit AZ-001F was replaced on final graded slopes of permanent program lands within the N9 CRAs from 2014 to 2025. Suitable plant growth material replacement status for some of the release areas shown on Map 1.1 were previously reported to the regulatory authority on the Reclamation Status Map 2 (as of December 31, 2023) shown on the Northwest Sheet contained in the 2023 Reclamation Status and Monitoring Report, Black Mesa and Kayenta Mines (submitted May 2024). Suitable plant growth material replacement areas for the 2024 and 2025 calendar years will be submitted to the regulatory authority with the next two annual reports in May 2025 and May 2026. Soil was redistributed on final graded slopes from stockpiles or replaced directly from soil removal areas prior to ripping and contour discing. Pursuant to Chapter 22 of Permit AZ-0001F, the thickness of soil replaced shall exceed the minimum average of one (1) foot.

Three (3) red rocked cultural planting sites totaling ten (10) acres combined as shown on Map 2.1, received an average of 3.9 feet of suitable residual soils and weathered overburden. Topsoil was not replaced at these three (3) sites that totaled ten (10) acres.

One suitable plant growth material thickness survey of the N9 reclaimed area included with this Phase I bond release application was completed during March 2025 as shown on Map 2.1. Personnel from Peabody Western Coal Company (PWCC) observed sites in the N9 reclaimed areas to verify the suitable plant growth material replacement thickness. A stratified grid sampling scheme using a random number generator program was used for the PWCC survey to locate forty-two (42) sites within the topsoiled, cultural planting, and suitable soil/steep slope areas of N9 (834 acres) prior to going into the field. Suitable plant growth material thickness verification sites were not placed within the rocked downdrain, large drainage areas, and permanent facility areas (ponds, roads, diversion, etc.) A sampling density of about 1 site per 20 acres was used; like those used and approved previously at Kayenta Mine for the N1/N2, N7/N8, N9, N11, N14, J16, J19, J21, and N9 soil thickness evaluations. A Tremble GeoXT survey grade GPS unit was used to navigate to each of the sites. At all sites, either a 3 ½-inch bucket auger or backhoe pit were used to verify the soil and mitigation material thickness by excavating to the contact with spoil. The results of the soil and mitigation material thickness verification survey are shown in Table 2.2 and Map 2.1 shows all sampled sites with corresponding thickness values.

Forty-two (42) sample sites were randomly placed within the 834 acres of disturbed lands that received suitable plant growth material within the release area. Suitable plant growth material thickness was verified at all forty-two (42) sites. No soil thickness verification measurements were recorded for two (2) natural ground and one (1) previous topsoil stockpile areas. Suitable plant growth material thickness among the remaining thirty-nine (39) profiles placed over the N9 release area ranged from 1.0 to 5.3 feet. The mean topsoil and suitable soil thickness value for these thirty-nine (39) sites listed in Table 2.2 was 2.3 feet. The mean soil and suitable material thickness of 2.3 feet exceeds the minimum 1-foot average topsoil thickness requirements presented in the approved reclamation plan in Chapter 22 of Permit AZ-0001F.

When the topsoiled reclamation areas are combined with the cultural planting and suitable soil/steep slope areas, the mean thickness of suitable plant growth material is 2.3 feet (Table 2.2). This mean thickness of 2.3 feet exceeds the average combined topsoil and mitigation material thickness of 1.6 to 1.7 feet as required by the spoil suitability mitigation requirements discussed in the previous section and shown on Map 2.2. In conclusion, PWCC has satisfied topsoil and suitable plant growth material thickness replacement requirements in conformance with applicable regulatory requirements and as stipulated by the approved reclamation plan for the N9 Phase I & II release areas shown on Map 1.1.

Table 2.2. Suitable Plant Growth Material Thickness Verification Sites Sampled by PWCC at N9 During March 2025 (See Map 2.1 for Site Locations).				
Site ID [1]	**Easting (feet)** [2]	**Northing (feet)** [2]	**Soil/Mitigation Thickness (feet)**	**Coal Resource Area**
1	12524	24614	1.3	N9
2	14134	27128	1.5	N9
3	14458	26343	1.0	N9
4	9400	23318	1.6	N9
5	13350	25534	1.4	N9
6	9739	24129	2.7	N9
7	9088	23982	2.8	N9
8	8678	23586	1.8	N9
9	9715	24641	1.8	N9
10	10627	25061	1.9	N9
11	9053	24919	1.8	N9
12	3135	19705	1.3	N9
13	4547	19748	1.0	N9
14	5322	20335	2.0	N9
15	8135	19506	3.0+ [5]	N9
16	7114	19255	3.0+	N9
17	7593	20143	1.4	N9
18	7996	22354	1.3	N9
19	7088	22175	1.3	N9
20	6059	20174	1.6	N9
21	8008	21000	3.0	N9
22	5254	22619	3.4	N9
23	4377	22893	2.0	N9
24	3618	22030	2.2	N9
25	3226	20820	1.4	N9
26	5549	24067	3.4 [4]	N9
27	6629	19240	1.0 [4]	N9
28	8286	20256	2.3 [4]	N9
29	8947	22469	1.8 [4]	N9
30	8621	21473	[6]	N9
31	10115	22728	[4] [6]	N9

32	11194	25098	1.8 (4)	N9
33	11746	25938	2.0 (4)	N9
34	12246	25042	4.7 (4)	N9
35	12745	27205	5.3 (4)	N9
36	9262	25555	4.5 (4)	N9
37	7746	25714	2.8 (4)	N9
38	11331	24657	2.3	N9
39	12211	25650	3.9 (3)	N9
40	6055	25084	3.5	N9
41	10176	25528	(5)	N9
42	4884	24208	1.8	N9
MEAN			**2.0+/3.0** (7)	

(1) For location see Map 2.1. (2) PWCC coordinate system. (3) Cultural planting area. (4) Suitable soil areas. (5) Topsoil stockpile area. (6) Natural ground. (7) Mean topsoil thickness/Suitable soil thickness.

TABLE N9-2025
Channel Design Summary

Channel N9-1W.1C Typical Rip Rap Lined Channel														
					Designed					As-Built				
Channel	Flow (Q) (cfs)	Slope (%)	Bottom Width (ft)	Side Slope H:1 (ft)	Depth Flow (ft)	Velocity (fps)	Free Board (ft)	Total Depth (ft)	Rip Rap (in)	Rip Rap (in)	Watershed (acres)	Time of Concentration (hr)	Curve Number	Design
N9-1W.1C	125.30	1.70	20	3	1.1	5.01	1	2.1	3	**3**	535.6	0.489	81	B

Design Flow: 10-year, 6-hour Storm

TABLE N9-2025
Channel Design Summary

Channel N9-2W.1C Typical Rip Rap Lined Channel														
					Designed					As-Built				
Channel	Flow (Q) (cfs)	Slope (%)	Bottom Width (ft)	Side Slope H:1 (ft)	Depth Flow (ft)	Velocity (fps)	Free Board (ft)	Total Depth (ft)	Rip Rap (in)	Rip Rap (in)	Watershed (acres)	Time of Concentration (hr)	Curve Number	Design
N9-2W.1C	68.07	7.60	18	3	0.6	6.13	1	1.6	3	**3**	438.6	0.668	79	B

Design Flow: 10-year, 6-hour Storm

TABLE N9-2025
Channel Design Summary

Channel N9-3W.1C

Typical Rip Rap Lined Channel

					Designed					As-Built				
Channel	Flow (Q) (cfs)	Slope (%)	Bottom Width (ft)	Side Slope H:1 (ft)	Depth Flow (ft)	Velocity (fps)	Free Board (ft)	Total Depth (ft)	Rip Rap (in)	Rip Rap (in)	Watershed (acres)	Time of Concentration (hr)	Curve Number	Design
N9-3W.1C	5.26	2.50	19	3	0.2	2.02	1	1.2	N/A	**N/A**	301.0	0.566	66	A

Design Flow: 10-year, 6-hour Storm

TABLE N9-2025
Channel Design Summary

Channel N9-6W.1C

Typical Rip Rap Lined Channel

					Designed					As-Built				
Channel	Flow (Q) (cfs)	Slope (%)	Bottom Width (ft)	Side Slope H:1 (ft)	Depth Flow (ft)	Velocity (fps)	Free Board (ft)	Total Depth (ft)	Rip Rap (in)	Rip Rap (in)	Watershed (acres)	Time of Concentration (hr)	Curve Number	Design
N9-6W.1C	29.28	7.40	15	3	0.4	4.51	1	1.4	3	**6**	132.4	0.284	78	B

Design Flow: 10-year, 6-hour Storm

KAYENTA MINE
PHASE I BOND RELEASE
WATERSHED & CHANNEL DESIGNS
N9

N9-1W.1C CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
20.00	3.0:1	3.0:1	1.7	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	125.30 cfs	
Depth:	1.08 ft	2.08 ft
Top Width:	26.46 ft	32.46 ft
Velocity:	5.01 fps	
X-Section Area:	25.00 sq ft	
Hydraulic Radius:	0.933 ft	
Froude Number:	0.91	
Manning's n:	0.0370	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

N9-1W.1C (N9-C Pond Channel) Watershed Design - 10yr-6hr

Gary Altsisi, P.E.

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	N9-1W.1C CHANNEL DESIGN

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	535.600	535.600	125.30	13.10

Structure Detail:

Structure #1 (Null)

N9-1W.1C CHANNEL DESIGN

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	535.600	0.489	0.000	0.000	81.000	M	125.30	13.102
	Σ	**535.600**						**125.30**	**13.102**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	12.98	105.00	809.00	2.880	0.078
		8. Large gullies, diversions, and low flowing streams	2.99	230.00	7,682.00	5.190	0.411
#1	**1**	**Time of Concentration:**					**0.489**

N9-2W.1C CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
18.00	3.0:1	3.0:1	7.6	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	68.07 cfs	
Depth:	0.56 ft	1.56 ft
Top Width:	21.38 ft	27.38 ft
Velocity:	6.13 fps	
X-Section Area:	11.10 sq ft	
Hydraulic Radius:	0.515 ft	
Froude Number:	1.50	
Manning's n:	0.0430	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

N9-2W.1C (N9-B Pond Channel) Watershed Design - 10yr-6hr

Gary Altsisi, P.E.

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	N9-2W.1C CHANNEL DESIGN

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	438.600	438.600	68.07	8.92

Structure Detail:

Structure #1 (Null)

N9-2W.1C CHANNEL DESIGN

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	438.600	0.668	0.000	0.000	79.000	M	68.07	8.924
	Σ	**438.600**						**68.07**	**8.924**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	7.07	63.00	891.00	2.120	0.116
		8. Large gullies, diversions, and low flowing streams	2.53	240.00	9,489.16	4.770	0.552
#1	**1**	**Time of Concentration:**					**0.668**

N9-3W.1C CHANNEL

Material: Graded loam to cobbles when noncolloidal

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
19.00	3.0:1	3.0:1	2.5	0.0300	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.26 cfs	
Depth:	0.13 ft	1.13 ft
Top Width:	19.80 ft	25.80 ft
Velocity:	2.02 fps	
X-Section Area:	2.60 sq ft	
Hydraulic Radius:	0.131 ft	
Froude Number:	0.99	

N9-3W.1C (N9-A Pond Channel) Watershed Design - 10yr-6hr

Gary Altsisi, P.E.

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	N9-3W.1C CHANNEL DESIGN

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	301.000	301.000	5.26	1.13

Structure Detail:

Structure #1 (Null)

N9-3W.1C CHANNEL DESIGN

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	301.000	0.566	0.000	0.000	66.000	M	5.26	1.134
	Σ	**301.000**						**5.26**	**1.134**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	7.27	120.00	1,650.00	2.150	0.213
		6. Grassed waterway	3.97	40.00	1,007.00	2.980	0.093
		8. Large gullies, diversions, and low flowing streams	3.51	185.00	5,267.05	5.620	0.260
#1	**1**	**Time of Concentration:**					**0.566**

N9-6W.1C CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	7.4	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	29.98 cfs	
Depth:	0.41 ft	1.41 ft
Top Width:	17.46 ft	23.46 ft
Velocity:	4.51 fps	
X-Section Area:	6.65 sq ft	
Hydraulic Radius:	0.378 ft	
Froude Number:	1.29	
Manning's n:	0.0470	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

N9-6W.1C (N9-G Pond Channel) Watershed Design - 10yr-6hr

Gary Altsisi, P.E.

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	N9-6W.1C CHANNEL DESIGN

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	132.400	132.400	29.28	2.46

Structure Detail:

Structure #1 (Null)

N9-6W.1C CHANNEL DESIGN

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	132.400	0.284	0.000	0.000	78.000	M	29.28	2.455
	Σ	**132.400**						**29.28**	**2.455**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	6.65	77.00	1,158.00	2.060	0.156
		8. Large gullies, diversions, and low flowing streams	3.08	75.00	2,437.04	5.260	0.128
#1	**1**	**Time of Concentration:**					**0.284**

2025

CERTIFICATION

PEABODY WESTERN COAL COMPANY
KAYENTA MINE, N9 COAL RESOURCE AREAS, PHASE I BOND RELEASE APPLICATION
NAVAJO COUNTY, ARIZONA

I HEREBY CERTIFY that, to the best of my knowledge and belief, all applicable reclamation activities described in the attached Phase I Bond Release Application for the N9 Coal Resource Areas dated March 6, 2025, have been accomplished in accordance with the reclamation requirements of the Act, the regulatory program, and the approved reclamation plan contained in the AZ-0001F Permit. The bond release parcel is free from enforcement actions.

Peabody Western Coal Company - Kayenta Mine

By: ______________________

Randy Lehn
Director Operations Support - Kayenta Mine

STATE OF ARIZONA

NAVAJO COUNTY

Signed or attested before me this 6th day of March 2025, by Randy Lehn, Director Operations Support of Kayenta Mine owned by Peabody Western Coal Company, a Delaware Corporation, on behalf of said Kayenta Mine.

SUSIE CRANK
Notary Public - Arizona
Navajo County
Commission # 664886
My Comm. Expires Apr 5, 2028

____
Notary Public

My commission expires:

April 5, 2028

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1402-159-01	3015	2/14/14	0-1	7.04	5.83	39.1	20.4	39.2	51.3	9.40	37.50	35.00	27.50	CL	<0.010	0.556	0.344	0.047	0.166	17.4	-4.35	-21.7	1.47	-5.82
1402-159-02	3015	2/14/14	1-3	6.86	6.04	37.3	21.1	46.2	50.9	8.78	50.00	26.25	23.75	SCL	0.267	0.417	0.280	0.001	0.136	13.0	2.67	-10.4	0.03	2.63
1402-159-03	2881	2/14/14	0-1	6.63	6.12	42.4	19.7	62.4	45.2	7.06	40.00	31.25	28.75	CL	0.768	0.757	0.451	0.094	0.212	23.6	7.68	-16.0	2.94	4.74
1402-159-04	2881	2/14/14	1-3	7.43	6.79	42.0	19.9	61.9	53.1	8.29	48.75	27.50	23.75	SCL	0.868	0.528	0.351	0.049	0.128	16.5	8.68	-7.82	1.53	7.15
1402-159-05	2910	2/14/14	0-1	3.95	7.83	45.1	18.6	160	52.6	5.58	30.00	38.75	31.25	CL	<0.010	1.236	0.800	<0.010	0.502	38.6	-4.35	-43.0	-2.06	-2.29
1402-159-06	2910	2/14/14	1-3	3.99	11.8	46.3	17.8	173	118	12.1	36.25	32.50	31.25	CL	<0.010	1.319	0.843	<0.010	0.509	41.2	-2.35	-43.6	-1.03	-1.32
1402-159-07	2992	2/14/14	0-1	5.12	2.65	54.9	7.83	5.55	23.5	9.17	37.50	27.50	35.00	CL	0.166	0.534	0.068	0.142	0.324	16.7	1.66	-15.0	4.44	-2.77
1402-159-08	2992	2/14/14	1-3	5.29	7.25	57.5	16.9	10.3	87.4	23.7	45.00	23.75	31.25	CL/SCL	0.066	0.625	0.143	0.114	0.366	19.5	0.66	-18.9	3.56	-2.90
1402-159-09	2937	2/14/14	0-1	6.99	8.03	42.2	20.8	39.4	53.1	9.68	32.50	33.75	33.75	CL	2.272	1.072	0.636	0.097	0.340	33.5	22.72	-10.8	3.03	19.69
1402-159-10	2937	2/14/14	1-3	7.66	6.85	41.7	18.1	27.9	64.4	13.4	42.50	28.75	28.75	CL	3.375	0.809				25.3	33.75	8.46		
1402-159-10R	2937	2/14/14	1-3	7.65	6.74	42.4	19.1	28.6	66.6	13.6	42.50	28.75	28.75	CL	3.375	0.823				25.7	33.75	8.04		
1402-159-11	2911	2/14/14	0-1	7.61	6.86	40.4	19.9	32.9	62.6	12.2	40.00	31.25	28.75	CL	3.576	0.682				21.3	35.76	14.4		
1402-159-12	2911	2/14/14	1-3	7.10	5.67	41.2	19.2	34.9	48.3	9.29	42.50	28.75	28.75	CL	2.272	0.626				19.6	22.72	3.15		
1402-159-13	2965	2/14/14	0-1	3.55	6.16	42.3	17.9	128.3	14.2	1.66	37.50	33.75	28.75	CL	<0.010	1.290	0.739	0.010	0.541	40.3	-4.35	-44.7	0.31	-4.67
1402-159-14	2965	2/14/14	1-3	2.62	12.0	43.2	22.3	290.4	0.39	0.03	42.50	28.75	28.75	CL	<0.010	2.155	1.191	0.046	0.918	67.3	-11.37	-78.7	1.44	-12.81
1402-159-15	2991	2/14/14	0-1	4.98	11.1	52.3	17.5	88.0	108	14.9	30.00	35.00	35.00	CL	<0.010	1.058	0.733	<0.010	0.342	33.1	-10.37	-43.4	-0.53	-9.84
1402-159-16	2991	2/14/14	1-3	6.49	10.9	45.9	17.7	53.7	107	18.0	41.25	30.00	28.75	CL	0.467	0.958	0.513	0.126	0.320	29.9	4.67	-25.3	3.93	0.74
1402-159-17	2990	2/14/14	0-1	7.14	3.82	45.4	22.0	24.0	21.4	4.46	32.50	35.00	32.50	CL	1.971	1.067	0.568	0.161	0.338	33.3	19.71	-13.6	5.02	14.69
1402-159-18	2990	2/14/14	1-3	7.35	10.3	41.1	18.6	43.3	109	19.6	40.00	28.75	31.25	CL	1.871	1.016	0.562	0.190	0.263	31.7	18.71	-13.0	5.94	12.76
															0.968	0.195	0.075	0.023	0.098	6.09	9.68	3.59	0.72	8.97

2014-1

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1411-214-01	24-3016	11/20/14	0-1	5.64	11.9	37.5	17.6	100	77.0	10.0	38.75	32.50	28.75	CL	0.288	0.974	0.627	0.017	0.329	30.4	2.88	-27.5	0.53	2.34
1411-214-02	24-3016	11/20/14	1-3	5.94	11.5	36.5	17.9	66.8	87.4	13.4	43.75	28.75	27.50	CL	0.478	0.975	0.605	0.066	0.305	30.5	4.78	-25.7	2.06	2.72
1411-214-03	25-2880	11/20/14	0-1	5.53	14.3	35.6	17.7	112	101	12.5	31.25	36.25	32.50	CL	0.288	1.069	0.667	0.087	0.316	33.4	2.88	-30.5	2.72	0.16
1411-214-04	25-2880	11/20/14	1-3	5.88	6.68	43.3	17.6	17.2	50.0	12.0	53.75	25.00	21.25	SCL	0.669	1.253	1.145	0.010	0.098	39.1	6.69	-32.5	0.31	6.38
1411-214-05	25-2850	11/20/14	0-1	5.90	12.6	36.6	17.0	107	80.9	10.3	40.00	32.50	27.50	CL	0.383	1.182	1.076	<0.010	0.113	36.9	3.83	-33.1	<0.01	3.83
1411-214-06	25-2850	11/20/14	1-3	5.02	12.0	36.2	17.2	108	71.3	9.0	38.75	32.50	28.75	CL	0.097	1.141	1.026	0.011	0.104	35.6	0.97	-34.7	0.34	0.62
1411-214-07	25-2851	11/20/14	0-1	7.09	10.1	30.2	18.1	63.8	68.3	10.7	40.00	32.50	27.50	CL	1.051	0.864	0.750	0.013	0.101	27.0	10.5	-16.5	0.41	10.1
1411-214-08	25-2851	11/20/14	1-3	7.72	7.80	36.8	17.5	20.2	62.2	14.3	42.50	30.00	27.50	CL	3.150	0.415				13.0	31.5	18.6		
1411-214-08R	25-2851	11/20/14	0-1	7.72	7.90	35.7	17.5	20.8	64.4	14.7	42.50	30.00	27.50	CL	3.150	0.419				13.1	31.5	18.4		

2014-2

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1505-099-01	24-5019	5/5/15	0-1	6.03	6.64	41.1	18.7	12.8	50.5	12.7	30.00	40.00	30.00	CL	0.351	0.473	0.142	0.151	0.180	14.8	3.51	-11.3	4.72	-1.21
1505-099-02	24-5019	5/5/15	1-3	7.31	13.7	37.2	17.0	23.0	137	30.6	47.50	27.50	25.00	SCL	1.120	0.476	0.297	0.070	0.109	14.9	11.2	-3.67	2.19	9.01
1505-099-03	25-4346	5/5/15	0-1	5.73	8.57	38.0	18.5	70.0	51.3	7.72	40.00	37.50	22.50	L	0.639	1.100	0.295	0.085	0.722	34.4	6.39	-28.0	2.66	3.74
1505-099-04	25-4346	5/5/15	1-3	7.06	11.0	38.8	20.3	62.9	86.6	13.4	41.25	33.75	25.00	L	1.696	0.651	0.330	0.047	0.274	20.3	17.0	-3.38	1.47	15.49
1505-099-05	25-4379	5/5/15	0-1	7.24	8.37	37.8	19.1	30.9	63.5	12.7	32.50	35.00	32.50	CL	2.945	0.705				22.0	29.5	7.43		
1505-099-06	25-4379	5/5/15	1-3	6.98	11.2	38.3	17.2	15.5	107.0	26.5	35.00	32.50	32.50	CL	1.024	0.665	0.220	0.064	0.381	20.8	10.2	-10.6	2.00	8.24
1505-099-07	25-4378	5/5/15	0-1	6.80	10.6	37.7	18.1	29.9	91.8	18.7	33.75	35.00	31.25	CL	0.639	0.837	0.434	0.162	0.241	26.1	6.39	-19.8	5.06	1.33
1505-099-08	25-4378	5/5/15	1-3	5.93	12.0	35.6	17.0	70.5	92.2	13.9	35.00	32.50	32.50	CL	0.447	1.800	0.972	0.027	0.800	56.2	4.47	-51.8	0.84	3.63
1505-099-09	25-4345	5/5/15	0-1	7.55	7.60	34.9	20.2	30.3	53.5	10.6	45.00	28.75	26.25	L	2.561	0.448				14.0	25.6	11.6		
1505-099-10	25-4345	5/5/15	1-3	7.48	7.40	33.9	18.5	27.0	52.6	11.0	46.25	28.75	25.00	L	2.273	0.450				14.1	22.7	8.67		
1505-099-10R	25-4345	5/5/15	1-3	7.48	7.27	33.4	18.6	27.2	53.7	11.2	46.25	28.75	25.00	L	2.369	0.438				13.7	23.7	10.0		
1505-099-11	25-4905	5/6/15	0-1	7.45	8.22	41.2	19.2	27.1	66.1	13.7	38.75	33.75	27.50	CL	1.504	0.840	0.410	0.071	0.359	26.2	15.0	-11.2	2.22	12.82
1505-099-12	25-4905	5/6/15	1-3	7.27	7.95	43.8	18.5	26.8	59.6	12.5	32.50	36.25	31.25	CL	1.600	0.796	0.359	0.073	0.364	24.9	16.0	-8.9	2.28	13.72
1505-099-13	25-4935	5/6/15	0-1	6.75	9.10	39.7	16.0	40.7	67.9	12.5	35.00	35.00	30.00	CL	0.447	0.654	0.458	0.021	0.375	26.7	4.47	-22.2	0.66	3.82
1505-099-14	25-4935	5/6/15	1-3	7.05	10.7	39.7	19.3	33.9	89.2	17.3	35.00	36.25	28.75	CL	1.120	0.690	0.304	0.167	0.219	21.5	11.2	-10.3	5.22	5.98
1505-099-15	25-4963	5/6/15	0-1	5.61	11.7	37.7	17.3	46.7	99.2	17.5	32.50	37.50	30.00	CL	0.543	0.903	0.549	-0.010	0.364	28.2	5.43	-22.8	-0.31	5.74
1505-099-16	25-4963	5/6/15	1-3	6.87	11.9	35.0	17.5	20.1	107.0	24.7	37.50	35.00	27.50	CL	0.159	0.788	0.322	0.065	0.401	24.6	1.59	-23.0	2.03	-0.44
1505-099-17	25-4962	5/6/15	0-1	7.37	7.48	36.3	16.9	20.9	53.1	11.9	45.00	30.00	25.00	L	1.504	0.326				10.2	15.0	4.86		
1505-099-18	25-4962	5/6/15	1-3	7.03	7.76	34.2	17.9	17.2	59.6	14.2	52.50	23.75	23.75	SCL	0.928	0.355	0.097	0.029	0.229	11.1	9.28	-1.81	0.91	8.37
1505-099-19	25-4934	5/6/15	0-1	7.18	7.76	41.1	16.6	19.6	56.5	12.9	42.50	30.00	27.50	CL	0.735	0.396	0.164	-0.005	0.237	12.4	7.35	-5.02	-0.16	7.51
1505-099-20	25-4934	5/6/15	1-3	7.15	6.93	37.9	16.2	24.5	47.4	10.5	47.50	26.25	26.25	SCL	0.928	0.432	0.202	0.103	0.126	13.5	9.28	-4.22	3.22	6.06
1505-099-20R	25-4934	5/6/15	1-3	7.17	6.69	42.2	16.8	24.2	44.8	9.89	47.50	26.25	26.25	SCL	0.831	0.440	0.207	0.102	0.131	13.7	8.31	-5.43	3.19	5.13
1505-099-21	25-4904	5/6/15	0-1	7.79	11.8	36.7	22.4	22.7	90.9	19.1	56.25	25.00	18.75	SL	1.312	0.270				8.4	13.12	4.70		
1505-099-22	25-4904	5/6/15	1-3	7.77	11.7	36.6	19.4	20.6	92.6	20.7	53.75	26.25	20.00	SL/SCL	2.369	0.504				15.7	23.7	7.94		
1505-099-23	25-4344	5/6/15	0-1	7.38	11.1	41.6	20.6	25.2	82.6	17.3	45.00	31.25	23.75	L	0.831	0.439	0.218	0.093	0.128	13.7	8.31	-5.38	2.91	5.41
1505-099-24	25-4344	5/6/15	1-3	5.68	17.4	45.7	19.4	67.5	123	18.6	32.50	38.75	28.75	CL	1.024	1.060	0.617	0.086	0.362	33.1	10.2	-22.9	2.66	7.58
1505-099-25	25-4377	5/6/15	0-1	6.65	15.1	42.2	21.2	43.0	111	19.6	37.50	33.75	28.75	CL	<0.010	1.130	0.659	0.091	0.381	35.3	<0.010	-35.3	2.84	-2.84
1505-099-26	25-4377	5/6/15	1-3	6.96	13.3	40.7	19.6	26.9	104.4	21.6	33.75	40.00	26.25	L	2.080	1.030	0.585	0.032	0.416	32.2	20.8	-11.4	1.00	19.8
1505-099-27	25-4376	5/6/15	0-1	7.55	11.2	42.3	19.0	15.4	88.3	21.3	41.25	33.75	25.00	L	1.312	0.472	0.215	0.028	0.229	14.7	13.1	-1.62	0.87	12.2
1505-099-28	25-4376	5/6/15	1-3	7.06	11.5	42.3	20.7	29.2	90.0	18.0	41.25	32.50	26.25	L	1.024	0.693	0.373	0.123	0.197	21.6	10.2	-11.4	3.84	6.39
1505-099-29	25-4343	5/6/15	0-1	7.66	9.49	39.7	17.9	11.8	74.4	19.3	43.75	31.25	25.00	L	1.408	0.302				9.43	14.1	4.64		
1505-099-30	25-4343	5/6/15	1-3	7.73	9.15	34.9	16.8	13.8	74.8	19.1	48.75	28.75	22.50	L	0.639	0.198				6.19	6.39	0.21		
1505-099-30R	25-4343	5/6/15	1-3	7.68	9.50	35.6	17.1	13.8	71.8	18.3	48.75	28.75	22.50	L	0.735	0.220				6.87	7.35	0.48		
1505-099-31	25-4903	5/6/15	0-1	6.34	9.94	42.3	20.9	51.7	96.1	16.0	37.50	35.00	27.50	CL	0.351	0.939	0.467	0.141	0.330	29.3	3.51	-25.8	4.40	-0.89
1505-099-32	25-4903	5/6/15	1-3	6.36	15.4	38.9	21.9	52.8	108	17.7	42.50	33.75	23.75	L	0.159	1.010	0.542	0.264	0.204	31.6	1.59	-30.0	8.25	-6.66
1505-099-33	25-4933	5/6/15	0-1	6.69	5.39	31.5	21.7	34.6	15.1	2.84	61.25	23.75	15.00	SL	0.735	0.263	0.160	0.011	0.091	8.2	7.35	-0.85	0.34	7.01
1505-099-34	25-4933	5/6/15	1-3	6.47	6.22	37.3	22.6	40.1	20.3	3.62	52.50	28.75	18.75	SL	0.639	0.540	0.341	0.015	0.184	16.9	6.39	-10.5	0.47	5.92
1505-099-35	25-4961	5/6/15	0-1	7.44	11.3	36.1	20.5	23.9	85.3	18.1	47.50	30.00	22.50	L	1.888	0.502				15.7	18.9	3.21		
1505-099-36	25-4961	5/6/15	1-3	7.34	11.9	34.4	18.3	28.4	97.9	20.3	50.00	28.75	21.25	L	1.216	0.702	0.398	0.061	0.243	21.9	12.2	-9.77	1.91	10.3
1505-099-37	26-4775	5/6/15	0-1	4.32	4.73	49.9	21.7	38.5	4.65	0.85	42.50	33.75	23.75	L	0.735	0.747	0.405	0.051	0.292	23.3	7.35	-16.0	1.59	5.76
1505-099-38	26-4775	5/6/15	1-3	4.05	4.84	48.7	18.5	43.5	5.57	1.00	47.50	30.00	22.50	L	0.351	0.749	0.298	0.115	0.336	23.4	3.51	-19.9	3.59	-0.08
1505-099-39	26-4776	5/6/15	0-1	4.54	5.47	41.3	20.2	59.5	5.83	0.92	41.25	32.50	26.25	L	0.063	0.493	0.270	0.033	0.191	15.4	0.63	-14.8	1.03	-0.40
1505-099-39R	26-4776	5/6/15	0-1	4.60	5.74	40.4	19.7	60.4	5.87	0.93														
1505-099-40	26-4776	5/6/15	1-3	6.19	4.70	33.1	26.1	28.4	7.83	1.50	47.50	30.00	22.50	L	0.198	0.396	0.278	-0.011	0.129	12.4	2.0	-10.4	-0.34	2.32
1505-099-40R	26-4776	5/6/15	1-3								48.75	28.75	22.50	L	0.299	0.391	0.266	-0.022	0.146	12.2	3.0	-9.2	-0.69	3.68

2015-1

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1611-119-0	N9 4615	11/9/16	0-1	6.09	9.24	37.7	17.9	51.3	85.3	14.5	51.25	23.75	25.00	SCL	0.24	0.72	0.43	0.04	0.26	22.6	2.37	-20.18	1.12	1.25
1611-119-0	N9 4615	11/9/16	1-3	6.16	7.24	38.3	18.8	33.8	60.5	11.8	41.25	31.25	27.50	CL	0.48	0.59	0.18	0.06	0.35	18.4	4.77	-13.7	2.00	2.77
1611-119-0	N9 4614	11/9/16	0-1	6.73	8.20	42.1	20.3	18.3	90.9	20.7	50.00	21.25	28.75	SCL	0.96	0.48	0.00	0.16	0.36	14.9	9.56	-5.4	4.97	4.60
1611-119-0	N9 4614	11/9/16	1-3	6.17	9.24	47.7	20.6	16.0	115	27.0	42.50	22.50	35.00	CL	0.56	0.63	0.00	0.17	0.58	19.7	5.57	-14.2	5.40	0.16
1611-119-0	N9 5015	11/9/16	0-1	6.29	8.34	34.8	19.5	33.9	79.6	15.4	52.50	26.25	21.25	SCL	0.48	0.86	0.29	0.17	0.40	26.9	4.77	-22.1	5.25	-0.48
1611-119-0	N9 5015	11/9/16	1-3	6.97	5.54	33.6	19.4	16.0	43.5	10.3	55.00	26.25	18.75	SL	<0.001	0.24	<0.01	0.14	0.11	7.5	-31.2	-38.6	4.50	-35.7
1611-119-0	N9 4719	11/9/16	0-1	7.30	7.03	43.2	21.2	23.3	58.7	12.5	50.00	23.75	26.25	SCL	3.35	0.39				12.2	33.5	21.4		
1611-119-0	N9 4719	11/9/16	1-3	7.11	6.69	44.2	18.4	20.0	60.5	13.8	31.25	35.00	33.75	CL	2.87	0.74				23.2	28.7	5.51		
1611-119-0	N9 4987	11/9/16	0-1	6.81	6.21	37.8	18.7	25.4	49.6	10.6	52.50	25.00	22.50	SCL	0.48	0.45	0.23	<0.01	0.25	14.2	4.77	-9.44	<0.01	4.77
1611-119-1	N9 4987	11/9/16	1-3	5.77	6.91	38.8	17.1	31.5	57.4	11.6	55.00	21.25	23.75	SCL	0.56	0.58	0.13	<0.01	0.59	18.2	5.57	-12.7	<0.01	5.57
611-119-10	N9 4987	11/9/16	1-3	5.77	6.69	39.7	16.3	30.4	54.4	11.3	56.25	21.25	22.50	SCL	0.56	0.60	0.28	<0.01	0.38	18.8	5.57	-13.3	<0.01	5.57
1611-119-1	N9 4988	11/9/16	0-1	6.68	6.34	39.5	19.4	17.0	56.5	13.3	60.00	17.50	22.50	SCL	1.04	0.40	0.11	0.05	0.24	12.5	10.4	-2.13	1.50	8.86
1611-119-1	N9 4988	11/9/16	1-3	6.86	5.75	38.6	20.6	20.0	46.1	10.2	57.50	17.50	25.00	SCL	0.96	0.28				8.8	9.56	0.72		
1611-119-1	N9 5016	11/9/16	0-1	6.63	7.66	37.4	19.4	17.9	79.2	18.4	63.75	16.25	20.00	SL/SCL	0.80	0.48	0.14	0.06	0.28	14.9	7.97	-6.91	1.94	6.03
1611-119-1	N9 5016	11/9/16	1-3	6.46	8.45	40.4	19.4	22.5	88.7	19.4	55.00	21.25	23.75	SCL	1.12	0.73	0.17	0.16	0.41	22.8	11.16	-11.7	4.84	6.32
1611-119-1	N9 4960	11/15/16	0-1	5.93	4.77	43.0	21.2	26.1	27.9	5.74	45.00	26.25	28.75	CL/SCL	0.72	0.41	0.10	0.07	0.24	12.7	7.17	-5.51	2.09	5.07
1611-119-1	N9 4960	11/15/16	1-3	6.37	6.53	38.7	20.5	25.8	54.4	11.3	56.25	21.25	22.50	SCL	0.88	0.59	0.21	0.14	0.24	18.5	8.76	-9.78	4.44	4.33

2016-1

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1710-194-01	4721	10/18/17	0-1	6.16	8.33	39.4	21.2	33.0	59.2	11.4	36.25	30.00	33.75	CL	0.27	0.55	0.26	0.05	0.22	17.18	2.71	-14.5	1.50	1.21
1710-194-02	4721	10/18/17	1-3	6.35	11.0	42.2	23.1	46.0	99.2	16.9	45.00	25.00	30.00	CL/SCL	0.17	0.86	0.51	0.10	0.25	26.7	1.71	-25.0	3.09	-1.38
1710-194-03	4532	10/18/17	0-1	4.28	15.1	38.7	21.0	249	60.5	5.20	40.00	28.75	31.25	CL	<0.010	1.70	1.22	0.04	0.44	53.0	-5.26	-58.2	1.16	-6.42
1710-194-04	4532	10/18/17	1-3	4.45	14.7	41.3	20.7	234	65.2	5.79	42.50	28.75	28.75	CL	<0.010	2.05	1.49	0.08	0.48	63.9	-4.27	-68.2	2.62	-6.89
1710-194-05	5043	10/18/17	0-1	6.72	11.5	38.2	20.1	32.1	104	20.4	50.00	23.75	26.25	SCL	0.37	0.77	0.30	0.08	0.40	24.2	3.70	-20.5	2.34	1.36
1710-194-06	5043	10/18/17	1-3	7.13	8.90	39.0	19.7	25.4	73.9	15.6	51.25	23.75	25.00	SCL	0.27	0.76	0.35	0.20	0.21	23.9	2.71	-21.2	6.31	-3.61
1710-194-07	5042	10/18/17	0-1	6.06	9.91	39.3	21.7	38.5	84.8	15.5	48.75	23.75	27.50	SCL	0.27	0.96	0.48	0.15	0.33	29.8	2.71	-27.1	4.78	-2.07
1710-194-08	5042	10/18/17	1-3	5.32	9.83	45.0	19.6	20.8	88.3	19.6	57.50	17.50	25.00	SCL	<0.010	1.00	0.39	0.31	0.30	31.2	-0.28	-31.5	9.65	-9.93
1710-194-09	4753	10/18/17	0-1	5.93	7.59	39.4	22.4	60.7	38.3	5.94	46.25	25.00	28.75	SCL	0.27	1.06	0.68	0.09	0.30	33.1	2.71	-30.4	2.72	-0.01
1710-194-10	4753	10/18/17	1-3	7.00	7.45	42.0	22.4	57.8	39.7	6.27	46.25	26.25	27.50	SCL	0.87	1.03	0.69	0.07	0.28	32.2	8.68	-23.5	2.12	6.56
1710-194-10R	4753	10/18/17	1-3	7.02	7.41	42.1	21.7	55.5	38.3	6.16	45.00	26.25	28.75	CL/SCL	0.87	1.01	0.66	0.13	0.22	31.6	8.68	-22.9	4.00	4.68
1710-194-11	4688	10/19/17	0-1	6.72	8.63	43.2	21.3	35.5	64.8	12.2	37.50	30.00	32.50	CL	0.97	0.95	0.64	0.11	0.20	29.8	9.68	-20.1	3.34	6.33
1710-194-12	4688	10/19/17	1-3	6.70	8.35	41.0	20.6	34.6	60.9	11.6	37.50	31.25	31.25	CL	0.67	0.79	0.46	0.15	0.19	24.7	6.69	-18.0	4.65	2.03
1710-194-13	4778	10/19/17	0-1	4.37	8.90	44.2	19.9	80.0	46.5	6.59	41.25	27.50	31.25	CL	<0.010	1.22	0.81	0.02	0.39	38.2	-3.27	-41.4	0.72	-3.99
1710-194-14	4778	10/19/17	1-3	4.63	8.37	43.7	22.2	98.7	34.4	4.43	51.25	22.50	26.25	SCL	<0.010	1.65	1.22	0.06	0.37	51.6	-0.28	-51.9	1.91	-2.19
1710-194-15	4716	10/19/17	0-1	5.13	7.63	37.9	19.5	54.2	43.1	7.09	41.25	28.75	30.00	CL	<0.010	1.65	0.64	0.57	0.44	51.4	-3.27	-54.7	17.7	-21.0
1710-194-16	4716	10/19/17	1-3	5.18	8.38	37.5	20.0	63.0	49.6	7.70	42.50	27.50	30.00	CL	<0.010	1.63	0.74	0.45	0.44	51.0	-5.26	-56.2	14.1	-19.3
1710-194-17	4717	10/19/17	0-1	6.24	6.85	37.5	24.4	29.5	44.8	8.63	47.50	26.25	26.25	SCL	0.87	0.98	0.29	0.35	0.35	30.6	8.68	-21.9	10.8	-2.16
1710-194-18	4717	10/19/17	1-3	6.16	6.91	38.9	22.5	27.1	48.3	9.69	46.25	26.25	27.50	SCL	0.67	1.12	0.39	0.35	0.39	35.1	6.69	-28.4	10.8	-4.09
1710-194-19	4718	10/19/17	0-1	5.74	8.19	36.2	20.8	54.1	50.5	8.24	47.50	26.25	26.25	SCL	0.17	0.90	0.33	0.25	0.33	28.2	1.71	-26.5	7.65	-5.94
1710-194-20	4718	10/19/17	1-3	3.03	10.7	37.2	23.4	169	21.1	2.15	51.25	25.00	23.75	SCL	<0.010	1.77	1.18	0.15	0.44	55.3	-10.2	-65.5	4.75	-14.9
1710-194-20R	4718	10/19/17	1-3	3.03	10.8	37.3	22.3	166	20.8	2.15	51.25	23.75	25.00	SCL	<0.010	1.82	1.24	0.15	0.44	57.0	-10.2	-67.2	4.72	-14.9
1710-194-21	4689	10/18/17	0-1	6.49	9.30	40.1	22.4	40.6	81.8	14.6	38.75	28.75	32.50	CL	0.17	0.68	0.36	0.08	0.24	21.3	1.71	-19.6	2.50	-0.79
1710-194-22	4689	10/18/17	1-3	6.19	9.47	41.2	23.5	58.8	77.0	12.0	35.00	31.25	33.75	CL	0.07	0.92	0.58	0.08	0.25	28.6	0.71	-27.9	2.56	-1.85
1710-194-23	4723	10/18/17	0-1	8.10	1.35	43.3	3.72	8.23	3.76	1.54	27.50	36.25	36.25	CL	17.2	0.04				1.26	172	171		
1710-194-24	4723	10/18/17	1-3	7.98	2.45	42.0	8.03	18.7	6.18	1.69	28.75	36.25	35.00	CL	16.5	0.06				1.79	165	163		
1710-194-25	4754	10/18/17	0-1	3.18	13.4	43.5	21.9	185	63.1	6.20	38.75	28.75	32.50	CL	<0.010	1.63	1.17	<0.010	0.48	50.8	-8.25	-59.0	<0.01	-8.25
1710-194-26	4754	10/18/17	1-3	3.40	11.8	46.9	20.4	145	60.5	6.65	37.50	30.00	32.50	CL	<0.010	1.69	1.04	0.07	0.58	52.9	-9.25	-62.1	2.22	-11.5
1710-194-27	4782	10/18/17	0-1	5.88	5.83	41.2	21.4	47.4	23.3	3.98	47.50	23.75	28.75	SCL	<0.010	0.99	0.62	0.06	0.32	31.0	-0.28	-31.3	1.84	-2.12
1710-194-28	4782	10/18/17	1-3	6.43	4.14	38.3	27.6	29.8	8.22	1.53	55.00	20.00	25.00	SCL	0.27	0.48	0.32	0.06	0.11	15.0	2.71	-12.3	1.78	0.92
1710-194-29	4722	10/18/17	0-1	6.32	10.2	41.2	19.3	46.6	78.3	13.6	40.00	27.50	32.50	CL	0.47	0.91	0.44	0.15	0.32	28.3	4.70	-23.6	4.75	-0.05
1710-194-30	4722	10/18/17	1-3	4.66	13.0	40.3	23.2	69.4	132	19.4	36.25	28.75	35.00	CL	<0.010	1.50	0.97	0.09	0.45	47.0	-2.28	-49.3	2.84	-5.12
1710-194-30R	4722	10/18/17	1-3	4.66	12.1	42.1	18.0	51.7	101	17.2	36.25	30.00	33.75	CL	<0.010	1.55	1.05	0.03	0.46	48.3	-3.27	-51.6	1.06	-4.33
1710-194-31	4651	10/19/17	0-1	6.99	8.98	39.9	20.5	31.8	73.9	14.5	37.50	28.75	33.75	CL	0.87	0.81	0.52	0.07	0.23	25.4	8.68	-16.7	2.16	6.53
1710-194-32	4651	10/19/17	1-3	7.12	8.69	40.6	20.8	31.4	69.2	13.5	36.25	31.25	32.50	CL	1.07	0.75	0.50	0.05	0.20	23.4	10.7	-12.8	1.66	9.02

2017-1

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1710-195-01	5066	10/18/17	0-1	6.52	8.67	38.0	20.1	55.3	56.1	9.14	47.50	22.50	30.00	SCL	1.07	0.76	0.45	0.08	0.24	23.9	10.7	-13.2	2.41	8.27
1710-195-02	5066	10/18/17	1-3	7.12	9.74	40.9	18.1	18.8	90.0	21.0	45.00	22.50	32.50	CL/SCL	0.77	0.71	0.00	0.31	0.42	22.3	7.69	-14.6	9.56	-1.87
1710-195-03	4531	10/18/17	0-1	6.83	9.21	40.1	19.6	15.4	85.7	20.5	50.00	25.00	25.00	SCL	<0.010	0.71	0.09	0.17	0.45	22.1	-3.27	-25.4	5.373	-8.64
1710-195-04	4531	10/18/17	1-3	6.80	8.82	40.6	19.8	11.8	82.6	20.8	56.25	21.25	22.50	SCL	0.07	0.76	0.09	0.23	0.44	23.8	0.71	-23.1	7.3	-6.60
1710-195-05	4652	10/18/17	0-1	6.81	7.00	38.8	21.4	28.7	47.4	9.47	45.00	23.75	31.25	CL/SCL	<0.010	0.47	0.28	0.04	0.16	14.6	-0.28	-14.9	1.12	-1.40
1710-195-06	4652	10/18/17	1-3	5.13	12.1	42.3	18.9	49.0	104	17.8	45.00	23.75	31.25	CL/SCL	<0.010	1.19	0.83	0.04	0.32	37.1	-4.27	-41.4	1.31	-5.58
1710-195-07	5064	10/18/17	0-1	7.23	6.63	39.6	19.7	24.8	46.5	9.88	46.25	25.00	28.75	SCL	0.47	0.57	0.16	0.19	0.21	17.7	4.70	-13.0	5.97	-1.27
1710-195-08	5064	10/18/17	1-3	7.17	6.85	22.3	20.1	31.6	45.7	8.98	48.75	23.75	27.50	SCL	0.27	0.67	0.31	0.12	0.25	21.0	2.71	-18.3	3.62	-0.92
1710-195-09	5065	10/18/17	0-1	6.55	5.98	34.8	20.8	42.0	27.6	4.92	57.50	21.25	21.25	SCL	1.07	0.54	0.34	0.06	0.14	16.9	10.7	-6.24	1.87	8.80
1710-195-10	5065	10/18/17	1-3	7.02	3.44	33.1	23.5	20.8	5.74	1.22	55.00	23.75	21.25	SCL	0.97	0.50	0.08	0.26	0.15	15.5	9.68	-5.79	8.12	1.55
1710-195-10R	5065	10/18/17	1-3	7.03	3.49	32.6	23.5	20.9	5.79	1.23	56.25	22.50	21.25	SCL	0.87	0.50	0.23	0.11	0.16	15.7	8.68	-6.97	3.47	5.21
1710-195-11	4931	10/18/17	0-1	6.66	7.81	38.4	20.4	37.0	54.8	10.2	41.25	25.00	33.75	CL	0.37	1.20	0.72	0.17	0.31	37.3	3.70	-33.6	5.31	-1.61
1710-195-12	4931	10/18/17	1-3	7.13	10.2	35.6	16.7	26.2	91.8	19.4	40.00	26.25	33.75	CL	0.67	0.80	0.37	0.22	0.21	24.9	6.69	-18.2	6.84	-0.15
1710-195-13	4682	10/18/17	0-1	6.59	6.93	38.4	21.3	26.6	48.3	9.87	43.75	26.25	30.00	CL	0.57	1.24	0.04	0.75	0.45	38.7	5.69	-33.0	23.5	-17.8
1710-195-14	4682	10/18/17	1-3	7.04	8.94	41.8	19.6	21.0	78.3	17.4	36.25	31.25	32.50	CL	0.67	0.76	0.13	0.30	0.33	23.9	6.69	-17.2	9.31	-2.62
1710-195-15	4683	10/18/17	0-1	7.33	9.71	40.0	18.9	39.6	80.0	14.8	36.25	30.00	33.75	CL	1.37	1.00	0.41	0.26	0.33	31.2	13.7	-17.5	8.25	5.41
1710-195-16	4683	10/18/17	1-3	7.47	10.9	41.8	18.6	34.8	95.3	18.5	37.50	27.50	35.00	CL	1.86	0.86	0.38	0.18	0.31	26.9	18.6	-8.26	5.50	13.1
1710-195-17	4781	10/18/17	0-1	6.02	8.46	39.9	19.6	61.5	51.3	8.06	42.50	23.75	33.75	CL	0.07	1.04	0.64	0.13	0.27	32.3	0.71	-31.6	3.91	-3.19
1710-195-18	4781	10/18/17	1-3	4.88	8.95	37.6	20.3	88.0	43.5	5.91	50.00	21.25	28.75	SCL	<0.010	1.15	0.72	0.01	0.43	36.0	-3.27	-39.3	0.28	-3.55
1710-195-19	4959	10/18/17	0-1	6.75	8.73	37.9	18.7	38.4	67.0	12.8	43.75	25.00	31.25	CL	0.07	0.53	0.24	0.11	0.17	16.4	0.71	-15.7	3.53	-2.82
1710-195-20	4959	10/18/17	1-3	7.00	9.84	38.0	18.7	38.1	81.3	15.3	41.25	26.25	32.50	CL	0.17	0.64	0.28	0.15	0.21	19.9	1.71	-18.2	4.72	-3.01
1710-195-20R	4959	10/18/17	1-3	7.00	9.94	37.5	18.6	37.7	82.6	15.6	41.25	26.25	32.50	CL	0.17	0.70	0.33	0.14	0.23	22.0	1.71	-20.3	4.44	-2.73
1710-195-21	4748	10/19/17	0-1	6.56	7.32	37.5	22.6	52.3	39.1	6.38	37.50	27.50	35.00	CL	0.77	1.42	0.74	0.26	0.42	44.2	7.69	-36.6	8.03	-0.34
1710-195-22	4748	10/19/17	1-3	6.8	7.15	41.3	22.8	44.7	39.6	6.82	36.25	27.50	36.25	CL	1.37	1.31	0.64	0.32	0.35	41.0	13.7	-27.3	10.0	3.66
1710-195-23	4749	10/19/17	0-1	7.46	6.54	42.5	19.0	20.9	48.3	10.8	33.75	28.75	37.50	CL	5.79	0.32				10.0	57.9	47.9		
1710-195-24	4749	10/19/17	1-3	7.34	10.0	45.1	18.3	23.1	90.9	20.0	33.75	28.75	37.50	CL	0.67	0.47	0.17	0.20	0.10	14.6	6.69	-7.89	6.09	0.60
1710-195-25	4750	10/19/17	0-1	7.14	8.41	44.2	19.5	31.7	66.1	13.1	31.25	30.00	38.75	CL	1.27	0.74	0.40	0.13	0.22	23.2	12.7	-10.5	4.12	8.54
1710-195-26	4750	10/19/17	1-3	7.62	10.7	43.4	17.9	22.0	99.2	22.2	30.00	33.75	36.25	CL	1.07	0.42	0.19	<0.010	0.23	13.0	10.7	-2.35	<0.01	10.7
1710-195-27	4751	10/19/17	0-1	6.09	13.6	45.0	18.5	85.6	105	14.5	33.75	28.75	37.50	CL	<0.010	1.46	0.97	0.11	0.38	45.7	-1.28	-47.0	3.47	-4.75
1710-195-28	4751	10/19/17	1-3	6.67	11.4	54.2	18.3	30.9	102	20.6	11.25	35.00	53.75	C	<0.010	0.82	0.20	0.16	0.47	25.7	-2.28	-28.0	4.84	-7.12
1710-195-29	4752	10/19/17	0-1	7.30	8.37	42.0	19.1	25.4	67.0	14.2	30.00	30.00	40.00	CL/C	1.66	0.68	0.29	0.08	0.31	21.3	16.6	-4.69	2.56	14.1
1710-195-30	4752	10/19/17	1-3	7.36	7.93	44.0	19.0	22.5	63.5	13.9	36.25	26.25	37.50	CL	2.06	0.68	0.30	0.11	0.27	21.2	20.6	-0.58	3.44	17.2
1710-195-30R	4752	10/19/17	1-3	7.36	8.14	41.7	19.2	22.9	65.7	14.3	36.25	26.25	37.50	CL	2.06	0.69	0.36	0.01	0.31	21.4	20.6	-0.81	0.37	20.3

2017-2

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1806-195-01	3-2391	6/19/18	0-1	6.89	3.69	39.5	30.1	11.3	4.00	0.88	51.25	26.25	22.50	SCL	1.26	0.20				6.10	12.6	6.53		
1806-195-02	3-2391	6/19/18	1-3	6.28	7.94	38.4	27.9	71.8	36.8	5.20	41.25	30.00	28.75	CL	0.27	0.82	0.58	0.04	0.21	25.7	2.72	-22.9	1.10	1.62
1806-195-03	3-1009	6/19/18	0-1	6.70	2.59	37.3	19.2	9.0	3.27	0.87	42.50	30.00	27.50	CL	0.57	0.20	0.04	0.02	0.14	6.22	5.70	-0.53	0.54	5.15
1806-195-04	3-1009	6/19/18	1-3	5.91	3.45	35.9	26.7	16.6	2.15	0.46	38.75	32.50	28.75	CL	0.07	0.43	0.18	0.07	0.18	13.3	0.74	-12.5	2.09	-1.36
1806-195-05	3-2388	6/19/18	0-1	7.03	1.35	33.4	7.98	2.8	2.55	1.10	50.00	27.50	22.50	SCL	0.52	0.15				4.62	5.20	0.58		
1806-195-06	3-2388	6/19/18	1-3	7.12	1.64	37.8	9.83	4.2	3.38	1.28	43.75	28.75	27.50	CL	0.62	0.42	0.31	0.01	0.10	13.1	6.19	-6.91	0.34	5.85
1806-195-07	3-2390	6/19/18	0-1	6.25	8.95	36.1	30.0	89.7	29.7	3.84	41.25	28.75	30.00	CL	0.17	0.81	0.61	0.01	0.19	25.3	1.73	-23.6	0.40	1.33
1806-195-08	3-2390	6/19/18	1-3	6.12	12.2	38.6	20.6	148	33.2	3.62	40.00	28.75	31.25	CL	<0.01	0.97	0.74	0.04	0.20	30.5	-3.23	-33.7	1.19	-4.42
1806-195-09	3-2387	6/19/18	0-1	4.62	8.55	38.6	26.3	107	17.7	2.16	37.50	30.00	32.50	CL	<0.01	0.95	0.67	0.02	0.26	29.7	-13.1	-42.8	0.66	-13.76
1806-195-10	3-2387	6/19/18	1-3	4.85	11.3	38.6	20.1	141	26.8	2.99	36.25	31.25	32.50	CL	<0.01	0.92	0.65	0.01	0.26	28.8	-5.21	-34.1	0.40	-5.61
1806-195-10R	3-2387	6/19/18	1-3	4.89	10.7	36.9	23.1	135	31.5	3.55	36.25	31.25	32.50	CL	<0.01	0.92	0.64	0.02	0.27	28.8	-5.21	-34.0	0.59	-5.80
1806-195-11	3-2393	6/19/18	0-1	6.26	3.58	34.2	24.0	21.9	2.72	0.57	46.25	27.50	26.25	SCL	0.17	0.36	0.18	0.00	0.17	11.3	1.73	-9.54	0.07	1.66
1806-195-12	3-2393	6/19/18	1-3	5.70	3.44	34.4	22.8	21.8	2.03	0.43	47.50	27.50	25.00	SCL	<0.01	0.42	0.26	0.01	0.16	13.3	-4.22	-17.5	0.21	-4.43
1806-195-13	4496	6/19/18	0-1	6.51	10.8	38.1	20.3	28.1	73.9	15.0	40.00	27.50	32.50	CL	0.97	1.14	0.65	0.32	0.17	35.6	9.66	-25.9	9.87	-0.21
1806-195-14	4496	6/19/18	1-3	5.09	13.9	35.8	18.0	118	71.8	8.72	38.75	27.50	33.75	CL	<0.01	1.81	1.05	0.36	0.40	56.6	-3.23	-59.8	11.3	-14.5
1806-195-15	4410	6/19/18	0-1	6.29	7.68	32.3	19.0	26.2	45.2	9.52	50.00	27.50	22.50	SCL	0.17	0.72	0.31	0.24	0.17	22.3	1.73	-20.6	7.35	-5.62
1806-195-16	4410	6/19/18	1-3	6.37	7.66	41.4	23.3	23.7	46.5	9.60	52.50	21.25	26.25	SCL	0.57	0.69	0.28	0.12	0.29	21.6	5.70	-15.9	3.84	1.86
1806-195-17	4495	6/19/18	0-1	6.49	10.6	34.4	21.5	44.7	79.6	13.8	38.75	28.75	32.50	CL	0.87	0.83	0.36	0.16	0.31	25.8	8.67	-17.2	5.00	3.67
1806-195-18	4495	6/19/18	1-3	6.63	11.5	32.2	17.7	35.4	81.8	15.9	35.00	31.25	33.75	CL	1.16	0.82	0.32	0.26	0.24	25.8	11.6	-14.1	8.06	3.58
1806-195-19	4534	6/19/18	0-1	6.64	4.85	38.1	22.5	18.4	6.05	1.34	66.25	22.50	11.25	SL	2.95	0.12				3.65	29.5	25.8		
1806-195-20	4534	6/19/18	1-3	6.75	5.58	40.8	24.3	19.4	22.7	4.87	50.00	27.50	22.50	SCL	7.76	0.22				6.93	77.6	70.6		
1806-195-20R	4534	6/19/18	1-3	6.80	5.26	40.5	22.1	17.7	21.0	4.71	51.25	26.25	22.50	SCL	7.76	0.24				7.52	77.6	70.0		
1806-195-21	4776a	6/19/18	0-1	5.33	9.02	32.7	22.6	121	12.0	1.42	56.25	21.25	22.50	SCL	<0.01	0.39	0.25	0.03	0.12	12.2	-0.25	-12.4	0.83	-1.08
1806-195-22	4776a	6/19/18	1-3	5.43	7.24	32.0	21.6	80.0	9.48	1.33	56.25	21.25	22.50	SCL	<0.01	0.24	0.12	0.05	0.06	7.43	-1.25	-8.68	1.70	-2.95
1806-195-23	4775a	6/19/18	0-1	3.81	7.97	39.3	19.7	100	2.85	0.37	30.00	33.75	36.25	CL	<0.01	1.18	0.80	0.00	0.39	37.0	-6.20	-43.2	0.00	-6.20
1806-195-24	4775a	6/19/18	1-3	4.33	8.34	40.8	19.2	97.9	15.6	2.03	36.25	31.25	32.50	CL	<0.01	1.23	0.59	0.28	0.36	38.6	-3.23	-41.8	8.89	-12.12
1806-195-25	4571	6/19/18	0-1	6.42	9.16	40.3	21.8	28.9	58.3	11.6	38.75	30.00	31.25	CL	0.97	0.69	0.19	0.33	0.17	21.4	9.66	-11.8	10.3	-0.69
1806-195-26	4571	6/19/18	1-3	6.52	10.2	40.3	18.1	29.3	70.9	14.8	31.25	32.50	36.25	CL	0.67	1.11	0.56	0.35	0.19	34.6	6.69	-27.9	11.0	-4.32
1806-195-27	4411	6/19/18	0-1	6.49	11.0	38.5	20.9	38.5	76.1	14.0	35.00	31.25	33.75	CL	0.17	0.74	0.31	0.16	0.27	23.1	1.73	-21.4	4.93	-3.20
1806-195-28	4411	6/19/18	1-3	6.55	7.93	30.1	17.4	19.6	50.9	11.8	50.00	28.75	21.25	L	0.47	0.65	0.18	0.27	0.20	20.2	4.70	-15.5	8.35	-3.64
1806-195-29	4433a	6/19/18	0-1	4.64	12.5	35.8	22.1	105	57.9	7.25	41.25	30.00	28.75	CL	<0.01	0.82	0.56	0.05	0.22	25.5	-4.22	-29.7	1.41	-5.63
1806-195-30	4433a	6/19/18	1-3	4.36	9.66	33.0	20.1	109	21.4	2.67	45.00	27.50	27.50	CL/SCL	<0.01	0.75	0.58	0.05	0.12	23.5	-2.24	-25.8	1.57	-3.81
1806-195-30R	4433a	6/19/18	1-3	4.31	9.18	34.7	19.3	102	20.3	2.60	46.25	27.50	26.25	SCL	<0.01	0.76	0.60	0.02	0.14	23.8	-2.24	-26.0	0.77	-3.01
1806-195-31	4433b	6/19/18	0-1	3.80	12.1	37.7	21.2	164	15.9	1.66	41.25	30.00	28.75	CL	<0.01	0.80	0.57	0.00	0.23	25.1	-3.23	-28.3	0.07	-3.30
1806-195-32	4433b	6/19/18	1-3	4.02	8.93	35.6	22.3	122	11.2	1.32	37.50	31.25	31.25	CL	<0.01	0.79	0.50	0.03	0.26	24.8	-5.21	-30.0	0.91	-6.12
1806-195-33	5092	6/19/18	0-1	6.05	6.00	38.9	24.7	40.3	17.7	3.11	36.25	31.25	32.50	CL	1.16	0.69	0.30	0.10	0.29	21.4	11.6	-9.79	3.06	8.58
1806-195-34	5092	6/19/18	1-3	6.18	5.79	37.4	24.5	40.4	16.0	2.80	36.25	30.00	33.75	CL	1.96	0.78	0.36	0.14	0.27	24.3	19.8	-4.74	4.43	15.15
1806-195-35	5114	6/19/18	0-1	6.13	12.8	38.7	20.0	75.4	72.2	10.5	46.25	25.00	28.75	SCL	0.67	1.00	0.38	0.16	0.45	31.1	6.69	-24.5	5.00	1.68
1806-195-36	5114	6/19/18	1-3	6.04	11.7	37.8	18.7	82.0	56.5	7.97	42.50	26.25	31.25	CL	0.57	1.01	0.41	0.16	0.43	31.4	5.70	-25.7	5.06	0.63
1806-195-37	5093	6/19/18	0-1	6.06	9.71	34.6	27.6	79.4	34.8	4.75	41.25	30.00	28.75	CL	0.67	1.11	0.70	0.02	0.40	34.6	6.69	-28.0	0.50	6.18
1806-195-38	5093	6/19/18	1-3	6.18	7.07	29.5	26.6	60.9	13.8	2.09	53.75	25.00	21.25	SCL	1.66	0.55	0.28	0.04	0.23	17.2	16.6	-0.56	1.21	15.4

2018-1

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1808-214-01	4459	8/15/18	0-1	5.70	10.8	46.4	19.9	19.8	97.0	21.8	37.5	30.0	32.5	CL	0.073	0.640	0.201	0.188	0.251	20.0	0.73	-19.2	5.86	-5.15
1808-214-02	4459	8/15/18	1-3	5.69	10.1	45.5	19.3	25.8	83.1	17.5	36.3	30.0	33.8	CL	0.569	0.558	0.042	0.091	0.425	17.4	5.69	-11.7	2.85	2.84
1808-214-03	4460	8/15/18	0-1	5.87	9.22	42.7	19.9	37.2	68.7	12.9	36.3	33.8	30.0	CL	1.015	0.764	0.320	0.097	0.347	23.9	10.2	-13.7	3.02	7.13
1808-214-04	4460	8/15/18	1-3	5.89	7.69	43.1	19.8	41.1	48.7	8.8	35.0	33.8	31.3	CL	1.336	0.703	0.226	0.235	0.242	21.9	13.4	-8.58	7.33	6.04
1808-214-05	4461	8/15/18	0-1	5.99	9.30	48.8	18.3	28.1	73.5	15.3	28.8	35.0	36.3	CL	<0.01	0.640	0.198	0.145	0.296	20.0	-3.23	-23.2	4.54	-7.77
1808-214-06	4461	8/15/18	1-3	6.00	12.9	47.2	23.0	42.5	108	18.9	27.5	35.0	37.5	CL	<0.01	0.764	0.334	0.140	0.290	23.9	-0.26	-24.1	4.38	-4.64
1808-214-07	4462	8/15/18	0-1	5.08	12.6	49.1	20.3	13.2	114	28.0	28.8	33.8	37.5	CL	1.039	0.547	0.110	0.186	0.251	17.1	10.4	-6.71	5.81	4.58
1808-214-08	4462	8/15/18	1-3	6.14	11.2	48.8	19.1	12.3	99.6	25.1	28.8	33.8	37.5	CL	0.767	0.445	0.088	0.122	0.235	13.9	7.67	-6.23	3.81	3.87
1808-214-09	4463	8/15/18	0-1	6.11	9.62	40.5	20.9	24.8	76.1	15.9	36.3	31.3	32.5	CL	1.707	0.667	0.282	0.147	0.238	20.8	17.1	-3.77	4.59	12.5
1808-214-10	4463	8/15/18	1-3	6.13	11.1	45.0	23.2	22.6	89.6	18.7	35.0	32.5	32.5	CL	1.065	0.590	0.163	0.185	0.242	18.4	10.6	-7.77	5.78	4.87
1808-214-10R	4463	8/15/18	1-3	6.15	10.9	44.5	22.8	22.0	87.0	18.4	33.8	32.5	33.8	CL	1.164	0.636	0.329	0.112	0.195	19.9	11.6	-8.23	3.49	8.15
1808-214-11	4464	8/15/18	0-1	5.98	10.9	41.8	25.5	70.6	55.7	8.03	33.8	36.3	30.0	CL	1.164	0.836	0.328	0.404	0.105	26.1	11.6	-14.5	12.6	-0.97
1808-214-12	4464	8/15/18	1-3	6.06	11.6	42.0	22.4	78.0	63.5	6.97	33.8	36.3	30.0	CL	0.841	0.845	0.355	0.251	0.238	26.4	8.41	-18.0	7.85	0.56
1808-214-13	4497	8/15/18	0-1	6.42	10.6	51.7	12.1	6.59	97.4	31.9	20.0	37.5	42.5	C	0.147	0.431	0.087	0.149	0.195	13.5	1.47	-12.0	4.65	-3.19
1808-214-14	4497	8/15/18	1-3	6.15	9.03	45.1	15.6	11.5	76.6	20.8	32.5	31.3	36.3	CL	0.272	0.654	0.220	0.129	0.305	20.4	2.72	-17.7	4.02	-1.30
1808-214-15	4498	8/15/18	0-1	6.20	10.9	46.5	19.4	16.5	93.5	22.1	31.3	31.3	37.5	CL	0.371	0.703	0.091	0.350	0.261	21.9	3.71	-18.2	10.9	-7.23
1808-214-16	4498	8/15/18	1-3	6.34	9.41	42.5	12.6	6.3	85.3	27.7	36.3	30.0	33.8	CL	1.065	0.474	0.097	0.117	0.260	14.8	10.6	-4.15	3.65	7.00
1808-214-17	4499	8/15/18	0-1	5.09	5.54	38.2	20.4	33.1	24.7	4.78	60.0	23.8	16.3	SL	<0.01	0.776	0.340	0.063	0.373	24.3	-2.24	-26.5	1.97	-4.21
1808-214-18	4499	8/15/18	1-3	5.28	5.12	40.1	19.7	28.9	22.9	4.64	52.5	30.0	17.5	SL	0.073	0.661	0.220	0.080	0.361	20.7	0.73	-19.9	2.50	-1.77
1808-214-19	4500	8/15/18	0-1	5.51	9.67	41.8	19.6	38.3	70.5	13.1	32.5	33.8	33.8	CL	0.966	0.786	0.273	0.252	0.262	24.6	9.66	-14.9	7.86	1.79
1808-214-20	4500	8/15/18	1-3	5.61	15.3	38.2	12.1	45.0	53.9	10.1	41.3	30.0	28.8	CL	0.569	0.980	0.665	0.136	0.279	30.6	5.69	-24.9	4.23	1.46
1808-214-20R	4500	8/15/18	1-3	5.70	10.6	37.9	17.8	59.2	72.2	11.8	41.3	28.8	30.0	CL	0.470	0.939	0.491	0.190	0.258	29.3	4.70	-24.6	5.94	-1.24
1808-214-21	4501	8/15/18	0-1	5.86	10.4	42.2	20.6	28.5	82.2	16.6	33.8	32.5	33.8	CL	1.237	0.659	0.297	0.124	0.237	20.6	12.4	-8.20	3.88	8.49
1808-214-22	4501	8/15/18	1-3	5.96	10.8	42.1	19.9	28.3	89.2	18.2	35.0	32.5	32.5	CL	1.138	0.640	0.270	0.065	0.305	20.0	11.4	-8.61	2.02	9.36
1808-214-23	4537	8/15/18	0-1	6.45	7.96	41.7	20.9	17.7	57.0	13.0	41.3	30.0	28.8	CL	1.436	0.537	0.066	0.271	0.200	16.8	14.4	-2.41	8.45	5.91
1808-214-24	4537	8/15/18	1-3	6.57	8.78	37.2	18.2	23.4	62.2	13.6	42.5	30.0	27.5	CL	1.263	0.689	0.335	0.109	0.245	21.5	12.6	-8.89	3.40	9.23
1808-214-25	4538	8/15/18	0-1	6.54	10.5	35.2	17.5	60.3	58.3	9.34	42.5	27.5	30.0	CL	0.272	0.839	0.556	0.115	0.168	26.2	2.72	-23.5	3.60	-0.88
1808-214-26	4538	8/15/18	1-3	6.49	12.0	34.6	17.8	108	56.5	7.14	42.5	28.8	28.8	CL	0.543	1.132	0.777	0.077	0.279	35.4	5.43	-29.9	2.39	3.04
1808-214-27	4539	8/15/18	0-1	6.61	10.2	34.4	16.5	32.7	74.8	15.1	50.0	25.0	25.0	SCL	1.039	0.834	0.372	0.249	0.212	26.0	10.4	-15.7	7.78	2.61
1808-214-28	4539	8/15/18	1-3	6.71	10.9	35.6	15.4	19.3	83.1	20.0	42.5	28.8	28.8	CL	1.634	0.704	0.181	0.290	0.233	22.0	16.3	-5.64	9.07	7.27
1808-214-29	4577	8/15/18	0-1	6.73	9.63	43.5	15.4	11.8	76.6	20.8	30.0	33.8	36.3	CL	1.461	0.606	0.266	0.115	0.225	18.9	14.6	-4.31	3.60	11.0
1808-214-30	4577	8/15/18	1-3	6.72	9.88	41.5	19.2	25.1	74.4	15.8	37.5	30.0	32.5	CL	1.461	0.703	0.228	0.252	0.224	22.0	14.6	-7.36	7.86	6.75
1808-214-30R	4577	8/15/18	1-3	6.73	11.0	38.2					36.3	31.3	32.5	CL	1.263	0.731	0.293	0.247	0.191	22.8	12.6	-10.2	7.71	4.92
1808-214-31	4578	8/15/18	0-1	6.14	6.71	44.4	15.5	10.5	48.7	13.5	27.5	37.5	35.0	CL	0.543	0.371	0.100	0.132	0.139	11.6	5.43	-6.16	4.11	1.32
1808-214-32	4578	8/15/18	1-3	6.25	8.73	38.4	17.1	16.5	65.7	16.0	38.8	28.8	32.5	CL	1.733	0.650	0.232	0.241	0.176	20.3	17.3	-2.96	7.54	9.79
1808-214-33	4616	8/15/18	0-1	6.14	14.3	32.3	19.3	57.0	93.1	15.1	53.8	21.3	25.0	SCL	0.642	0.348	0.176	0.048	0.124	10.9	6.42	-4.45	1.50	4.92
1808-214-34	4616	8/15/18	1-3	6.24	12.3	34.2	19.3	55.0	85.3	14.0	48.8	26.3	25.0	SCL	0.345	0.666	0.297	0.251	0.118	20.8	3.45	-17.4	7.84	-4.39
1808-214-35	5087	8/15/18	0-1	5.48	5.43	33.1	23.1	39.3	13.4	2.39	53.8	23.8	22.5	SCL	0.272	0.578	0.402	0.038	0.137	18.1	2.72	-15.3	1.20	1.52
1808-214-36	5087	8/15/18	1-3	5.61	9.37	32.2	19.6	72.7	40.0	5.89	51.3	25.0	23.8	SCL	0.371	0.890	0.509	0.138	0.243	27.8	3.71	-24.1	4.31	-0.60
1808-214-37	5109	8/15/18	0-1	5.72	8.98	36.9	18.9	62.1	44.4	6.97	47.5	28.8	23.8	L	0.569	0.826	0.409	0.153	0.265	25.8	5.69	-20.1	4.78	0.91
1808-214-38	5109	8/15/18	1-3	5.78	8.83	35.1	19.8	68.5	40.0	6.01	48.8	27.5	23.8	SCL	0.470	0.833	0.378	0.221	0.235	26.0	4.70	-21.3	6.89	-2.19

2018-2

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
1811-256-0	5088	11/28/18	0-1	6.97	6.30	41.7	19.7	56.1	57.9	9.40	40.00	31.25	28.75	CL	0.90	0.99	0.54	0.18	0.27	31.1	9.02	-22.1	5.69	3.34
1811-256-0	5088	11/28/18	1-3	6.75	6.79	39.3	19.1	68.5	58.3	8.61	42.50	27.50	30.00	CL	0.70	1.15	0.73	0.14	0.29	35.9	7.02	-28.9	4.25	2.77
1811-256-0	5091	11/28/18	0-1	5.61	9.08	44.1	19.6	77.6	97.0	13.9	32.50	36.25	31.25	CL	0.30	1.22	0.46	0.36	0.39	38.0	3.01	-35.0	11.3	-8.30
1811-256-0	5091	11/28/18	1-3	6.35	9.10	37.0	20.6	38.3	110	20.3	51.25	25.00	23.75	SCL	1.20	0.81	0.41	0.14	0.25	25.2	12.0	-13.1	4.47	7.56
1811-256-0	5089	11/28/18	0-1	6.12	8.15	38.9	20.6	135	52.6	5.97	41.25	28.75	30.00	CL	0.70	1.67	1.04	0.13	0.49	52.1	7.02	-45.1	4.09	2.93
1811-256-0	5089	11/28/18	1-3	4.82	6.53	42.5	19.9	77.5	44.8	6.42	45.00	27.50	27.50	CL	0.80	1.26	0.76	0.10	0.40	39.3	8.02	-31.3	3.12	4.90
1811-256-0	5090	11/28/18	0-1	7.54	5.21	35.6	21.8	62.9	26.0	4.00	56.25	23.75	20.00	SCL	0.60	0.36	0.27	0.01	0.09	11.2	6.01	-5.19	0.19	5.83
1811-256-0	5090	11/28/18	0-1 Dup	7.48	4.23	35.3	23.6	46.2	16.0	2.70	56.25	23.75	20.00	SCL	0.60	0.33	0.24	0.02	0.07	10.2	6.01	-4.18	0.53	5.48
1811-256-0	5090	11/28/18	1-3	7.27	4.89	33.2	21.1	59.6	20.7	3.27	61.25	21.25	17.50	SL	0.70	0.25	0.18	0.02	0.06	7.9	7.02	-0.92	0.47	6.55
1811-256-1	5110	11/28/18	0-1	6.21	5.93	39.2	21.9	59.6	35.9	5.62	46.25	27.50	26.25	SCL	0.60	1.02	0.61	0.12	0.29	31.7	6.01	-25.7	3.62	2.39
811-256-10	5110	11/28/18	0-1	6.40	5.80	41.5	21.9	68.4	34.3	5.10	47.50	27.50	25.00	SCL	0.60	0.97	0.55	0.10	0.32	30.2	6.01	-24.2	3.12	2.89
1811-256-1	5110	11/28/18	1-3	6.32	6.32	37.5	21.5	72.1	44.4	6.49	46.25	28.75	25.00	L	0.30	0.91	0.56	0.08	0.27	28.3	3.01	-25.3	2.53	0.48
1811-256-1	5046	11/28/18	0-1	5.84	6.51	38.9	35.7	85.6	21.5	2.76	50.00	28.75	21.25	L	0.50	0.70	0.56	0.00	0.14	21.9	5.01	-16.8	0.06	4.95
1811-256-1	5046	11/28/18	0-1 Dup	5.84	6.57	36.8	33.2	89.7	21.3	2.72	52.50	26.25	21.25	SCL	0.40	0.83	0.67	0.01	0.15	25.9	4.01	-21.9	0.22	3.79
1811-256-1	5046	11/28/18	1-3	4.46	4.40	39.9	21.0	104	10.7	1.35	45.00	31.25	23.75	L	<0.001	1.10	0.81	0.00	0.29	34.3	-4.01	-38.3	0.03	-4.04
1811-256-1	5070	11/28/18	0-1	7.41	5.57	40.9	35.7	57.8	11.1	1.62	48.75	28.75	22.50	L	2.11	0.59				18.6	21.1	2.51		
1811-256-1	5070	11/28/18	1-3	7.80	4.27	41.5	40.0	24.1	8.48	1.50	52.50	27.50	20.00	SCL	7.02	0.35				11.0	70.2	59.2		
1811-256-1	5071	11/28/18	0-1	7.55	4.26	36.8	31.7	32.0	13.8	2.45	51.25	27.50	21.25	SCL	2.51	0.31				9.53	25.1	15.5		
1811-256-1	5071	11/28/18	1-3	6.88	5.10	39.5	34.2	57.6	12.5	1.85	46.25	28.75	25.00	L	3.01	0.95				29.8	30.1	0.26		
1811-256-1	5094	11/28/18	0-1	6.74	4.34	40.0	26.9	35.8	16.9	2.98	37.50	32.50	30.00	CL	1.70	0.65	0.37	<0.01	0.28	20.2	17.0	-3.15	<0.01	17.0
1811-256-2	5115	11/28/18	0-1	7.88	4.83	33.8	21.9	64.5	16.1	2.46	56.25	26.25	17.50	SL	1.20	0.13				4.08	12.0	7.95		
811-256-20	5115	11/28/18	0-1	7.99	4.83	32.5	21.8	64.3	16.0	2.43	56.25	26.25	17.50	SL	1.20	0.13				4.05	12.0	8.0		
1811-256-2	5115	11/28/18	1-3	8.10	5.41	32.7	21.8	91.3	12.4	1.66	60.00	22.50	17.50	SL	1.20	0.20				6.26	12.0	5.766		
1811-256-2	5115	11/28/18	1-3 Dup	8.12	5.82	31.6	22.2	101	14.3	1.82	61.25	22.50	16.25	SL	1.10	0.18				5.68	11.0	5.34		
1811-256-2	5113	11/28/18	0-1	6.53	7.64	36.5	19.3	61.7	57.0	8.95	42.50	27.50	30.00	CL	0.70	0.85	0.50	0.10	0.28	26.7	7.02	-19.7	3.03	3.99
1811-256-2	5113	11/28/18	1-3	6.24	9.78	41.4	18.7	80.8	83.9	11.9	38.75	28.75	32.50	CL	0.60	1.11	0.75	0.07	0.29	34.6	6.01	-28.6	2.06	3.95
1811-256-2	5112	11/28/18	0-1	6.58	7.91	40.7	18.7	63.8	57.9	9.01	38.75	30.00	31.25	CL	0.70	1.05	0.62	0.19	0.23	32.7	7.02	-25.7	6.00	1.02
1811-256-2	5112	11/28/18	0-1 Dup	6.56	8.02	40.1	19.3	67.4	57.4	8.72	41.25	28.75	30.00	CL	0.60	0.99	0.58	0.16	0.25	30.8	6.01	-24.8	5.00	1.02
1811-256-2	5112	11/28/18	1-3	6.26	8.51	38.2	19.4	83.1	63.9	8.9	43.75	26.25	30.00	CL	0.40	1.10	0.69	0.15	0.26	34.3	4.01	-30.3	4.59	-0.58
1811-256-2	5111	11/28/18	0-1	6.54	8.47	36.8	20.5	68.1	69.2	10.4	47.50	26.25	26.25	SCL	0.60	1.02	0.58	0.17	0.27	31.7	6.01	-25.7	5.34	0.67
1811-256-2	5111	11/28/18	1-3	6.46	8.28	35.4	19.9	77.4	61.8	8.86	46.25	27.50	26.25	SCL	0.40	0.88	0.50	0.12	0.25	27.4	4.01	-23.4	3.87	0.14
1811-256-3	5128	11/28/18	0-1	6.24	7.57	34.1	22.8	69.7	54.4	8.00	46.25	28.75	25.00	L	0.40	0.93	0.53	0.13	0.27	28.9	4.01	-24.9	4.00	0.01
811-256-30	5128	11/28/18	0-1	6.27	7.97	33.2	22.0	74.4	57.9	8.34	46.25	28.75	25.00	L	0.30	0.89	0.47	0.12	0.29	27.7	3.01	-24.7	3.75	-0.74
1811-256-3	5128	11/28/18	1-3	6.91	5.68	32.2	27.5	48.6	31.1	5.03	56.25	22.50	21.25	SCL	0.90	0.58	0.44	0.01	0.13	18.0	9.02	-8.97	0.34	8.68
1811-256-3	5127	11/28/18	0-1	5.52	7.69	36.5	21.2	88.9	41.5	5.59	43.75	28.75	27.50	CL	0.20	1.14	0.74	0.08	0.33	35.7	2.01	-33.7	2.37	-0.37
1811-256-3	5127	11/28/18	0-1 Dup	5.62	7.87	33.6	22.7	91.3	42.9	5.68	45.00	28.75	26.25	L	0.20	1.11	0.75	0.08	0.28	34.7	2.01	-32.7	2.62	-0.62
1811-256-3	5127	11/28/18	1-3	5.94	5.53	38.9	22.5	50.3	25.6	4.24	43.75	27.50	28.75	CL	0.30	1.04	0.50	0.20	0.35	32.5	3.01	-29.5	6.22	-3.21
1811-256-3	5094	11/28/18	1-3	6.68	4.35	47.7	37.9	28.1	7.92	1.38	48.75	27.50	23.75	SCL	3.71	0.63				26.0	37.1	11.1		
1811-256-3	5132	11/28/18	0-1	6.56	6.15	38.7	22.7	47.8	39.1	6.58	40.00	28.75	31.25	CL	0.50	0.96	0.59	0.05	0.32	30.1	5.01	-25.0	1.69	3.33
1811-256-3	5132	11/28/18	1-3	6.33	5.25	37.2	23.3	37.8	35.0	6.34	43.75	28.75	27.50	CL	0.40	0.68	0.37	0.13	0.18	21.4	4.01	-17.3	4.06	-0.05
1811-256-3	5131	11/28/18	0-1	6.67	4.35	32.7	29.0	31.2	18.9	3.44	56.25	22.50	21.25	SCL	1.30	0.25				7.96	13.0	5.07		
1811-256-3	5131	11/28/18	1-3	3.94	5.50	34.2	24.7	74.3	11.4	1.63	56.25	22.50	21.25	SCL	<0.001	0.89	0.69	0.04	0.16	27.9	-5.01	-32.9	1.22	-6.23
1811-256-4	5130	11/28/18	0-1	6.46	9.55	37.2	22.0	38.8	97.4	17.7	40.00	28.75	31.25	CL	0.70	1.13	0.48	0.36	0.29	35.2	7.02	-28.2	11.2	-4.17
811-256-40	5130	11/28/18	0-1	6.48	9.55	37.1	22.5	39.2	98.7	17.8	40.00	28.75	31.25	CL	0.70	1.13	0.43	0.40	0.30	35.2	7.02	-28.2	12.4	-5.42
1811-256-4	5130	11/28/18	0-1 Dup	6.51	8.76	35.2	23.2	39.4	102	18.3	41.25	27.50	31.25	CL	0.70	1.14	0.42	0.41	0.31	35.5	7.02	-28.5	12.7	-5.73
1811-256-4	5130	11/28/18	1-3	3.73	11.2	33.6	24.0	277	49.2	4.01	47.50	27.50	25.00	SCL	<0.01	1.31	0.13	0.73	0.46	40.9	-8.02	-48.9	22.8	-30.8
1811-256-4	5129	11/28/18	0-1	5.88	9.08	33.6	24.0	277	49.2	4.01	47.50	27.50	25.00	SCL	0.20	1.06	0.61	0.15	0.31	33.2	2.01	-31.2	4.72	-2.71
1811-256-4	5129	11/28/18	1-3	6.22	8.45	38.3	22.2	85.6	70.5	9.60	40.00	30.00	30.00	CL	0.30	0.94	0.53	0.12	0.29	29.2	3.01	-26.2	3.78	-0.77

2018-3

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
112-182-0	4937	12/21/21	0-1	3.53	8.67	43.0	21.2	87.2	20.1	2.72	36.25	33.75	30.00	CL	<0.01	0.80	0.53	0.00	0.27	25.0	-2.01	-27.0	0.06	-2.08
112-182-0	4937	12/21/21	1-3	4.42	10.6	42.7	19.1	71.1	44.4	6.61	43.75	28.75	27.50	CL	<0.01	0.56	0.42	0.01	0.14	17.6	-0.02	-17.7	0.16	-0.17
112-182-0	4938	12/21/21	0-1	6.94	6.47	40.1	23.0	43.9	25.4	4.40	48.75	23.75	27.50	SCL	1.49	0.71	0.46	0.03	0.22	22.0	14.9	-7.08	0.91	14.0
112-182-0	4938	12/21/21	1-3	6.72	7.52	39.8	22.1	53.6	32.3	5.24	47.50	25.00	27.50	SCL	1.30	0.75	0.48	0.06	0.21	23.4	13.0	-10.4	1.78	11.2
112-182-0	4964	12/21/21	0-1	7.42	4.35	41.6	24.7	29.0	6.35	1.23	43.75	25.00	31.25	CL	2.29	0.23				7.18	22.9	15.7		
112-182-0	4964	12/21/21	1-3	7.25	8.98	41.1	21.5	47.1	54.8	9.35	40.00	30.00	30.00	CL	3.29	1.02				31.8	32.9	1.08		
112-182-0	4991	12/21/21	0-1	7.18	5.28	43.2	26.1	45.4	7.13	1.19	42.50	26.25	31.25	CL	1.40	0.28				8.71	14.0	5.24		
112-182-0	4991	12/21/21	1-3	7.37	5.76	44.0	25.0	55.1	7.00	1.11	42.50	25.00	32.50	CL	1.79	0.28				8.77	17.9	9.17		
112-182-0	4992	12/21/21	0-1	7.66	4.14	40.4	21.7	29.1	4.44	0.88	40.00	28.75	31.25	CL	2.79	0.16				4.86	27.9	23.1		
112-182-1	4992	12/21/21	1-3	7.61	4.84	40.9	24.9	38.6	6.05	1.07	41.25	27.50	31.25	CL	3.19	0.17				5.30	31.9	26.6		
112-182-1(	4992	12/21/21	1-3	7.53	4.80	39.0	24.8	40.7	6.57	1.15	41.25	26.25	32.50	CL	3.19	0.17				5.45	31.9	26.5		
112-182-1	5022	12/21/21	0-1	7.47	1.01	44.5	2.51	5.82	1.93	0.95	40.00	25.00	35.00	CL	2.49	0.03				0.97	24.9	24.0		
112-182-1	5022	12/21/21	1-3	7.84	0.95	45.6	1.39	5.87	2.32	1.22	31.25	28.75	40.00	CL/C	2.89	0.02				0.70	28.9	28.2		
112-182-1	5116	12/21/21	0-1	5.60	7.31	42.5	23.3	77.2	17.1	2.42	40.00	28.75	31.25	CL	0.50	1.06	0.70	0.04	0.32	33.0	4.97	-28.0	1.09	3.88
112-182-1	5116	12/21/21	1-3	5.90	8.74	41.3	21.0	95.4	19.4	2.55	45.00	26.25	28.75	CL/SCL	1.00	1.10	0.67	0.05	0.38	34.3	10.0	-24.3	1.50	8.46

2021-1

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
2205-238-01	4680 C	5/16/22	0-1	7.17	5.08	41.1	25.3	17.9	21.7	4.66	41.25	31.25	27.50	CL	3.62	0.39				12.1	36.2	24.1		
2205-238-02	4680 C	5/16/22	1-3	6.82	7.98	46.3	24.4	53.8	34.4	5.60	40.00	28.75	31.25	CL	2.71	0.87	0.41	0.21	0.24	27.1	27.1	-0.03	6.55	20.6
2205-238-03	4680 D	5/16/22	0-1	7.18	3.44	37.1	25.7	17.3	1.55	0.33	45.00	26.25	28.75	CL/SCL	2.10	0.18				5.69	21.0	15.3		
2205-238-04	4680 D	5/16/22	1-3	6.13	6.57	44.1	25.3	67.4	8.79	1.29	42.50	27.50	30.00	CL	1.18	1.16	0.88	0.03	0.25	36.2	11.8	-24.3	0.84	11.0
2205-238-05	4714 C	5/16/22	0-1	5.71	6.14	38.5	24.7	71.2	1.57	0.23	46.25	26.25	27.50	SCL	1.29	0.86	0.51	0.00	0.34	26.9	12.9	-14.1	0.15	12.7
2205-238-06	4714 C	5/16/22	1-3	3.43	8.14	41.3	21.2	100	2.21	0.28	47.50	25.00	27.50	SCL	-0.34	1.52	0.97	0.00	0.55	47.5	-3.40	-50.9	0.00	-3.39
2205-238-07	4746 C	5/16/22	0-1	2.84	13.2	40.9	21.6	172	0.32	0.03	41.25	27.50	31.25	CL	-1.46	1.30	0.96	0.00	0.35	40.7	-14.6	-55.2	-0.07	-14.5
2205-238-08	4746 C	5/16/22	1-3	4.51	6.65	41.8	21.5	78.7	2.16	0.30	42.50	27.50	30.00	CL	0.98	1.43	0.98	0.05	0.40	44.6	9.81	-34.8	1.57	8.23
2205-238-09	4746 D	5/16/22	0-1	3.04	5.80	38.6	22.6	49.1	1.73	0.29	25.00	37.50	37.50	CL	-0.44	1.34	0.83	0.02	0.50	41.9	-4.41	-46.3	0.48	-4.89
2205-238-10	4746 D	5/16/22	1-3	3.15	7.96	42.1	21.7	93.0	3.45	0.46	18.75	41.25	40.00	SICL/SIC	-0.24	1.99	1.25	0.02	0.72	62.3	-2.38	-64.6	0.68	-3.06
2205-238-10R	4746 D	5/16/22	1-3	2.98	7.58	40.3	19.1	85.6	3.02	0.42	20.00	40.00	40.00	SICL/CL/SIC/C	-0.24	2.09	1.32	0.09	0.69	65.4	-2.38	-67.8	2.71	-5.10
2205-238-11	4775 B	5/16/22	0-1	4.57	5.56	41.3	22.5	44.4	7.22	1.25	37.50	30.00	32.50	CL	0.17	0.89	0.61	0.02	0.27	27.9	1.68	-26.2	0.54	1.14
2205-238-12	4775 B	5/16/22	1-3	4.67	5.80	43.7	22.7	51.4	8.26	1.36	37.50	28.75	33.75	CL	0.07	0.90	0.65	0.00	0.26	28.3	0.67	-27.6	0.00	0.67
2205-238-13	4807 A	5/16/22	0-1	6.82	6.92	46.7	21.7	17.7	43.9	9.80	28.75	30.00	41.25	C	1.29	0.64	0.36	0.05	0.23	20.0	12.9	-7.15	1.60	11.3
2205-238-14	4807 A	5/16/22	1-3	7.05	8.01	45.5	21.1	15.7	60.0	14.0	26.25	30.00	43.75	C	0.88	0.58	0.27	0.12	0.20	18.3	8.79	-9.48	3.67	5.12

2022-1

GAL #	LOCATION	SAMPLE DATE	SAMPLE DEPTH	PH UNITS	EC MMHO/CM	% SAT	CALCIUM MEQ/L	MAGNESIUM MEQ/L	SODIUM MEQ/L	SAR	% SAND	% SILT	% CLAY	CLASS	% CACO3	TOT S %	SULFATE S%	PYR S %	ORG S%	ACID POT TN/1000TN	NEUT POT TN/1000TN	A-B POT TN/1000TN	PYR A POT TN/1000TN	PYRS A-B TN/1000TN
2206-149-01	5020 A	6/3/22	0-1	3.43	8.94	39.1	26.1	100	32.1	4.03	40.00	31.25	28.75	CL	-0.24	1.15	0.59	0.05	0.51	35.8	-2.38	-38.2	1.41	-3.79
2206-149-02	5020 A	6/3/22	1-3	3.86	19.19	39.5	25.2	236	124	10.8	26.25	35.00	38.75	CL	-0.24	1.60	0.93	0.10	0.58	50.1	-2.38	-52.5	3.03	-5.41
2206-149-03	5020 B	6/3/22	0-1	4.97	9.69	36.2	23.0	118	31.6	3.77	32.50	38.75	28.75	CL	0.17	1.23	0.67	0.04	0.51	38.3	1.68	-36.6	1.22	0.46
2206-149-04	5020 B	6/3/22	1-3	3.04	9.72	38.3	25.8	132	15.3	1.72	27.50	41.25	31.25	CL	-0.44	2.04	0.72	-0.03	1.36	63.9	-4.41	-68.3	-1.00	-3.41
2206-149-05	5020 C	6/3/22	0-1	7.40	4.79	41.4	27.6	33.8	11.5	2.07	42.50	30.00	27.50	CL	4.03	0.62				19.3	40.3	21.0		
2206-149-06	5020 C	6/3/22	1-3	7.30	5.48	46.2	26.0	39.3	18.1	3.17	37.50	32.50	30.00	CL	3.22	0.62				19.4	32.2	12.7		
2206-149-07	5020 D	6/3/22	0-1	7.19	4.12	43.4	25.5	32.7	4.92	0.91	36.25	30.00	33.75	CL	2.71	0.19				5.88	27.1	21.2		
2206-149-08	5020 D	6/3/22	1-3	5.55	4.36	37.0	25.2	41.4	2.50	0.43	32.50	33.75	33.75	CL	0.78	0.62	0.37	0.05	0.20	19.3	7.78	-11.6	1.41	6.37
2206-149-09	5045 A	6/3/22	0-1	7.22	8.71	38.4	23.4	54.5	51.8	8.29	48.75	25.00	26.25	SCL	0.78	0.58	0.36	0.05	0.17	18.2	7.78	-10.4	1.69	6.09
2206-149-10	5045 A	6/3/22	1-3	5.00	11.02	41.9	21.1	114	47.4	5.76	40.00	30.00	30.00	CL	-0.03	0.98	0.68	0.05	0.25	30.7	-0.35	-31.0	1.62	-1.97
2206-149 10R	5045 A	6/3/22	1-3	5.02	11.38	40.8	25.9	144	57.4	6.23	38.75	31.25	30.00	CL	-0.03	0.99	0.68	0.08	0.23	31.0	-0.35	-31.4	2.34	-2.69
2206-149-11	5045 B	6/3/22	0-1	5.67	19.42	42.4	19.5	164	151	15.7	41.25	25.00	33.75	CL	0.17	0.81	0.62	0.01	0.17	25.2	1.68	-23.5	0.44	1.24
2206-149-12	5045 B	6/3/22	1-3	3.31	14.44	45.3	19.6	110	93.1	11.6	48.75	21.25	30.00	SCL	-0.44	1.71	1.06	-0.01	0.66	53.5	-4.41	-57.9	-0.25	-4.16
2206-149-13	5045 C	6/3/22	0-1	6.99	7.61	38.9	45.6	38.5	11.1	1.71	52.50	25.00	22.50	SCL	1.18	0.33				10.2	11.8	1.65		
2206-149-14	5045 C	6/3/22	1-3	6.47	5.45	38.5	31.4	37.7	10.4	1.76	50.00	26.25	23.75	SCL	0.78	0.47	0.32	0.02	0.13	14.7	7.78	-6.90	0.66	7.12
2206-149-15	5045 D	6/3/22	0-1	5.63	4.50	43.9	21.9	41.5	5.44	0.97	33.75	35.00	31.25	CL	0.27	0.90	0.52	0.04	0.34	28.1	2.70	-25.4	1.22	1.48
2206-149-16	5045 D	6/3/22	1-3	6.84	6.00	42.8	27.5	49.6	16.3	2.63	42.50	30.00	27.50	CL	1.18	0.67	0.47	0.02	0.19	20.9	11.8	-9.08	0.47	11.4
2206-149-17	5069 A	6/3/22	0-1	6.69	6.46	38.6	20.7	48.4	23.0	3.91	41.25	27.50	31.25	CL	1.29	0.93	0.63	0.08	0.22	29.1	12.9	-16.3	2.47	10.4
2206-149-18	5069 A	6/3/22	1-3	6.59	6.70	38.6	20.3	52.5	22.1	3.66	43.75	27.50	28.75	CL	0.98	1.00	0.73	0.05	0.23	31.2	9.81	-21.4	1.44	8.37
2206-149-19	5069 B	6/3/22	0-1	5.49	16.66	35.1	19.1	174	83.1	8.46	38.75	32.50	28.75	CL	0.37	0.97	0.73	0.03	0.21	30.4	3.71	-26.7	0.87	2.84
2206-149-20	5069 B	6/3/22	1-3	3.00	18.43	41.1	19.9	138	96.1	10.8	23.75	42.50	33.75	CL	-0.64	1.41	0.79	0.01	0.60	44.0	-5.43	-49.4	0.31	-5.74
2206-149-20R	5069 B	6/3/22	1-3	3.01	17.11	44.0	19.5	123	87.0	10.3	22.50	42.50	35.00	CL	-0.84	1.40	0.83	-0.07	0.64	43.8	-6.44	-50.3	-2.12	-4.32
2206-149-21	5069 C	6/3/22	0-1	6.44	19.18	34.9	22.5	231	42.8	3.80	51.25	23.75	25.00	SCL	0.57	0.92	0.68	0.02	0.23	28.9	5.74	-23.1	0.50	5.24
2206-149-22	5069 C	6/3/22	1-3	7.40	11.60	38.7	26.8	108	21.5	2.62	52.50	23.75	23.75	SCL	1.49	1.04	0.88	-0.01	0.17	32.6	14.9	-17.7	-0.19	15.1
2206-149-23	5069 D	6/3/22	0-1	4.93	8.25	36.2	30.2	60.3	12.2	1.82	42.50	30.00	27.50	CL	0.17	0.82	0.58	0.01	0.24	25.7	1.68	-24.0	0.22	1.46
2206-149-24	5069 D	6/3/22	1-3	4.90	14.06	35.7	48.4	83.1	23.4	2.88	51.25	27.50	21.25	SCL	0.27	0.57	0.40	0.01	0.17	17.9	2.70	-15.2	0.31	2.38
2206-149-25	5091 A	6/3/22	0-1	5.63	9.35	46.5	19.7	81.0	39.7	5.60	30.00	32.50	37.50	CL	0.17	1.44	1.10	0.02	0.31	44.9	1.68	-43.2	0.69	0.99
2206-149-26	5091 A	6/3/22	1-3	5.55	11.27	45.4	18.7	107	49.2	6.20	38.75	28.75	32.50	CL	0.07	1.47	1.11	0.01	0.36	46.0	0.67	-45.4	0.19	0.48
2206-149-27	5091 B	6/3/22	0-1	4.04	7.39	42.3	19.6	74.0	13.8	2.02	32.50	33.75	33.75	CL	-0.14	1.16	0.77	0.06	0.32	36.3	-1.37	-37.6	2.00	-3.37
2206-149-28	5091 B	6/3/22	1-3	4.08	4.04	45.8	22.0	25.4	4.96	1.02	32.50	33.75	33.75	CL	-0.14	0.96	0.33	0.11	0.52	30.1	-1.37	-31.5	3.53	-4.90
2206-149-29	5091 C	6/3/22	0-1	4.18	10.86	45.2	17.9	107	41.4	5.24	35.00	30.00	35.00	CL	-0.24	1.89	1.44	-0.03	0.48	59.0	-2.38	-61.4	-0.94	-1.44
2206-149-30	5091 C	6/3/22	1-3	4.46	11.61	43.8	18.1	120	46.5	5.60	38.75	30.00	31.25	CL	-0.03	1.67	1.12	-0.01	0.56	52.1	-0.35	-52.5	-0.25	-0.10
2206-149-30R	5091 C	6/3/22	1-3	4.51	11.62	44.6	18.3	122	47.0	5.61	37.50	30.00	32.50	CL	-0.03	1.66	1.13	-0.04	0.57	51.8	-0.35	-52.1	-1.37	1.02
2206-149-31	5091 D	6/3/22	0-1	6.22	8.38	37.6	18.8	54.5	41.3	6.83	37.50	32.50	30.00	CL	0.88	0.56	0.39	0.02	0.16	17.5	8.79	-8.69	0.50	8.29
2206-149-32	5091 D	6/3/22	1-3	6.73	6.62	33.6	23.3	43.2	21.1	3.66	51.25	23.75	25.00	SCL	1.18	0.30				9.32	11.8	2.52		

2022-2

LABORATORY ANALYTICAL REPORT
Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9
Workorder: H23120111

Report Date: 12/27/23
Date Received: 12/05/23

Sample ID	Client Sample ID	Analysis Units Up	Analysis Units Low	Sand % Results	Silt % Results	Clay % Results	Texture Results	pH-SatPst s_u_ Results	Percent Sat % Results	Cond-SatPst mmhos/cm Results	Ca-SatPst-Sat Paste meq/L Results	Mg-SatPst-Sat Paste meq/L Results	Na-SatPst-Sat Paste meq/L Results	SAR unitless Results
H23120111-001	4710 A	0	1	34	34	32	CL	3.1	43.9	12.2	15.4	174	1.60	0.2
H23120111-002	4710 A	1	3	34	36	30	CL	3.5	50.3	16.0	18.6	304	45.2	3.6
H23120111-003	4710 B	0	1	42	32	26	L	5.4	50.6	7.2	18.2	75.7	27.8	4.1
H23120111-004	4710 B	1	3	34	36	30	CL	6.2	49.6	7.3	18.8	66.7	33.2	5.1
H23120111-005	4710 C	0	1	34	38	28	CL	5.2	48.3	8.1	17.5	82.9	34.1	4.8
H23120111-006	4710 C	1	3	40	34	26	L	4.1	50.1	10.4	17.2	91.4	62.1	8.4
H23120111-007	4710 D	0	1	32	40	28	CL	3.9	46.1	12.7	17.7	196	45.4	4.4
H23120111-008	4710 D	1	3	34	38	28	CL	6.1	49.6	8.6	19.2	52.2	59.3	9.9
H23120111-009	4715 A	0	1	14	50	36	SICL	7.3	56.4	4.5	24.1	39.3	7.10	1.3
H23120111-010	4715 A	1	3	14	52	34	SICL	7.6	54.3	3.6	24.0	22.6	7.23	1.5
H23120111-011	4715 B	0	1	40	34	26	L	3.9	42.0	10.4	18.1	198	9.36	0.9
H23120111-012	4715 B	1	3	38	36	26	L	3.6	43.3	8.4	16.9	126	7.72	0.9
H23120111-013	4715 C	0	1	44	32	24	L	6.6	43.1	3.9	24.4	31.5	5.46	1.0
H23120111-014	4715 C	1	3	52	34	14	L	6.8	38.4	4.3	23.3	38.6	6.12	1.1
H23120111-015	4715 D	0	1	36	36	28	CL	3.8	49.3	5.1	20.7	62.1	6.04	0.9
H23120111-016	4715 D	1	3	40	32	28	CL	4.0	51.5	6.6	19.7	84.1	12.1	1.7
H23120111-017	4711 A	0	1	34	36	30	CL	4.7	47.3	7.3	19.4	90.7	16.7	2.3
H23120111-018	4711 A	1	3	36	36	28	CL	4.3	50.7	8.4	18.9	106	21.7	2.8
H23120111-019	4711 B	0	1	32	40	28	CL	4.8	47.2	7.3	20.6	86.3	15.4	2.1
H23120111-020	4711 B	1	3	38	36	26	L	3.9	44.9	7.3	18.4	90.2	15.0	2.0
H23120111-021	4711 C	0	1	34	38	28	CL	5.9	46.3	7.0	20.0	69.0	28.7	4.2
H23120111-022	4711 C	1	3	36	36	28	CL	5.8	46.6	7.7	16.6	68.3	35.2	5.1
H23120111-023	4711 D	0	1	36	36	28	CL	5.6	46.6	6.3	18.7	65.7	17.0	2.5
H23120111-024	4711 D	1	3	52	28	20	L	3.4	47.7	6.1	20.4	57.1	8.18	1.3
H23120111-025	4746 B	0	1	36	36	28	CL	2.7	38.3	9.5	18.2	78.6	0.14	< 0.1
H23120111-026	4746 B	1	3	52	30	18	L	2.9	42.2	3.1	24.2	11.3	0.34	< 0.1
H23120111-027	4746 C	0	1	36	34	30	CL	3.3	45.1	5.6	20.1	65.5	0.65	0.1
H23120111-028	4746 C	1	3	38	36	26	L	4.1	44.4	4.8	24.6	48.8	6.16	1.0
H23120111-029	4746 D	0	1	16	56	28	SICL	7.8	44.7	5.2	20.7	46.3	15.2	2.6
H23120111-030	4746 D	1	3	16	50	34	SICL	7.9	51.0	5.3	21.8	53.2	15.2	2.5
H23120111-031	4681 A	0	1	32	40	28	CL	6.7	50.5	4.5	25.6	43.3	11.9	2.0
H23120111-032	4681 A	1	3	34	38	28	CL	6.4	46.0	4.6	23.7	53.2	7.56	1.2
H23120111-033	4681 B	0	1	44	34	22	L	7.3	42.6	4.0	23.3	24.9	12.9	2.6
H23120111-034	4681 B	1	3	32	38	30	CL	6.8	50.5	5.3	21.7	38.3	23.3	4.3
H23120111-035	4681 D	0	1	44	34	22	L	7.3	40.6	4.3	23.5	21.5	19.1	4.0
H23120111-036	4681 D	1	3	26	44	30	CL	7.3	51.5	4.9	20.8	26.3	28.7	5.9

2023-1

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9
Workorder: H23120111

Report Date: 12/27/23
Date Received: 12/05/23

2023-2

Sample ID	Client Sample ID	Analysis Units Up	Analysis Units Low	Neut Potential t/kt Results	Acid Potential t/kt Results	Acid/Base Potential t/kt Results	AP, Pyritic S t/kt Results	ABP, Pyritic S t/kt Results	Sulfur, Total % Results	Sulfur, Sulfate % Results	Sulfur, Pyritic % Results	Sulfur, Organic % Results
H23120111-001	4710 A	0	1	-1	61	-61	14	-14	1.95	1.36	0.44	0.15
H23120111-002	4710 A	1	3	1	69	-67	14	-13	2.19	1.52	0.45	0.22
H23120111-003	4710 B	0	1	8	43	-35	14	-7	1.36	0.69	0.46	0.21
H23120111-004	4710 B	1	3	13	35	-22	10	3	1.11	0.66	0.32	0.13
H23120111-005	4710 C	0	1	9	55	-46	22	-13	1.75	0.77	0.69	0.30
H23120111-006	4710 C	1	3	3	55	-53	21	-18	1.77	0.81	0.68	0.29
H23120111-007	4710 D	0	1	2	50	-47	16	-13	1.59	0.94	0.50	0.15
H23120111-008	4710 D	1	3	9	49	-40	24	-14	1.57	0.71	0.75	0.11
H23120111-009	4715 A	0	1	58	12	46			0.40			
H23120111-010	4715 A	1	3	58	2.7	55			0.09			
H23120111-011	4715 B	0	1	2	38	-36	9.1	-7	1.20	0.81	0.29	0.10
H23120111-012	4715 B	1	3	0	36	-36	8.9	-9	1.15	0.75	0.29	0.11
H23120111-013	4715 C	0	1	14	19	-5	5.8	8	0.62	0.36	0.19	0.06
H23120111-014	4715 C	1	3	11	14	-3	2.9	8	0.43	0.29	0.09	0.05
H23120111-015	4715 D	0	1	2	40	-38	6.9	-5	1.29	0.95	0.22	0.12
H23120111-016	4715 D	1	3	3	42	-38	7.3	-4	1.34	0.98	0.23	0.12
H23120111-017	4711 A	0	1	5	43	-38	13	-8	1.38	0.84	0.40	0.13
H23120111-018	4711 A	1	3	4	49	-45	12	-9	1.56	1.04	0.39	0.13
H23120111-019	4711 B	0	1	5	40	-35	13	-8	1.28	0.76	0.40	0.12
H23120111-020	4711 B	1	3	2	44	-42	14	-12	1.42	0.82	0.43	0.16
H23120111-021	4711 C	0	1	14	39	-25	14	-1	1.24	0.59	0.46	0.19
H23120111-022	4711 C	1	3	13	46	-33	17	-4	1.48	0.74	0.55	0.19
H23120111-023	4711 D	0	1	12	39	-27	13	0	1.26	0.69	0.41	0.17
H23120111-024	4711 D	1	3	1	43	-42	13	-12	1.38	0.73	0.41	0.23
H23120111-025	4746 B	0	1	-5	40	-40	8.2	-8	1.28	0.92	0.26	0.09
H23120111-026	4746 B	1	3	-1	30	-30	12	-12	0.95	0.31	0.39	0.25
H23120111-027	4746 C	0	1	0	33	-33	8.3	-8	1.05	0.67	0.27	0.12
H23120111-028	4746 C	1	3	4	31	-27	6.3	-2	0.99	0.70	0.20	0.09
H23120111-029	4746 D	0	1	23	9.5	13			0.30			
H23120111-030	4746 D	1	3	15	98	-82	3.6	12	3.13	2.63	0.12	0.38
H23120111-031	4681 A	0	1	16	34	-18	12	4	1.08	0.61	0.38	0.09
H23120111-032	4681 A	1	3	17	35	-18	10	7	1.13	0.69	0.33	0.11
H23120111-033	4681 B	0	1	49	9.5	39	3.4	46	0.30	0.17	0.11	0.03
H23120111-034	4681 B	1	3	27	31	-4	12	15	1.00	0.51	0.39	0.09
H23120111-035	4681 D	0	1	55	8.0	47			0.26			
H23120111-036	4681 D	1	3	130	9.6	120			0.31			

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9 Spoils
Workorder: H24020280

Report Date: 03/04/24
Date Received: 02/13/24

2024-A

		Analysis		Sand	Silt	Clay	Texture	pH-SatPst	Percent Sat	Cond-SatPst	Ca-SatPst-Sat Paste	Mg-SatPst-Sat Paste	Na-SatPst-Sat Paste	SAR
		Units		%	%	%		s_u_	%	mmhos/cm	meq/L	meq/L	meq/L	unitless
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24020280-001	5105 A	0	1	28	43	29	CL	3.7	47.6	7.5	20.0	111	2.49	0.3
H24020280-002	5105 A	1	3	30	41	29	CL	3.9	58.2	9.0	19.6	147	3.10	0.3
H24020280-003	5105 B	0	1	38	36	26	L	4.6	44.6	4.5	22.4	40.8	8.34	1.5
H24020280-004	5105 B	1	3	40	33	27	CL	4.8	42.8	12.4	19.7	200	34.9	3.3
H24020280-005	5105 C	0	1	32	40	28	CL	3.9	49.3	8.0	19.9	127	2.81	0.3
H24020280-006	5105 C	1	3	36	36	28	CL	3.1	50.4	10.2	18.8	110	1.01	0.1
H24020280-007	5105 D	0	1	28	42	30	CL	3.4	52.2	8.4	18.8	128	1.24	0.1
H24020280-008	5105 D	1	3	30	41	29	CL	3.5	54.7	9.2	18.9	143	1.76	0.2
H24020280-009	5121 A	0	1	40	36	24	L	4.2	43.5	5.3	20.0	56.7	7.46	1.2
H24020280-010	5121 A	1	3	40	36	24	L	3.3	49.1	7.9	18.7	105	6.63	0.8
H24020280-011	5121 B	0	1	52	27	21	SCL	2.7	38.4	7.1	16.6	56.0	2.71	0.4
H24020280-012	5121 B	1	3	54	28	18	SL	2.7	42.2	5.8	15.8	29.7	7.11	1.6
H24020280-013	5121 C	0	1	34	40	26	L	6.6	50.6	6.6	18.9	51.5	34.0	6.7
H24020280-014	5121 C	1	3	36	37	27	CL	6.8	48.9	7.7	18.9	48.1	52.6	9.1
H24020280-015	5121 D	0	1	42	34	24	L	3.6	40.2	7.8	18.4	106	10.8	1.4
H24020280-016	5121 D	1	3	40	34	26	L	4.1	42.2	9.0	18.1	143	9.03	1.0
H24020280-017	5103 A	0	1	30	42	28	CL	3.7	49.9	5.8	19.0	64.1	5.08	0.8
H24020280-018	5103 A	1	3	28	42	30	CL	3.2	50.9	9.7	17.2	127	3.66	0.4
H24020280-019	5103 B	0	1	42	33	25	L	3.5	51.5	5.9	17.0	60.4	6.34	1.0
H24020280-020	5103 B	1	3	62	18	20	SCL	3.1	54.0	6.9	20.1	51.5	18.4	3.1
H24020280-021	5103 C	0	1	30	44	26	L	3.4	48.4	5.8	19.3	64.6	2.49	0.4
H24020280-022	5103 C	1	3	38	37	25	L	3.4	51.6	5.4	18.9	53.9	4.57	0.8
H24020280-023	5103 D	0	1	42	34	24	L	4.7	50.3	4.0	21.9	30.8	6.99	1.2
H24020280-024	5103 D	1	3	40	35	25	L	4.3	48.1	4.2	23.6	29.1	6.48	1.3
H24020280-025	5079 A	0	1	40	34	26	L	7.5	48.4	4.7	20.7	46.0	10.8	1.9
H24020280-026	5079 A	1	3	32	38	30	CL	7.6	47.5	3.9	20.5	32.5	6.76	1.3
H24020280-027	5079 B	0	1	32	42	26	L	5.6	52.1	4.7	20.0	58.3	3.95	0.6
H24020280-028	5079 B	1	3	38	38	24	L	5.8	51.4	4.7	19.8	58.8	2.64	0.4
H24020280-029	5079 C	0	1	34	41	25	L	5.6	45.2	4.5	19.4	57.2	2.81	0.4
H24020280-030	5079 C	1	3	40	36	24	L	3.7	44.1	11.8	18.4	236	1.32	0.1
H24020280-031	5079 D	0	1	36	36	28	CL	7.0	48.0	5.4	22.1	62.9	7.07	1.1
H24020280-032	5079 D	1	3	40	35	25	L	6.8	44.4	6.6	22.3	93.1	7.53	1.0
H24020280-033	4937 B	0	1	60	24	16	SL	7.5	38.8	3.3	20.1	22.9	5.75	1.2
H24020280-034	4937 B	1	3	60	26	14	SL	7.1	40.5	4.8	19.6	46.5	13.4	2.3
H24020280-035	4937 C	0	1	40	34	26	L	7.2	43.3	1.8	15.0	8.66	1.32	0.4
H24020280-036	4937 C	1	3	52	26	22	SCL	7.5	42.2	3.5	20.1	27.1	6.46	1.3
H24020280-037	5011	0	1	38	36	26	L	6.1	45.0	8.2	19.4	58.0	52.1	8.4
H24020280-038	5011	1	3	38	36	26	L	5.8	47.0	6.1	19.5	40.4	31.8	5.8
H24020280-039	Pit 1	0	10	44	31	25	L	7.0	45.3	6.6	20.2	45.1	31.2	5.5

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9 Spoils
Workorder: H24020280

Report Date: 03/04/24
Date Received: 02/13/24

		Analysis		Neut Potential	Acid Potential	Acid/Base Potential	AP, Pyritic S	ABP, Pyritic S	Sulfur, Total	Sulfur, Sulfate	Sulfur, Pyritic	Sulfur, Organic
		Units		t/kt	t/kt	t/kt	t/kt	t/kt	%	%	%	%
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24020280-001	5105 A	0	1	2	34	-32	8.9	-7	1.09	0.70	0.28	0.11
H24020280-002	5105 A	1	3	3	36	-34	7.7	-5	1.16	0.82	0.25	0.10
H24020280-003	5105 B	0	1	4	33	-29	12	-7	1.06	0.55	0.38	0.13
H24020280-004	5105 B	1	3	5	43	-37	12	-7	1.36	0.83	0.38	0.15
H24020280-005	5105 C	0	1	2	34	-31	7.5	-5	1.08	0.75	0.24	0.09
H24020280-006	5105 C	1	3	-4	70	-74	16	-20	2.23	1.43	0.51	0.29
H24020280-007	5105 D	0	1	1	37	-36	9.1	-8	1.17	0.79	0.29	0.09
H24020280-008	5105 D	1	3	1	40	-39	8.9	-8	1.29	0.90	0.29	0.10
H24020280-009	5121 A	0	1	3	26	-23	5.9	-3	0.83	0.54	0.19	0.10
H24020280-010	5121 A	1	3	1	33	-32	5.6	-5	1.04	0.75	0.18	0.11
H24020280-011	5121 B	0	1	-3	25	-28	6.0	-9	0.80	0.62	0.19	0.08
H24020280-012	5121 B	1	3	-2	22	-25	5.2	-8	0.71	0.45	0.17	0.10
H24020280-013	5121 C	0	1	13	29	-16	13	0	0.94	0.43	0.42	0.09
H24020280-014	5121 C	1	3	17	29	-12	14	3	0.92	0.39	0.44	0.08
H24020280-015	5121 D	0	1	1	30	-28	5.8	-4	0.95	0.67	0.19	0.09
H24020280-016	5121 D	1	3	2	32	-30	5.9	-4	1.03	0.72	0.19	0.12
H24020280-017	5103 A	0	1	2	29	-27	5.6	-4	0.93	0.67	0.18	0.08
H24020280-018	5103 A	1	3	-1	40	-41	8.7	-10	1.28	0.92	0.28	0.09
H24020280-019	5103 B	0	1	2	36	-34	7.3	-5	1.15	0.73	0.24	0.19
H24020280-020	5103 B	1	3	0	45	-45	7.9	-8	1.43	0.79	0.25	0.39
H24020280-021	5103 C	0	1	0	35	-35	9.3	-9	1.13	0.70	0.30	0.12
H24020280-022	5103 C	1	3	1	38	-37	8.9	-8	1.22	0.77	0.28	0.17
H24020280-023	5103 D	0	1	8	26	-18	7.1	1	0.83	0.50	0.23	0.11
H24020280-024	5103 D	1	3	6	29	-23	7.5	-1	0.94	0.57	0.24	0.13
H24020280-025	5079 A	0	1	17	21	-4	4.4	12	0.66	0.47	0.14	0.05
H24020280-026	5079 A	1	3	21	21	1			0.67			
H24020280-027	5079 B	0	1	8	24	-17	6.4	1	0.78	0.50	0.21	0.07
H24020280-028	5079 B	1	3	9	36	-27	9.0	0	1.15	0.75	0.29	0.11
H24020280-029	5079 C	0	1	10	34	-24	8.8	1	1.08	0.71	0.28	0.09
H24020280-030	5079 C	1	3	2	60	-59	14	-12	1.93	1.31	0.44	0.17
H24020280-031	5079 D	0	1	14	27	-13	7.3	6	0.85	0.54	0.23	0.08
H24020280-032	5079 D	1	3	12	30	-18	6.6	5	0.97	0.68	0.21	0.08
H24020280-033	4937 B	0	1	16	4.5	12			0.14			
H24020280-034	4937 B	1	3	13	7.4	6			0.24			
H24020280-035	4937 C	0	1	18	8.9	9			0.28			
H24020280-036	4937 C	1	3	9	6.9	3			0.22			
H24020280-037	5011	0	1	10	24	-13	9.1	1	0.75	0.36	0.29	0.10
H24020280-038	5011	1	3	10	21	-11	8.4	2	0.68	0.29	0.27	0.11
H24020280-039	Pit 1	0	10	14	21	-7	7.9	6	0.69	0.35	0.25	0.08

2024-6

2024-1

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9 Spoils
Workorder: H24050777

Report Date: 07/02/24
Date Received: 05/28/24

	Analysis			Sand	Silt	Clay	Texture	pH-SatPst	Cond-SatPst	Percent Sat	Ca-SatPst-Sat Paste	Mg-SatPst-Sat Paste	Na-SatPst-Sat Paste	SAR
		Units		%	%	%		s_u_	mmhos/cm	%	meq/L	meq/L	meq/L	unitless
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24050777-001	4562 A	0	1	28	38	34	CL	7.0	7.0	54.7	24.3	31.2	55.5	10.5
H24050777-002	4562 A	1	3	28	38	34	CL	7.3	8.5	57.2	24.0	24.9	81.7	16.5
H24050777-003	4562 B	0	1	24	44	32	CL	7.2	5.2	50.1	27.2	23.4	32.1	6.4
H24050777-004	4562 B	1	3	26	38	36	CL	7.2	6.4	56.5	25.6	19.5	52.0	11.0
H24050777-005	4562 C	0	1	28	40	32	CL	3.0	10.8	47.1	20.1	70.8	77.4	11.5
H24050777-006	4562 C	1	3	34	38	28	CL	5.4	8.6	43.1	18.5	47.6	75.7	13.2
H24050777-007	4369 A	0	1	48	28	24	L	6.5	5.3	38.6	20.5	20.3	38.6	8.7
H24050777-008	4369 A	1	3	50	28	22	L	6.0	6.6	37.3	20.4	23.5	58.3	12.5
H24050777-009	4369 B	0	1	44	32	24	L	5.4	5.6	42.7	22.4	45.7	28.4	4.9
H24050777-010	4369 B	1	3	46	32	22	L	6.1	4.7	38.9	21.4	29.4	24.5	4.8
H24050777-011	4369 C	0	1	46	32	22	L	3.9	5.8	38.5	19.2	40.8	32.6	6.0
H24050777-012	4369 C	1	3	48	28	24	L	3.6	7.2	38.9	18.8	45.5	47.2	8.4
H24050777-013	4369 D	0	1	54	26	20	SCL	2.8	10.3	44.7	16.1	66.7	39.0	5.5
H24050777-014	4369 D	1	3	52	26	22	SCL	4.2	6.9	42.9	20.9	49.6	39.2	6.6
H24050777-015	4336 A	0	1	40	32	28	CL	5.8	7.5	41.7	22.9	73.6	39.7	5.6
H24050777-016	4336 A	1	3	46	28	26	L	5.5	9.3	43.0	27.7	72.5	66.3	9.5
H24050777-017	4336 B	0	1	40	36	24	L	4.6	7.2	38.0	19.9	92.9	22.2	3.0
H24050777-018	4336 B	1	3	44	32	24	L	5.5	9.5	36.5	26.9	112	46.4	5.5
H24050777-019	4336 C	0	1	34	36	30	CL	6.0	8.4	48.4	23.2	82.4	51.8	7.3
H24050777-020	4336 C	1	3	38	34	28	CL	5.4	6.6	42.3	21.1	67.8	29.0	4.3
H24050777-021	4336 D	0	1	48	28	24	L	4.6	7.0	38.1	17.9	80.4	28.7	4.1
H24050777-022	4336 D	1	3	68	16	16	SL	3.8	8.2	39.0	18.8	102	26.4	3.4
H24050777-023	4335 A	0	1	32	34	34	CL	2.7	13.8	45.8	18.6	177	23.4	2.3
H24050777-024	4335 A	1	3	40	32	28	CL	3.6	13.4	41.7	17.7	159	75.1	8.0
H24050777-025	4335 B	0	1	36	36	28	CL	5.8	6.2	37.1	17.8	39.4	39.2	7.3
H24050777-026	4335 B	1	3	38	36	26	L	6.0	7.4	32.9	19.4	45.5	49.6	8.7
H24050777-027	4335 C	0	1	38	34	28	CL	6.0	7.6	41.1	18.5	54.6	49.9	8.2
H24050777-028	4335 C	1	3	42	32	26	L	4.9	9.6	37.2	17.6	98.5	49.0	6.4
H24050777-029	4562 D	0	1	28	42	30	CL	5.3	9.5	48.7	21.0	86.7	58.3	8.6
H24050777-030	4562 D	1	3	36	36	28	CL	6.2	9.4	41.6	18.1	30.5	80.4	20.0
H24050777-031	4523 A	0	1	60	22	18	SL	4.3	7.8	38.4	16.8	67.2	37.9	6.8
H24050777-032	4523 A	1	3	60	24	16	SL	3.2	11.2	36.3	17.4	49.2	73.4	13.9
H24050777-033	4523 B	0	1	30	38	32	CL	6.2	6.6	52.7	20.7	42.6	38.7	7.6
H24050777-034	4523 B	1	3	30	38	32	CL	6.0	6.8	45.9	18.5	34.1	40.2	10.1
H24050777-035	4523 C	0	1	38	34	28	CL	5.3	6.4	42.8	20.9	55.1	28.2	5.4
H24050777-036	4523 C	1	3	50	26	24	SCL	6.6	6.4	37.5	24.5	29.5	38.7	8.9
H24050777-037	4523 D	0	1	36	36	28	CL	6.3	6.8	40.5	18.7	57.2	33.4	6.6
H24050777-038	4523 D	1	3	34	36	30	CL	5.9	6.3	44.5	18.1	51.8	30.7	6.2
H24050777-039	4898 A	0	1	36	36	28	CL	6.6	5.6	47.4	19.2	47.1	24.7	5.1

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9 Spoils
Workorder: H24050777

Report Date: 07/02/24
Date Received: 05/28/24

2024-2

Sample ID	Client Sample ID	Up	Low	Neut Potential	Acid Potential	Acid/Base Potential	AP, Pyritic S	ABP, Pyritic S	Sulfur, Total	Sulfur, Sulfate	Sulfur, Pyritic	Sulfur, Organic
	Units			t/kt	t/kt	t/kt	t/kt	t/kt	%	%	%	%
				Results	Results	Results	Results	Results	Results	Results	Results	Results
H24050777-001	4562 A	0	1	14	26	-13	10	3	0.84	0.40	0.33	0.11
H24050777-002	4562 A	1	3	19	21	-2	7.3	12	0.67	0.33	0.23	0.11
H24050777-003	4562 B	0	1	33	16	17			0.51			
H24050777-004	4562 B	1	3	26	19	7			0.62			
H24050777-005	4562 C	0	1	-3	47	-47	16	-16	1.51	0.77	0.50	0.24
H24050777-006	4562 C	1	3	7	40	-33	16	-8	1.29	0.58	0.50	0.22
H24050777-007	4369 A	0	1	8	13	-5	5.6	3	0.42	0.17	0.18	0.06
H24050777-008	4369 A	1	3	9	17	-8	5.3	4	0.54	0.29	0.17	0.08
H24050777-009	4369 B	0	1	6	27	-21	9.7	-4	0.85	0.44	0.31	0.11
H24050777-010	4369 B	1	3	8	22	-14	6.4	1	0.69	0.39	0.21	0.10
H24050777-011	4369 C	0	1	2	58	-56	32	-30	1.87	0.56	1.02	0.29
H24050777-012	4369 C	1	3	2	89	-87	60	-59	2.84	0.47	1.94	0.43
H24050777-013	4369 D	0	1	-5	100	-100	60	-60	3.31	0.70	1.92	0.69
H24050777-014	4369 D	1	3	2	84	-82	54	-51	2.69	0.44	1.72	0.53
H24050777-015	4336 A	0	1	11	31	-19	8.6	3	0.98	0.61	0.28	0.09
H24050777-016	4336 A	1	3	12	41	-29	12	0	1.31	0.81	0.37	0.12
H24050777-017	4336 B	0	1	2	37	-35	13	-10	1.19	0.62	0.41	0.15
H24050777-018	4336 B	1	3	6	38	-31	13	-7	1.21	0.64	0.41	0.15
H24050777-019	4336 C	0	1	9	29	-20	8.6	0	0.93	0.56	0.27	0.09
H24050777-020	4336 C	1	3	6	32	-26	9.7	-3	1.03	0.62	0.31	0.10
H24050777-021	4336 D	0	1	4	31	-27	10	-6	0.98	0.56	0.32	0.10
H24050777-022	4336 D	1	3	1	24	-23	5.7	-5	0.76	0.50	0.18	0.08
H24050777-023	4335 A	0	1	-5	67	-67	15	-15	2.13	1.36	0.49	0.28
H24050777-024	4335 A	1	3	1	48	-47	15	-15	1.53	0.87	0.48	0.18
H24050777-025	4335 B	0	1	12	20	-8	7.6	5	0.64	0.34	0.24	0.06
H24050777-026	4335 B	1	3	17	20	-3	7.6	9	0.64	0.34	0.24	0.06
H24050777-027	4335 C	0	1	10	28	-17	9.4	1	0.88	0.49	0.30	0.09
H24050777-028	4335 C	1	3	6	32	-26	10	-4	1.02	0.58	0.33	0.11
H24050777-029	4562 D	0	1	6	47	-41	15	-9	1.50	0.82	0.48	0.20
H24050777-030	4562 D	1	3	9	60	-52	37	-28	1.92	0.50	1.18	0.24
H24050777-031	4523 A	0	1	1	39	-38	10	-10	1.25	0.76	0.33	0.16
H24050777-032	4523 A	1	3	-2	46	-46	21	-21	1.48	0.64	0.68	0.17
H24050777-033	4523 B	0	1	14	25	-11	10	4	0.79	0.36	0.33	0.10
H24050777-034	4523 B	1	3	10	26	-16	8.3	1	0.82	0.46	0.27	0.10
H24050777-035	4523 C	0	1	7	35	-28	11	-4	1.12	0.64	0.35	0.13
H24050777-036	4523 C	1	3	24	29	-5	7.7	16	0.92	0.52	0.25	0.15
H24050777-037	4523 D	0	1	12	30	-18	8.3	4	0.96	0.59	0.27	0.11
H24050777-038	4523 D	1	3	11	27	-16	6.5	5	0.86	0.51	0.21	0.14
H24050777-039	4898 A	0	1	15	24	-10	8.0	7	0.78	0.43	0.26	0.09

LABORATORY ANALYTICAL REPORT
Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9 Spoils
Workorder: H24050777

Report Date: 07/02/24
Date Received: 05/28/24

2024-3

	Analysis			Sand	Silt	Clay	Texture	pH-SatPst	Cond-SatPst	Percent Sat	Ca-SatPst-Sat Paste	Mg-SatPst-Sat Paste	Na-SatPst-Sat Paste	SAR
		Units		%	%	%		s_u_	mmhos/cm	%	meq/L	meq/L	meq/L	unitless
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24050777-040	4898 A	1	3	42	32	26	L	6.8	8.2	38.5	17.0	48.9	57.3	11.8
H24050777-041	4898 B	0	1	20	42	38	SiCL	6.3	9.8	55.1	25.1	30.9	97.3	18.4
H24050777-042	4898 B	1	3	32	36	32	CL	5.4	7.1	45.1	20.9	15.9	66.1	15.0
H24050777-043	4898 C	0	1	32	36	32	CL	6.2	9.0	38.6	17.9	54.6	66.7	10.6
H24050777-044	4898 C	1	3	26	40	34	CL	5.6	10.0	39.2	16.0	59.1	83.6	12.9
H24050777-045	4898 D	0	1	34	36	30	CL	4.0	10.7	35.8	17.2	197	17.8	1.7
H24050777-046	4898 D	1	3	36	36	28	CL	3.9	7.9	40.2	17.0	115	18.4	2.2
H24050777-047	4408 A	0	1	30	38	32	CL	6.9	3.6	45.7	19.0	14.7	17.0	3.9
H24050777-048	4408 A	1	3	30	40	30	CL	7.1	7.3	45.3	19.8	26.0	66.5	13.5
H24050777-049	4408 B	0	1	36	34	30	CL	6.1	8.7	42.9	20.9	79.5	64.9	9.2
H24050777-050	4408 B	1	3	34	34	32	CL	3.0	14.9	43.6	14.8	152	60.4	5.9
H24050777-051	4408 C	0	1	70	20	10	SL	7.8	1.5	35.2	7.52	5.57	5.51	2.1
H24050777-052	4408 C	1	3	70	20	10	SL	7.5	2.9	36.8	21.1	13.4	8.02	1.9
H24050777-053	4408 D	0	1	36	36	28	CL	5.6	3.3	46.5	18.8	17.2	9.79	2.2
H24050777-054	4408 D	1	3	44	30	26	L	6.9	4.0	46.9	16.6	16.2	25.2	5.8
H24050777-055	4371 A	0	1	42	34	24	L	6.0	5.3	35.9	15.4	41.0	29.3	5.4
H24050777-056	4371 A	1	3	44	32	24	L	6.2	5.8	39.8	17.3	41.3	36.5	6.7
H24050777-057	4371 B	0	1	30	40	30	CL	6.9	6.6	46.4	18.7	46.5	39.8	6.6
H24050777-058	4371 B	1	3	32	38	30	CL	6.5	6.9	46.0	19.3	54.9	42.7	7.1
H24050777-059	4371 C	0	1	26	40	34	CL	5.9	8.8	42.8	17.6	57.5	73.0	11.7
H24050777-060	4371 C	1	3	32	36	32	CL	4.9	7.9	43.0	19.2	63.5	60.5	9.4
H24050777-061	4371 D	0	1	36	36	28	CL	6.0	8.2	39.4	18.8	41.7	61.1	11.1
H24050777-062	4371 D	1	3	32	36	32	CL	6.1	10.1	45.2	20.9	46.1	74.3	12.8
H24050777-063	4337 A	0	1	42	32	26	L	6.4	4.3	40.0	20.3	25.1	15.1	3.2
H24050777-064	4337 A	1	3	42	32	26	L	4.5	6.5	40.1	17.8	45.7	28.1	5.0
H24050777-065	4337 B	0	1	44	30	26	L	6.4	7.1	39.4	18.4	41.0	35.8	6.6
H24050777-066	4337 B	1	3	40	34	26	L	6.9	6.2	41.0	20.6	31.9	34.3	6.7
H24050777-067	4337 C	0	1	30	40	30	CL	6.0	9.1	49.8	20.2	42.3	65.9	11.8
H24050777-068	4337 C	1	3	40	30	30	CL	4.8	10.4	57.8	19.1	22.0	106	23.4
H24050777-069	4337 D	0	1	38	34	28	CL	6.1	6.6	42.7	19.6	48.1	37.1	6.4
H24050777-070	4337 D	1	3	42	34	24	L	5.7	6.0	41.9	19.1	46.2	26.7	4.7

2024-4

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9 Spoils
Workorder: H24050777

Report Date: 07/02/24
Date Received: 05/28/24

		Analysis		Neut Potential	Acid Potential	Acid/Base Potential	AP, Pyritic S	ABP, Pyritic S	Sulfur, Total	Sulfur, Sulfate	Sulfur, Pyritic	Sulfur, Organic
		Units		t/kt	t/kt	t/kt	t/kt	t/kt	%	%	%	%
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24050777-040	4898 A	1	3	18	21	-3	7.1	11	0.68	0.38	0.23	0.07
H24050777-041	4898 B	0	1	11	13	-2	3.9	7	0.43	0.22	0.13	0.08
H24050777-042	4898 B	1	3	7	24	-17	6.3	1	0.78	0.41	0.20	0.17
H24050777-043	4898 C	0	1	6	22	-16	6.4	0	0.69	0.44	0.21	0.04
H24050777-044	4898 C	1	3	5	27	-22	7.9	-3	0.87	0.59	0.25	0.03
H24050777-045	4898 D	0	1	3	42	-39	8.6	-6	1.35	0.96	0.27	0.11
H24050777-046	4898 D	1	3	3	40	-37	8.5	-6	1.28	0.90	0.27	0.11
H24050777-047	4408 A	0	1	14	12	2			0.38			
H24050777-048	4408 A	1	3	13	16	-3	5.3	8	0.52	0.30	0.17	0.06
H24050777-049	4408 B	0	1	13	32	-19	9.1	3	1.01	0.63	0.29	0.09
H24050777-050	4408 B	1	3	-3	64	-64	12	-12	2.03	1.45	0.39	0.20
H24050777-051	4408 C	0	1	11	2.0	8			0.06			
H24050777-052	4408 C	1	3	9	3.4	5			0.11			
H24050777-053	4408 D	0	1	8	17	-9	5.6	2	0.54	0.30	0.18	0.07
H24050777-054	4408 D	1	3	11	16	-5	5.5	6	0.51	0.28	0.18	0.05
H24050777-055	4371 A	0	1	17	12	5			0.38			
H24050777-056	4371 A	1	3	22	22	0			0.71			
H24050777-057	4371 B	0	1	19	25	-5	7.9	11	0.78	0.47	0.25	0.06
H24050777-058	4371 B	1	3	16	26	-10	7.5	9	0.85	0.53	0.24	0.07
H24050777-059	4371 C	0	1	11	32	-21	7.1	4	1.03	0.71	0.23	0.09
H24050777-060	4371 C	1	3	7	36	-29	6.4	1	1.15	0.83	0.20	0.11
H24050777-061	4371 D	0	1	12	27	-14	7.0	5	0.85	0.52	0.23	0.10
H24050777-062	4371 D	1	3	12	30	-18	5.9	6	0.95	0.66	0.19	0.11
H24050777-063	4337 A	0	1	10	25	-16	10	0	0.81	0.38	0.32	0.12
H24050777-064	4337 A	1	3	4	49	-45	20	-16	1.56	0.72	0.64	0.20
H24050777-065	4337 B	0	1	17	23	-5	6.8	11	0.72	0.42	0.22	0.09
H24050777-066	4337 B	1	3	16	16	-1	5.3	10	0.52	0.28	0.17	0.07
H24050777-067	4337 C	0	1	9	22	-13	6.4	2	0.71	0.41	0.21	0.10
H24050777-068	4337 C	1	3	7	25	-18	6.6	0	0.80	0.35	0.21	0.24
H24050777-069	4337 D	0	1	10	28	-18	9.6	1	0.89	0.48	0.31	0.11
H24050777-070	4337 D	1	3	8	34	-25	12	-4	1.08	0.54	0.39	0.15

LABORATORY ANALYTICAL REPORT
Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: Spoils N9
Workorder: H24090035

Report Date: 10/03/24
Date Received: 09/03/24

2024-5

Sample ID	Client Sample ID	Analysis Up	Low	Sand	Silt	Clay	Texture	pH-SatPst	Cond-SatPst	Percent Sat	Ca-SatPst-Sat Paste	Mg-SatPst-Sat Paste	Na-SatPst-Sat Paste	SAR
Units				%	%	%		s_u_	mmhos/cm	%	meq/L	meq/L	meq/L	unitless
		Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24090035-001	5142 A	0	1	50	27	23	SCL	6.8	3.2	40.3	22.1	18.0	6.87	1.5
H24090035-002	5142 A	1	3	48	29	23	L	7.3	4.3	43.3	18.8	25.8	18.4	3.9
H24090035-003	5142 B	0	1	44	31	25	L	6.2	4.1	43.7	20.4	23.3	15.9	3.4
H24090035-004	5142 B	1	3	50	27	23	SCL	6.2	4.8	42.4	20.4	29.4	22.3	4.5
H24090035-005	5142 C	0	1	32	41	27	CL	3.6	12.7	42.0	19.0	243	12.3	1.1
H24090035-006	5142 C	1	3	38	35	27	CL	3.8	10.9	41.7	18.3	175	24.3	2.5
H24090035-007	5142 D	0	1	42	33	25	L	5.9	5.4	45.4	20.9	41.7	21.5	3.8
H24090035-008	5142 D	1	3	38	33	29	CL	6.4	9.1	47.0	18.3	67.4	58.7	9.0
H24090035-009	5126 A	0	1	36	37	27	CL	5.4	4.4	42.0	20.8	50.2	3.48	0.6
H24090035-010	5126 A	1	3	36	35	29	CL	5.4	4.3	44.1	22.4	39.9	6.97	1.2
H24090035-011	5126 B	0	1	42	31	27	CL	6.9	5.0	42.7	22.9	48.1	14.0	2.4
H24090035-012	5126 B	1	3	40	33	27	CL	6.5	5.4	45.7	22.0	48.5	16.8	2.8
H24090035-013	5126 C	0	1	48	31	21	L	6.0	3.2	36.7	23.1	22.1	2.13	0.4
H24090035-014	5126 C	1	3	52	29	19	L	5.0	8.7	36.8	19.6	112	27.0	3.3
H24090035-015	5126 D	0	1	48	29	23	L	4.4	3.9	38.4	20.7	37.8	3.30	0.6
H24090035-016	5126 D	1	3	52	27	21	SCL	4.6	4.3	41.6	19.6	46.2	4.72	0.8
H24090035-017	5155 A	0	1	54	27	19	SL	5.6	2.8	36.7	23.0	14.4	2.00	0.5
H24090035-018	5155 A	1	3	56	25	19	SL	4.7	4.9	37.1	20.5	48.0	10.1	1.7
H24090035-019	5155 B	0	1	52	29	19	L	5.2	2.9	36.4	22.4	18.6	1.83	0.4
H24090035-020	5155 B	1	3	56	25	19	SL	5.0	6.6	35.5	20.5	79.4	15.9	2.2
H24090035-021	5015 A	0	1	40	35	25	L	5.6	8.8	43.5	19.6	85.6	42.0	5.8
H24090035-022	5015 A	1	3	42	33	25	L	6.0	9.5	42.5	19.0	69.9	65.9	9.9
H24090035-023	5015 D	0	1	52	27	21	SCL	6.1	11.6	36.2	19.3	130	60.9	7.0
H24090035-024	5015 D	1	3	34	39	27	CL	6.3	13.4	47.9	18.1	110	103	12.9
H24090035-025	4690	0	1	50	29	21	L	3.6	15.5	36.9	18.5	217	64.7	6.0
H24090035-026	4690	1	3	50	29	21	L	3.7	13.8	37.1	19.2	199	55.3	5.3
H24090035-027	4894	0	1	42	33	25	L	7.0	7.2	42.6	19.4	37.3	51.9	9.7
H24090035-028	4894	1	3	44	33	23	L	7.3	5.9	40.2	17.7	24.8	40.4	8.8
H24090035-029	5141 B	0	1	42	33	25	L	5.3	3.3	41.8	19.1	24.4	4.11	0.9
H24090035-030	5141 B	1	3	48	29	23	L	5.9	9.7	41.6	18.6	124	35.5	4.2
H24090035-031	5141 C	0	1	38	33	29	CL	3.5	2.5	44.3	22.4	9.19	0.69	0.2
H24090035-032	5141 C	1	3	42	31	27	CL	4.0	4.2	45.2	20.5	42.4	5.09	0.9
H24090035-033	4653	1	3	54	25	21	SCL	3.4	11.0	38.6	21.0	121	32.2	3.8
H24090035-034	4380	0	1	38	33	29	CL	4.6	4.3	44.5	19.2	42.3	8.37	1.5
H24090035-035	4380	1	3	40	35	25	L	5.0	5.4	47.7	18.8	58.6	11.4	1.8
H24090035-036	4334	0	1	66	23	11	SL	7.7	3.0	35.8	25.0	9.00	5.57	1.4
H24090035-037	4334	1	3	60	21	19	SL	7.0	5.5	38.3	21.3	23.9	33.1	7.0
H24090035-038	4908	0	1	30	41	29	CL	6.1	5.4	43.5	19.2	43.4	22.2	4.0
H24090035-039	4908	1	3	32	37	31	CL	5.9	9.5	49.7	17.4	79.8	62.2	8.9

ENERGY LABORATORIES
Trust our People. Trust our Data.
Billings, MT 406.252.6325 • Casper, WY 307.235.0515 • Gillette, WY 307.686.7175 • Helena, MT 406.442.0711

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

2024-6

Client: Peabody Western Coal Co. Kayenta Mine
Project: Spoils N9
Workorder: H24090035

Report Date: 10/03/24
Date Received: 09/03/24

		Analysis		Neut Potential	Acid Potential	Acid/Base Potential	AP, Pyritic S	ABP, Pyritic S	Sulfur, Total	Sulfur, Sulfate	Sulfur, Pyritic	Sulfur, Organic
		Units		t/kt	t/kt	t/kt	t/kt	t/kt	%	%	%	%
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24090035-001	5142 A	0	1	9	13.9	-5	6.81	2	0.44	0.16	0.22	0.06
H24090035-002	5142 A	1	3	9	13.4	-4	3.66	5	0.43	0.28	0.12	0.03
H24090035-003	5142 B	0	1	11	18.0	-7	7.10	4	0.58	0.27	0.23	0.08
H24090035-004	5142 B	1	3	8	24.4	-17	6.23	2	0.78	0.50	0.20	0.09
H24090035-005	5142 C	0	1	0	43.0	-43	11.2	-11	1.38	0.91	0.36	0.10
H24090035-006	5142 C	1	3	1	45.6	-44	10.1	-9	1.46	1.00	0.32	0.14
H24090035-007	5142 D	0	1	8	27.9	-20	7.76	0	0.89	0.53	0.25	0.11
H24090035-008	5142 D	1	3	9	34.2	-25	9.82	-1	1.10	0.67	0.31	0.11
H24090035-009	5126 A	0	1	9	29.4	-21	6.96	2	0.94	0.61	0.22	0.11
H24090035-010	5126 A	1	3	11	24.8	-14	7.96	3	0.79	0.45	0.25	0.09
H24090035-011	5126 B	0	1	21	27.8	-7	6.55	14	0.89	0.60	0.21	0.08
H24090035-012	5126 B	1	3	19	34.2	-15	6.48	13	1.10	0.80	0.21	0.09
H24090035-013	5126 C	0	1	7	19.6	-12	6.93	0	0.63	0.34	0.22	0.06
H24090035-014	5126 C	1	3	5	36.9	-32	9.05	-4	1.18	0.79	0.29	0.10
H24090035-015	5126 D	0	1	3	35.6	-32	9.51	-6	1.14	0.69	0.30	0.15
H24090035-016	5126 D	1	3	4	42.1	-39	11.1	-8	1.35	0.84	0.36	0.15
H24090035-017	5155 A	0	1	6	17.0	-11	5.77	0	0.54	0.30	0.18	0.06
H24090035-018	5155 A	1	3	3	32.3	-30	5.61	-3	1.03	0.78	0.18	0.07
H24090035-019	5155 B	0	1	5	21.8	-17	4.82	0	0.70	0.49	0.15	0.05
H24090035-020	5155 B	1	3	4	24.2	-20	3.85	0	0.77	0.61	0.12	0.05
H24090035-021	5015 A	0	1	6	32.8	-27	9.55	-4	1.05	0.67	0.31	0.08
H24090035-022	5015 A	1	3	8	27.3	-20	7.34	0	0.87	0.58	0.23	0.06
H24090035-023	5015 D	0	1	9	21.2	-12	8.15	1	0.68	0.35	0.26	0.06
H24090035-024	5015 D	1	3	9	34.0	-25	12.6	-3	1.09	0.60	0.40	0.08
H24090035-025	4690	0	1	-2	46.5	-47	11.0	-13	1.49	1.02	0.35	0.12
H24090035-026	4690	1	3	-1	39.6	-40	8.68	-9	1.27	0.90	0.28	0.09
H24090035-027	4894	0	1	14	26.4	-12	8.95	5	0.85	0.48	0.29	0.08
H24090035-028	4894	1	3	21	22.3	-1	8.62	13	0.71	0.37	0.28	0.06
H24090035-029	5141 B	0	1	6	23.8	-17	7.52	-1	0.76	0.43	0.24	0.08
H24090035-030	5141 B	1	3	8	29.9	-22	5.88	2	0.96	0.70	0.19	0.07
H24090035-031	5141 C	0	1	1	20.6	-20	6.83	-6	0.66	0.31	0.22	0.13
H24090035-032	5141 C	1	3	3	27.7	-25	4.97	-2	0.89	0.62	0.16	0.10
H24090035-033	4653	1	3	-2	44.4	-44	22.6	-24	1.42	0.54	0.72	0.16
H24090035-034	4380	0	1	8	26.7	-19	7.55	0	0.85	0.53	0.24	0.08
H24090035-035	4380	1	3	7	32.4	-25	7.76	0	1.04	0.68	0.25	0.11
H24090035-036	4334	0	1	17	4.24	13			0.14			
H24090035-037	4334	1	3	14	11.1	3			0.36			
H24090035-038	4908	0	1	12	37.2	-25	11.6	1	1.19	0.72	0.37	0.10
H24090035-039	4908	1	3	12	44.0	-32	11.2	0	1.41	0.93	0.36	0.12

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: Spoils N9
Workorder: H24090035

Report Date: 10/03/24
Date Received: 09/03/24

		Analysis		Sand	Silt	Clay	Texture	pH-SatPst	Cond-SatPst	Percent Sat	Ca-SatPst-Sat Paste	Mg-SatPst-Sat Paste	Na-SatPst-Sat Paste	SAR
		Units		%	%	%		s_u_	mmhos/cm	%	meq/L	meq/L	meq/L	unitless
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H24090035-040	4347	0	1	30	39	31	CL	6.3	11.2	47.3	16.4	61.5	97.9	15.7
H24090035-041	4347	1	3	36	34	30	CL	6.1	13.7	45.6	19.6	79.2	123	17.5
H24090035-042	4653	0	1	42	30	28	CL	5.3	9.5	42.2	19.1	69.5	60.7	9.1
H24090035-043	4654	0	1	46	28	26	L	6.5	7.1	43.7	17.8	59.1	35.7	5.8
H24090035-044	4654	1	3	42	30	28	CL	6.2	6.4	45.0	18.2	39.1	36.1	6.8
H24090035-045	4579	0	1	68	18	14	SL	7.8	2.6	33.9	16.1	7.96	8.97	2.6
H24090035-046	4579	1	3	64	18	18	SL	7.5	4.2	36.2	18.6	15.2	22.0	5.3
H24090035-049	5143	0	1	58	20	22	SCL	4.8	3.0	36.6	21.5	18.1	2.11	0.5
H24090035-050	5143	1	3	44	28	28	CL	5.1	3.7	42.2	19.8	30.5	4.88	1.0

2024-7

Billings, MT 406.252.6325 • Casper, WY 307.235.0515 • Gillette, WY 307.686.7175 • Helena, MT 406.442.0711

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: Spoils N9
Workorder: H24090035

Report Date: 10/03/24
Date Received: 09/03/24

	Analysis			Neut Potential	Acid Potential	Acid/Base Potential	AP, Pyritic S	ABP, Pyritic S	Sulfur, Total	Sulfur, Sulfate	Sulfur, Pyritic	Sulfur, Organic
		Units		t/kt	t/kt	t/kt	t/kt	t/kt	%	%	%	%
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24090035-040	4347	0	1	16	30.7	-15	6.36	9	0.98	0.70	0.20	0.08
H24090035-041	4347	1	3	14	41.2	-27	8.14	6	1.32	0.95	0.26	0.11
H24090035-042	4653	0	1	6	29.6	-24	10.9	-5	0.95	0.49	0.35	0.11
H24090035-043	4654	0	1	9	24.4	-15	7.19	2	0.78	0.49	0.23	0.06
H24090035-044	4654	1	3	8	33.0	-25	14.1	-6	1.06	0.48	0.45	0.12
H24090035-045	4579	0	1	17	2.45	14			0.08			
H24090035-046	4579	1	3	17	6.21	11			0.20			
H24090035-049	5143	0	1	4	19.3	-15	5.35	-1	0.62	0.39	0.17	0.06
H24090035-050	5143	1	3	10	25.4	-15	8.09	2	0.81	0.45	0.26	0.11

2024-8

LABORATORY ANALYTICAL REPORT
Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: Spoils N9
Workorder: H24090769

Report Date: 10/23/24
Date Received: 09/20/24

		Analysis		Sand	Silt	Clay	Texture	pH-SatPst	Cond-SatPst	Percent Sat	Ca-SatPst-Sat Paste	Mg-SatPst-Sat Paste	Na-SatPst-Sat Paste	SAR
		Units		%	%	%		s_u_	mmhos/cm	%	meq/L	meq/L	meq/L	unitless
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
H24090769-001	5277A	0	1	44	33	23	L	5.6	3.5	43.2	24.9	25.5	4.76	1.0
H24090769-002	5277 A	1	3	34	43	23	L	7.0	2.6	45.7	26.0	14.0	2.38	0.5
H24090769-003	5277 B	0	1	40	35	25	L	4.8	5.7	40.5	24.4	61.3	11.5	1.8
H24090769-004	5277 B	1	3	46	33	21	L	5.0	4.0	51.5	28.6	23.5	8.93	1.8
H24090769-005	5277 C	0	1	40	37	23	L	3.9	4.9	42.0	21.3	60.7	4.03	0.6
H24090769-006	5277 C	1	3	42	35	23	L	4.2	6.4	45.1	20.3	95.6	5.70	0.8
H24090769-007	5277D	0	1	34	37	29	CL	5.6	3.1	43.9	23.3	16.3	6.99	1.6
H24090769-008	5277D	1	3	32	37	31	CL	6.0	3.4	48.8	25.1	22.8	5.40	1.1
H24090769-009	GS #1	0	0	46	31	23	L	5.5	3.8	34.4	21.0	40.4	3.27	0.6
H24090769-010	GS #2	0	0	54	25	21	SCL	6.1	3.9	34.8	17.4	54.7	6.58	1.1

2024-9

2024-10

LABORATORY ANALYTICAL REPORT
Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: Spoils N9
Workorder: H24090769

Report Date: 10/23/24
Date Received: 09/20/24

	Analysis			Neut Potential	Acid Potential	Acid/Base Potential	AP, Pyritic S	ABP, Pyritic S	Sulfur, Total	Sulfur, Sulfate	Sulfur, Pyritic	Sulfur, Organic
	Units			t/kt	t/kt	t/kt	t/kt	t/kt	%	%	%	%
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24090769-001	5277A	0	1	11	18.7	-8	5.60	5	0.60	0.32	0.18	0.10
H24090769-002	5277 A	1	3	21	6.36	14			0.20			
H24090769-003	5277 B	0	1	7	23.8	-17	5.56	1	0.76	0.50	0.18	0.08
H24090769-004	5277 B	1	3	12	16.5	-4	3.88	8	0.53	0.29	0.12	0.11
H24090769-005	5277 C	0	1	1	37.0	-36	11.7	-10	1.18	0.64	0.37	0.17
H24090769-006	5277 C	1	3	1	34.4	-33	8.51	-7	1.10	0.69	0.27	0.14
H24090769-007	5277D	0	1	10	10.2	0	4.08	6	0.33	0.14	0.13	0.06
H24090769-008	5277D	1	3	11	13.6	-3	3.29	7	0.44	0.28	0.11	0.05
H24090769-009	GS #1	0	0	7	23.0	-16	9.10	-2	0.74	0.33	0.29	0.12
H24090769-010	GS #2	0	0	10	23.2	-13	10.5	0	0.74	0.27	0.33	0.13

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9 Spoils
Workorder: H24100872

Revised Date: 11/14/24
Report Date: 11/13/24
Date Received: 10/28/24

2024-11

	Analysis		Sand	Silt	Clay	Texture	pH-SatPst	Cond-SatPst	Percent Sat	Ca-SatPst-Sat Paste	Mg-SatPst-Sat Paste	Na-SatPst-Sat Paste	SAR
	Units		%	%	%		s_u_	mmhos/cm	%	meq/L	meq/L	meq/L	unitless
Sample ID	**Client Sample ID**	**Up**	**Low**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**

Sample ID	Client Sample ID	Up	Low	Sand % Results	Silt % Results	Clay % Results	Texture Results	pH-SatPst s_u_ Results	Cond-SatPst mmhos/cm Results	Percent Sat % Results	Ca-SatPst-Sat Paste meq/L Results	Mg-SatPst-Sat Paste meq/L Results	Na-SatPst-Sat Paste meq/L Results	SAR unitless Results
H24100872-001	4381 D	0	1	28	42	30	CL	6.4	7.6	46.1	21.4	63.5	34.5	5.3
H24100872-002	4381 C	1	3	36	36	28	CL	6.5	4.9	43.9	19.1	35.3	18.4	3.5
H24100872-003	4381 D	1	3	28	40	32	CL	6.4	8.4	44.7	21.2	85.9	32.7	4.5
H24100872-004	4381 C	0	1	40	34	26	L	6.2	6.3	39.3	19.4	39.7	31.1	5.7
H24100872-005	4579	1	3	52	26	22	SCL	7.0	5.2	39.4	21.5	35.4	19.0	3.6
H24100872-006	4579	0	1	54	24	22	SCL	6.2	7.4	40.7	18.7	59.5	37.3	6.0
H24100872-007	4653 A	1	3	26	40	34	CL	3.8	5.6	47.2	19.0	53.4	5.86	1.0
H24100872-008	4653 B	0	1	40	32	28	CL	5.4	8.8	46.0	19.2	48.8	58.8	10.1
H24100872-009	4690 B	0	1	38	34	28	CL	3.8	10.6	44.1	19.1	66.1	77.8	11.9
H24100872-010	4690 B	1	3	38	34	28	CL	4.1	7.5	44.5	18.1	40.0	52.0	9.7
H24100872-011	4690 D	1	3	38	42	20	L	4.4	18.2	40.0	20.2	179	135	13.6
H24100872-012	4690 C	0	1	40	34	26	L	5.1	10.0	41.0	17.5	98.3	54.3	7.1
H24100872-013	4690 D	0	1	50	30	20	L	5.1	12.8	37.4	20.1	109	91.5	11.4
H24100872-014	4690 A	0	1	42	32	26	L	5.8	7.2	36.5	21.0	22.8	54.1	11.6
H24100872-015	4690 A	1	3	44	30	26	L	6.3	8.3	38.6	24.4	19.0	69.6	14.9
H24100872-016	4690 C	1	3	34	36	30	CL	4.5	9.6	46.0	17.0	128	31.3	3.7
H24100872-017	5130 D	1	3	68	18	14	SL	7.5	2.7	31.0	24.2	3.51	6.63	1.8
H24100872-018	5130 D	0	1	56	26	18	SL	6.2	5.1	34.4	19.6	41.4	15.6	2.8
H24100872-019	5130 C	0	1	44	30	26	L	7.2	4.2	42.6	20.9	43.8	3.49	0.6
H24100872-020	5130 B	1	3	42	30	28	CL	5.6	6.6	42.8	20.2	70.1	19.5	2.9
H24100872-021	5130 C	1	3	62	20	18	SL	7.4	4.9	35.7	19.8	50.5	6.08	1.0
H24100872-022	5130 A	1	3	40	34	26	L	6.4	7.8	45.2	20.8	77.9	32.1	4.6
H24100872-023	5130 B	0	1	44	30	26	L	5.8	6.7	40.8	21.1	72.5	18.4	2.7
H24100872-024	5130 A	0	1	42	32	26	L	6.1	9.5	43.0	20.9	102	39.5	5.0
H24100872-025	4653 C	1	3	36	34	30	CL	5.6	10.0	43.8	21.8	50.1	78.8	13.1
H24100872-026	4653 A	0	1	34	38	28	CL	4.4	5.9	43.8	20.6	55.6	16.8	2.7
H24100872-027	4653 D	1	3	38	34	28	CL	6.8	8.8	41.8	20.3	30.7	71.4	14.1
H24100872-028	4653 D	0	1	38	32	30	CL	7.0	7.9	41.9	20.8	29.5	61.8	12.3
H24100872-029	4653 C	0	1	36	34	30	CL	6.1	8.5	45.7	21.3	37.9	63.7	11.7
H24100872-030	4653 B	1	3	42	32	26	L	5.6	9.1	45.2	20.0	50.5	66.4	11.2
H24100872-031	4596 D	0	1	38	32	30	CL	6.4	4.7	43.8	25.3	43.9	9.31	1.6
H24100872-032	4596 A	0	1	38	34	28	CL	6.6	5.4	44.2	22.3	51.5	15.5	2.6
H24100872-033	4596 A	1	3	40	32	28	CL	5.8	5.9	42.7	21.4	63.8	15.1	2.3
H24100872-034	4596 D	1	3	36	34	30	CL	7.0	4.2	48.5	26.7	27.0	10.8	2.1
H24100872-035	4596 C	1	3	48	28	24	L	5.0	7.2	41.9	19.9	64.2	34.7	5.4
H24100872-036	4596 C	0	1	38	34	28	CL	4.4	4.7	41.8	20.4	27.0	18.0	3.7
H24100872-037	4348	0	1	34	40	26	L	6.7	10.8	46.6	19.6	87.3	67.3	9.2
H24100872-038	4348	1	3	32	40	28	CL	6.6	9.2	48.7	19.9	72.4	56.1	8.3

LABORATORY ANALYTICAL REPORT
Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: N9 Spoils
Workorder: H24100872

Revised Date: 11/14/24
Report Date: 11/13/24
Date Received: 10/28/24

2024-12

		Analysis		Neut Potential	Acid Potential	Acid/Base Potential	AP, Pyritic S	ABP, Pyritic S	Sulfur, Total	Sulfur, Sulfate	Sulfur, Pyritic	Sulfur, Organic
		Units		t/kt	t/kt	t/kt	t/kt	t/kt	%	%	%	%
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24100872-001	4381 D	0	1	38.6	54.8	-16.2	13.5	25.1	1.75	1.17	0.43	0.16
H24100872-002	4381 C	1	3	16.4	28.6	-12.2	8.80	7.56	0.91	0.55	0.28	0.09
H24100872-003	4381 D	1	3	41.0	49.2	-8.32	7.64	35.3	1.58	1.24	0.24	0.09
H24100872-004	4381 C	0	1	15.8	26.9	-11.0	6.78	9.05	0.86	0.57	0.22	0.07
H24100872-005	4579	1	3	19.5	11.2	8.26			0.36			
H24100872-006	4579	0	1	8.0	20.6	-12.6	4.02	4.00	0.66	0.48	0.13	0.05
H24100872-007	4653 A	1	3	1.0	47.8	-46.8	16.4	-15.3	1.53	0.93	0.52	0.08
H24100872-008	4653 B	0	1	5.6	24.7	-19.1	8.68	-3.11	0.79	0.45	0.28	0.06
H24100872-009	4690 B	0	1	2.8	38.8	-36.1	16.9	-14.1	1.24	0.60	0.54	0.10
H24100872-010	4690 B	1	3	4.4	36.9	-32.5	17.0	-12.6	1.18	0.51	0.54	0.13
H24100872-011	4690 D	1	3	16.5	45.4	-28.9	3.09	13.4	1.45	1.32	0.10	0.04
H24100872-012	4690 C	0	1	5.5	27.2	-21.7	6.24	-0.75	0.87	0.62	0.20	0.05
H24100872-013	4690 D	0	1	24.8	45.7	-20.8	2.36	22.5	1.46	1.34	0.08	0.04
H24100872-014	4690 A	0	1	7.8	28.5	-20.6	9.85	-2.02	0.91	0.53	0.32	0.06
H24100872-015	4690 A	1	3	7.4	32.5	-25.2	7.39	-0.03	1.04	0.73	0.24	0.07
H24100872-016	4690 C	1	3	4.1	39.8	-35.7	6.84	-2.77	1.27	1.01	0.22	0.05
H24100872-017	5130 D	1	3	8.0	1.54	6.47			0.05			
H24100872-018	5130 D	0	1	5.3	13.7	-8.43	2.74	2.54	0.44	0.32	0.09	0.03
H24100872-019	5130 C	0	1	20.5	9.62	10.9			0.31			
H24100872-020	5130 B	1	3	8.0	25.6	-17.7	5.17	2.82	0.82	0.59	0.17	0.06
H24100872-021	5130 C	1	3	17.1	9.71	7.36			0.31			
H24100872-022	5130 A	1	3	9.7	26.1	-16.4	5.56	4.10	0.84	0.58	0.18	0.07
H24100872-023	5130 B	0	1	9.3	24.1	-14.8	5.54	3.77	0.77	0.53	0.18	0.07
H24100872-024	5130 A	0	1	8.6	26.5	-17.9	6.02	2.57	0.85	0.59	0.19	0.07
H24100872-025	4653 C	1	3	6.3	22.7	-16.3	7.37	-1.03	0.73	0.43	0.24	0.06
H24100872-026	4653 A	0	1	3.7	30.6	-26.9	12.2	-8.50	0.98	0.52	0.39	0.07
H24100872-027	4653 D	1	3	10.9	17.8	-6.96	7.64	3.22	0.57	0.27	0.24	0.06
H24100872-028	4653 D	0	1	10.4	16.2	-5.83	6.37	4.01	0.52	0.27	0.20	0.05
H24100872-029	4653 C	0	1	7.8	20.3	-12.5	9.24	-1.45	0.65	0.29	0.30	0.06
H24100872-030	4653 B	1	3	5.6	22.3	-16.7	6.84	-1.23	0.71	0.44	0.22	0.06
H24100872-031	4596 D	0	1	18.9	38.2	-19.3	9.79	9.10	1.22	0.81	0.31	0.10
H24100872-032	4596 A	0	1	13.8	37.2	-23.4	14.5	-0.73	1.19	0.61	0.46	0.11
H24100872-033	4596 A	1	3	9.0	40.2	-31.1	13.2	-4.16	1.28	0.73	0.42	0.13
H24100872-034	4596 D	1	3	40.1	20.1	20.0			0.64			
H24100872-035	4596 C	1	3	6.8	43.0	-36.2	13.3	-6.56	1.38	0.73	0.43	0.22
H24100872-036	4596 C	0	1	3.6	32.2	-28.5	10.6	-6.97	1.03	0.53	0.34	0.16
H24100872-037	4348	0	1	13.9	36.6	-22.7	6.80	7.06	1.17	0.86	0.22	0.09
H24100872-038	4348	1	3	14.2	35.6	-21.4	7.83	6.38	1.14	0.80	0.25	0.09

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: Spoils N9
Workorder: H24120005

Report Date: 12/10/24
Date Received: 12/02/24

2024-13

	Analysis			Sand	Silt	Clay	Texture	pH-SatPst	Cond-SatPst	Percent Sat	Ca-SatPst-Sat Paste	Mg-SatPst-Sat Paste	Na-SatPst-Sat Paste	SAR
		Units		%	%	%		s_u_	mmhos/cm	%	meq/L	meq/L	meq/L	unitless
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24120005-001	4502	0	1	60	22	18	SL	7.4	4.5	36.5	26.2	17.0	23.5	5.0
H24120005-002	4502	1	3	64	22	14	SL	7.6	3.8	37.1	25.8	14.3	14.2	3.2
H24120005-003	4540	0	1	66	22	12	SL	7.7	3.9	35.5	26.5	16.5	15.2	3.3
H24120005-004	4540	1	3	60	24	16	SL	7.6	4.5	36.4	24.9	20.8	22.3	4.7
H24120005-005	5144	0	1	62	22	16	SL	5.0	14.0	34.1	22.8	254	50.8	4.3
H24120005-006	5144	1	3	60	22	18	SL	3.8	20.6	34.5	24.4	351	84.6	6.2

LABORATORY ANALYTICAL REPORT

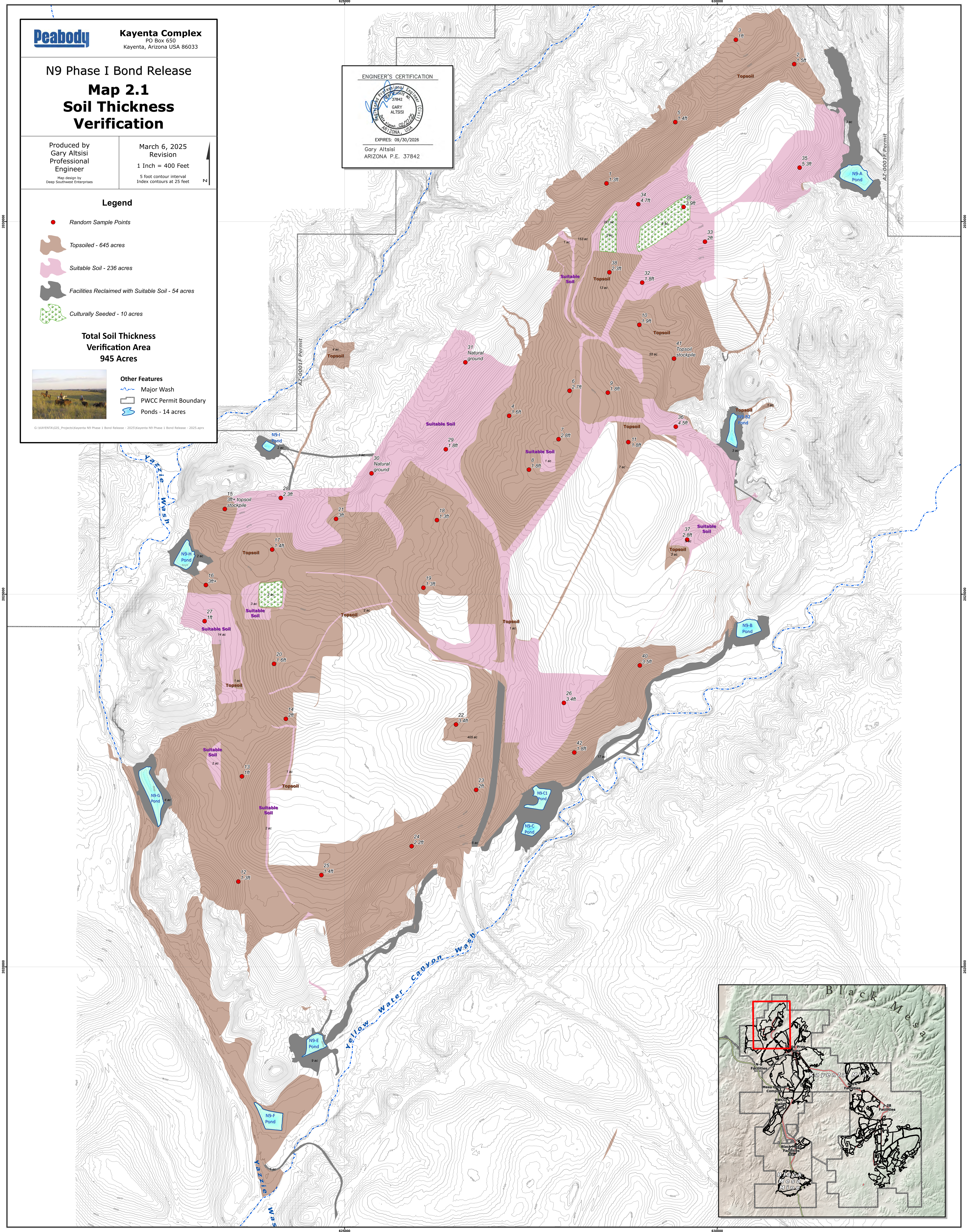
Prepared by Helena, MT Branch

Client: Peabody Western Coal Co. Kayenta Mine
Project: Spoils N9
Workorder: H24120005

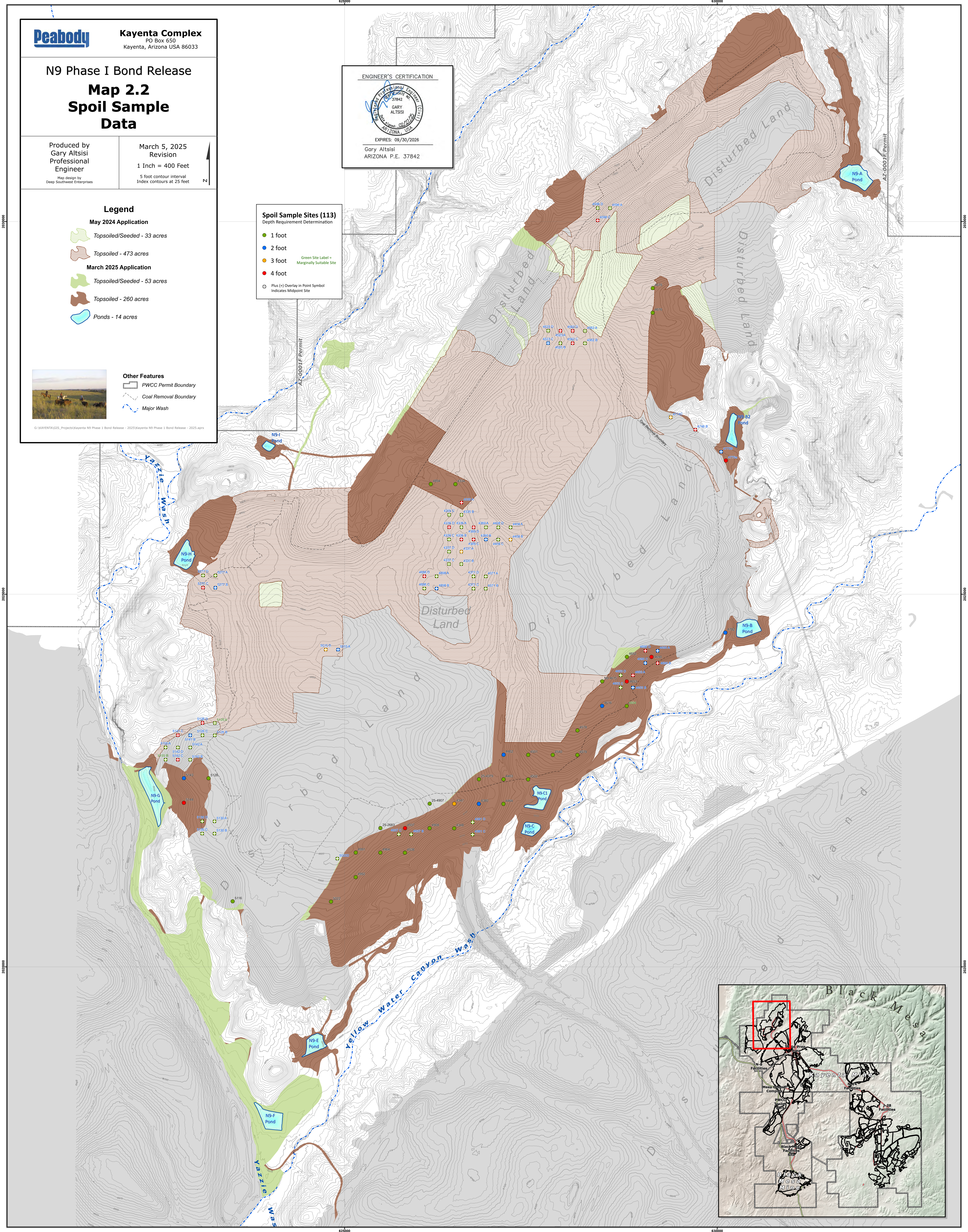
Report Date: 12/10/24
Date Received: 12/02/24

	Analysis			Neut Potential	Acid Potential	Acid/Base Potential	AP, Pyritic S	ABP, Pyritic S	Sulfur, Total	Sulfur, Sulfate	Sulfur, Pyritic	Sulfur, Organic
		Units		t/kt	t/kt	t/kt	t/kt	t/kt	%	%	%	%
Sample ID	Client Sample ID	Up	Low	Results	Results	Results	Results	Results	Results	Results	Results	Results
H24120005-001	4502	0	1	15.2	6.65	8.52	2.73	12.4	0.21	0.09	0.09	0.04
H24120005-002	4502	1	3	15.2	3.78	11.4	1.58	13.6	0.12	0.05	0.05	0.02
H24120005-003	4540	0	1	19.3	3.32	16.0	1.12	18.2	0.11	0.06	0.04	0.01
H24120005-004	4540	1	3	21.1	7.95	13.2	3.08	18.0	0.25	0.12	0.10	0.04
H24120005-005	5144	0	1	4.90	25.3	-20.4	4.75	0.15	0.81	0.59	0.15	0.07
H24120005-006	5144	1	3	0.31	35.9	-35.6	6.35	-6.04	1.15	0.82	0.20	0.13

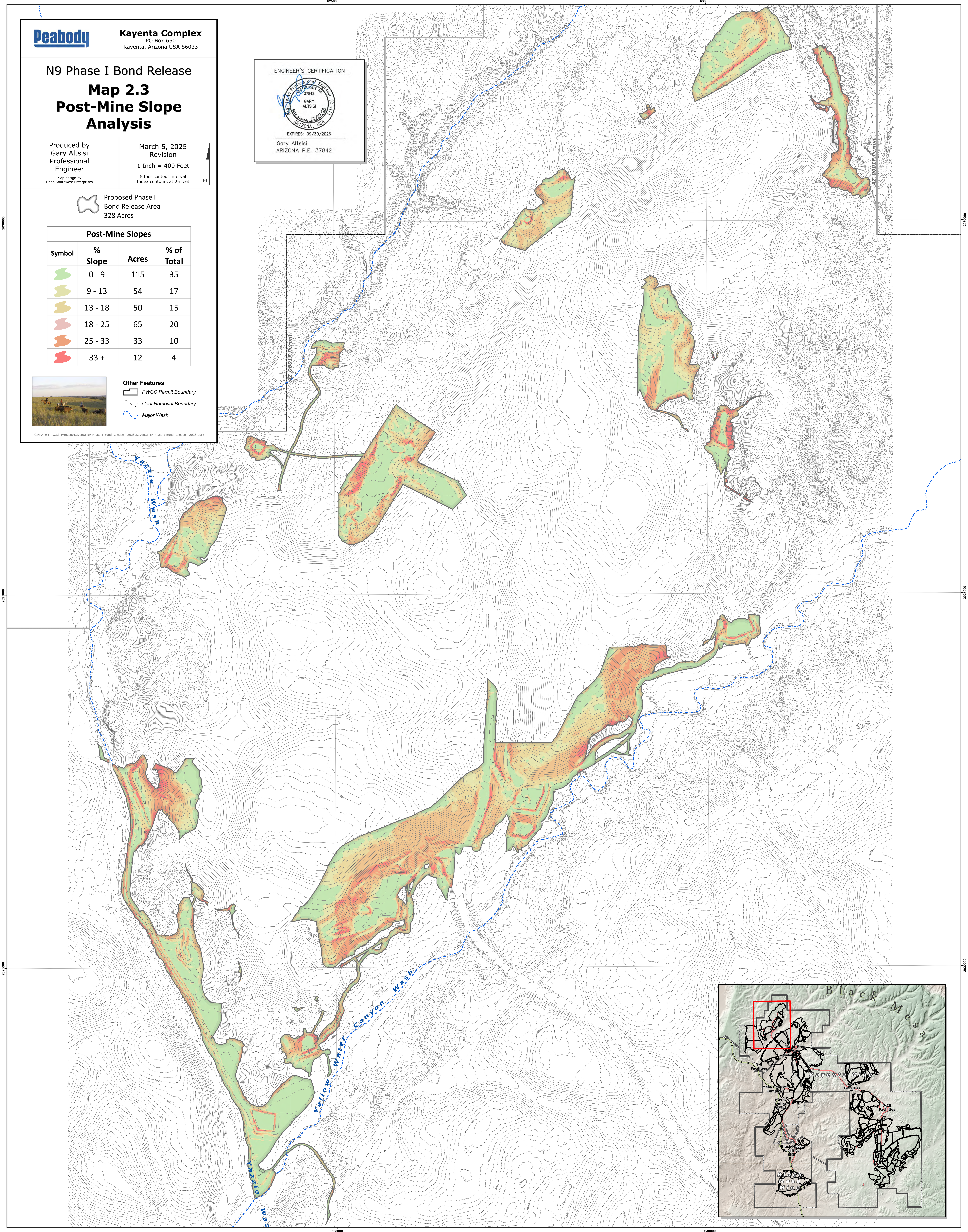
2024-14

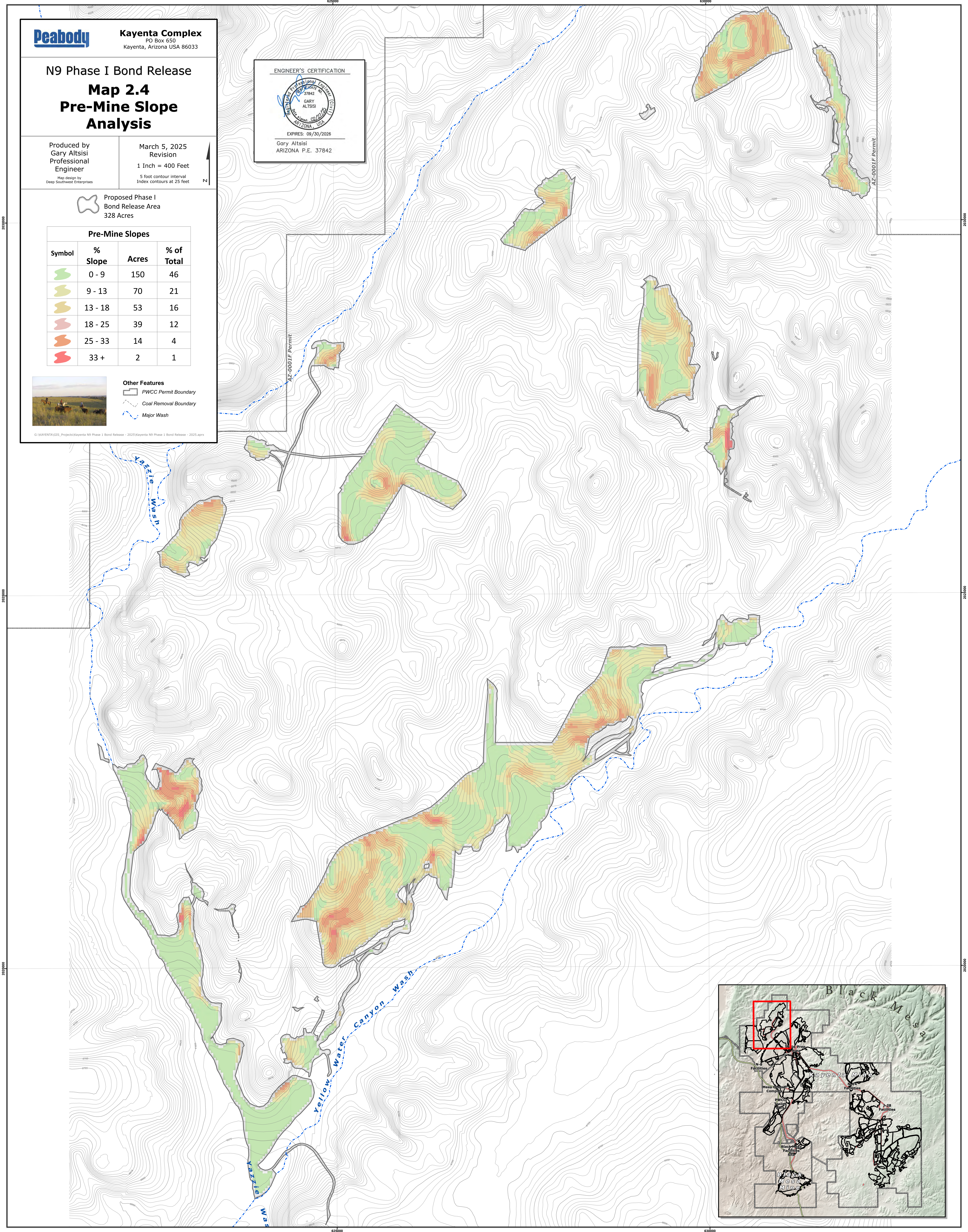


Peabody
Kayenta Complex
PO Box 650
Kayenta, Arizona USA 86033
N9 Phase I Bond Release
Map 2.1
Soil Thickness Verification
Produced by
Gary Altsisi
Professional
Engineer
Map design by
Deep Southwest Enterprises
March 6, 2025
Revision
1 Inch = 400 Feet
5 foot contour interval
Index contours at 25 feet
N
Legend
Random Sample Points
Topsoiled - 645 acres
Suitable Soil - 236 acres
Facilities Reclaimed with Suitable Soil - 54 acres
Culturally Seeded - 10 acres
Total Soil Thickness
Verification Area
945 Acres
Other Features
Major Wash
PWCC Permit Boundary
Ponds - 14 acres
ENGINEER'S CERTIFICATION
Registered Professional Engineer (Civil)
Certificate No.
37842
GARY
ALTSISI
Date Signed: 03/27/25
ARIZONA, USA
EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842
625000
630000
AZ-0001F Permit
Yazzie Wash
Yellow Water Canyon Wash
Black Mesa
N9-A Pond
N9-B Pond
N9-C1 Pond
N9-C Pond
N9-E Pond
N9-F Pond
N9-G Pond
N9-H Pond
N9-I Pond
Topsoil
Suitable Soil
Natural ground
Topsoil stockpile
3ft+ topsoil stockpile



Peabody
Kayenta Complex
PO Box 650
Kayenta, Arizona USA 86033
N9 Phase I Bond Release
Map 2.2
Spoil Sample Data
Produced by Gary Altsisi Professional Engineer
Map design by Deep Southwest Enterprises
March 5, 2025 Revision
1 Inch = 400 Feet
5 foot contour interval
Index contours at 25 feet
N
Legend
May 2024 Application
Topsoiled/Seeded - 33 acres
Topsoiled - 473 acres
March 2025 Application
Topsoiled/Seeded - 53 acres
Topsoiled - 260 acres
Ponds - 14 acres
Other Features
PWCC Permit Boundary
Coal Removal Boundary
Major Wash
Spoil Sample Sites (113)
Depth Requirement Determination
1 foot
2 foot
3 foot
4 foot
Green Site Label = Marginally Suitable Site
Plus (+) Overlay in Point Symbol Indicates Midpoint Site
ENGINEER'S CERTIFICATION
Registered Professional Engineer (Civil)
37842
GARY ALTSISI
ARIZONA, USA
EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842
AZ-0001F Permit
Disturbed Land
N9-A Pond
N9-B2 Pond
N9-I Pond
N9-H Pond
N9-B Pond
N9-C1 Pond
N9-C Pond
N9-G Pond
N9-E Pond
N9-F Pond
Coal Removal Boundary
Yazzie Wash
Yellow Water Canyon Wash
Black Mesa
Kayenta Mine
625000
630000


Peabody
Kayenta Complex
PO Box 650
Kayenta, Arizona USA 86033
N9 Phase I Bond Release
Map 2.3
Post-Mine Slope Analysis
Produced by Gary Altsisi Professional Engineer
Map design by Deep Southwest Enterprises
March 5, 2025 Revision
1 Inch = 400 Feet
5 foot contour interval
Index contours at 25 feet
N
Proposed Phase I Bond Release Area 328 Acres
Post-Mine Slopes
Symbol | % Slope | Acres | % of Total
0 - 9 | 115 | 35
9 - 13 | 54 | 17
13 - 18 | 50 | 15
18 - 25 | 65 | 20
25 - 33 | 33 | 10
33 + | 12 | 4
Other Features
PWCC Permit Boundary
Coal Removal Boundary
Major Wash
ENGINEER'S CERTIFICATION
Registered Professional Engineer
37842
GARY ALTSISI
ARIZONA, USA
EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842
625000
630000
AZ-0001F Permit
Yazzie Wash
Yellow Water Canyon Wash
Black Mesa



Peabody

Kayenta Complex
PO Box 650
Kayenta, Arizona USA 86033

N9 Phase I Bond Release

Map 2.4 Pre-Mine Slope Analysis

Produced by
Gary Altsisi
Professional Engineer

Map design by
Deep Southwest Enterprises

March 5, 2025
Revision

1 Inch = 400 Feet

5 foot contour interval
Index contours at 25 feet

N

Proposed Phase I
Bond Release Area
328 Acres

Pre-Mine Slopes

Symbol	% Slope	Acres	% of Total
	0 - 9	150	46
	9 - 13	70	21
	13 - 18	53	16
	18 - 25	39	12
	25 - 33	14	4
	33 +	2	1

Other Features
- *PWCC Permit Boundary*
- *Coal Removal Boundary*
- *Major Wash*

G:\KAYENTA\GIS_Projects\Kayenta N9 Phase 1 Bond Release - 2025\Kayenta N9 Phase 1 Bond Release - 2025.aprx

ENGINEER'S CERTIFICATION

Registered Professional Engineer (Civil)
CERTIFICATE NO. 37842
GARY ALTSISI
Date signed: 02/27/25
ARIZONA, USA

EXPIRES: 09/30/2026

Gary Altsisi
ARIZONA P.E. 37842

Peabody

Kayenta Complex
PO Box 650
Kayenta, Arizona USA 86033

N9 Phase I Bond Release

Map 2.5
Post-Mine Topographic Surface Comparison

Produced by
Gary Altsisi
Professional
Engineer

Map design by
Deep Southwest Enterprises

March 5, 2025
Revision

1 Inch = 400 Feet

5 foot contour interval
Index contours at 25 feet

N

Proposed Phase I
Bond Release Area
328 Acres

Final Surface Divergence From PMT

Symbol	Divergence (feet)	Acres	% of Total
	< -40 (min -65)	0	0
	-40 to -21	8	3
	Within 20	309	94
	21 to 40	9	3
	> 40 (max 45)	1	<1

Other Features
PWCC Permit Boundary
Major Wash

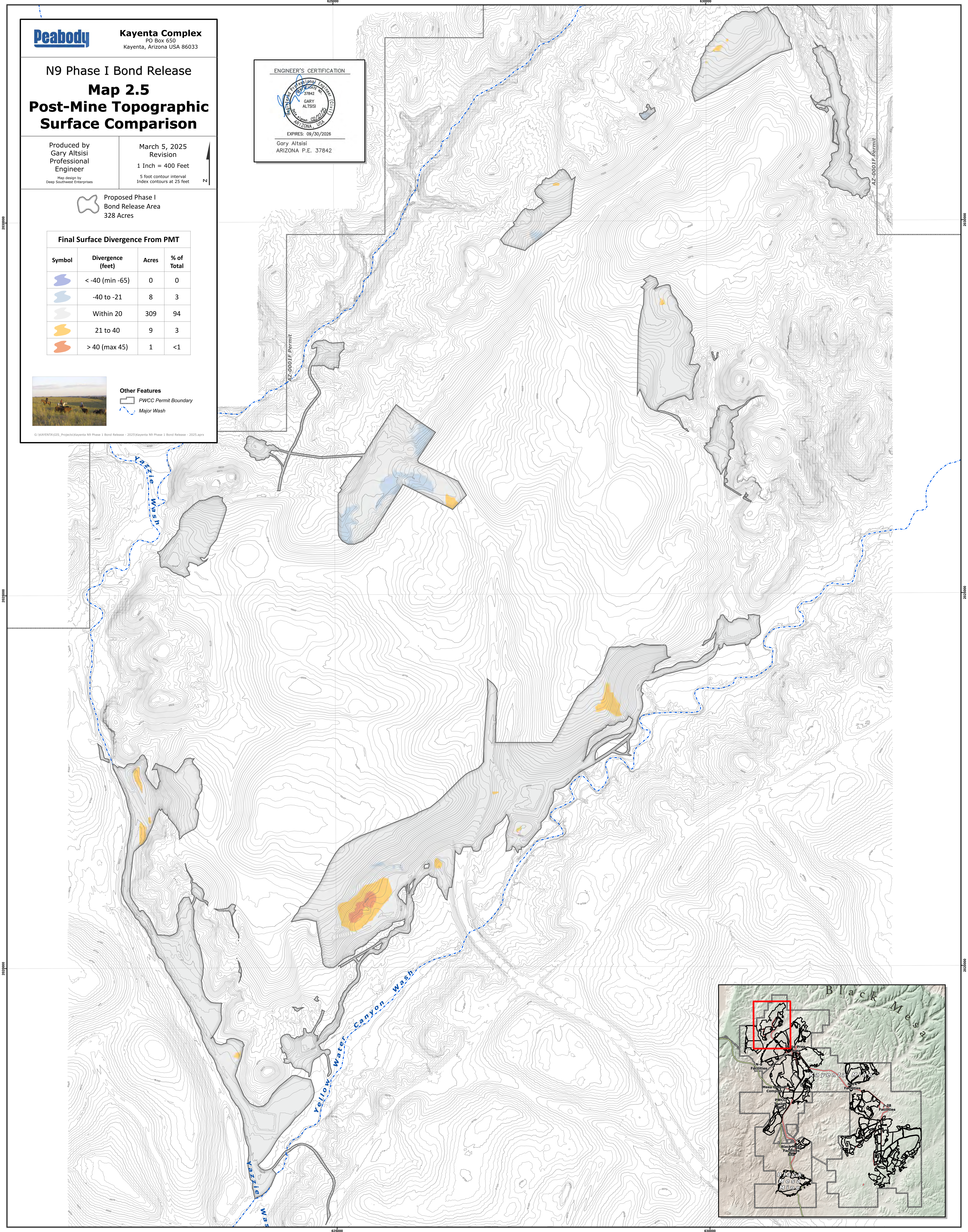
G:\KAYENTA\GIS_Projects\Kayenta N9 Phase 1 Bond Release - 2025\Kayenta N9 Phase 1 Bond Release - 2025.aprx

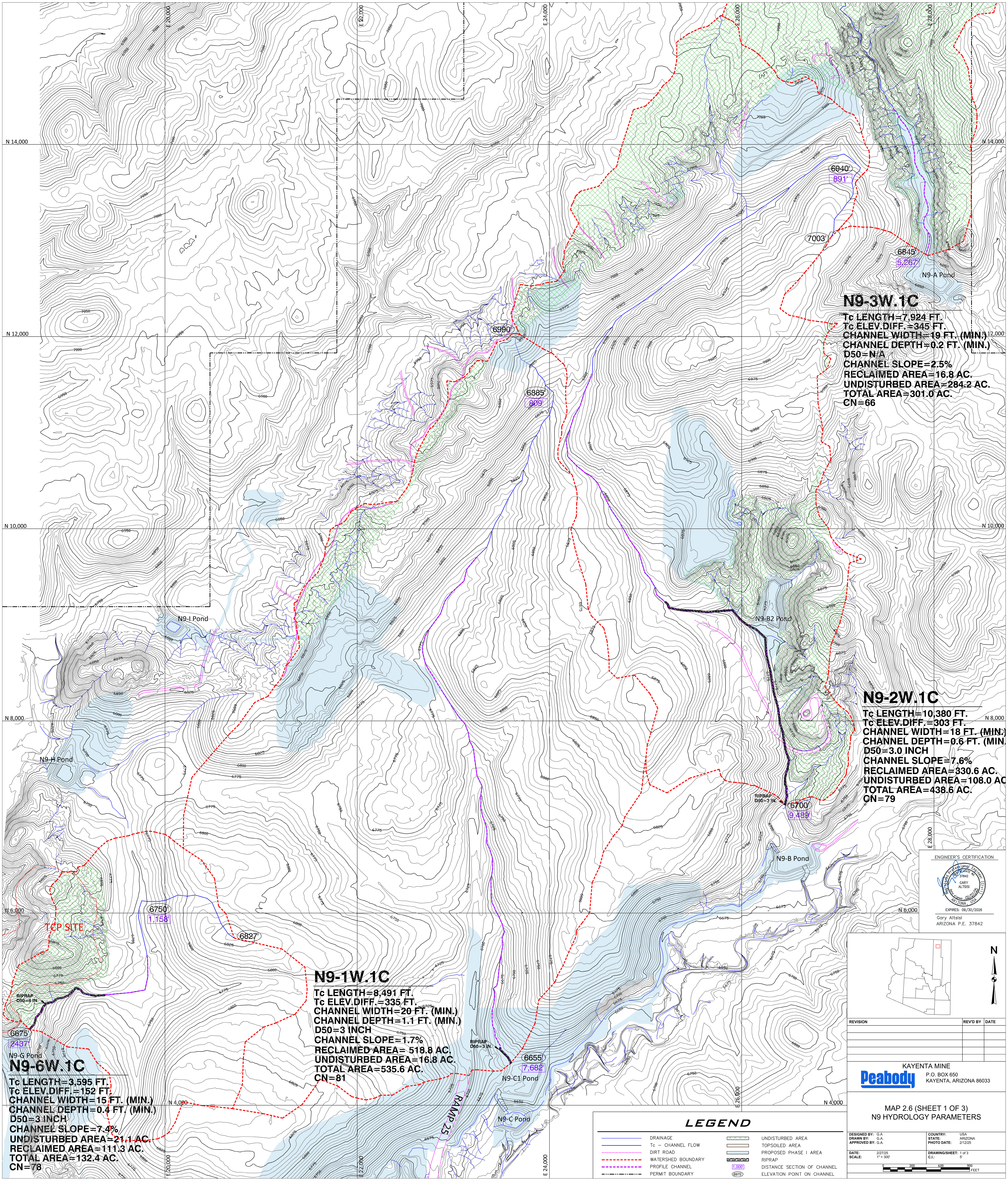
ENGINEER'S CERTIFICATION

Registered Professional Engineer (Civil)
CERTIFICATE NO.
37842
GARY
ALTSISI
Date signed: 02/27/25
ARIZONA, USA

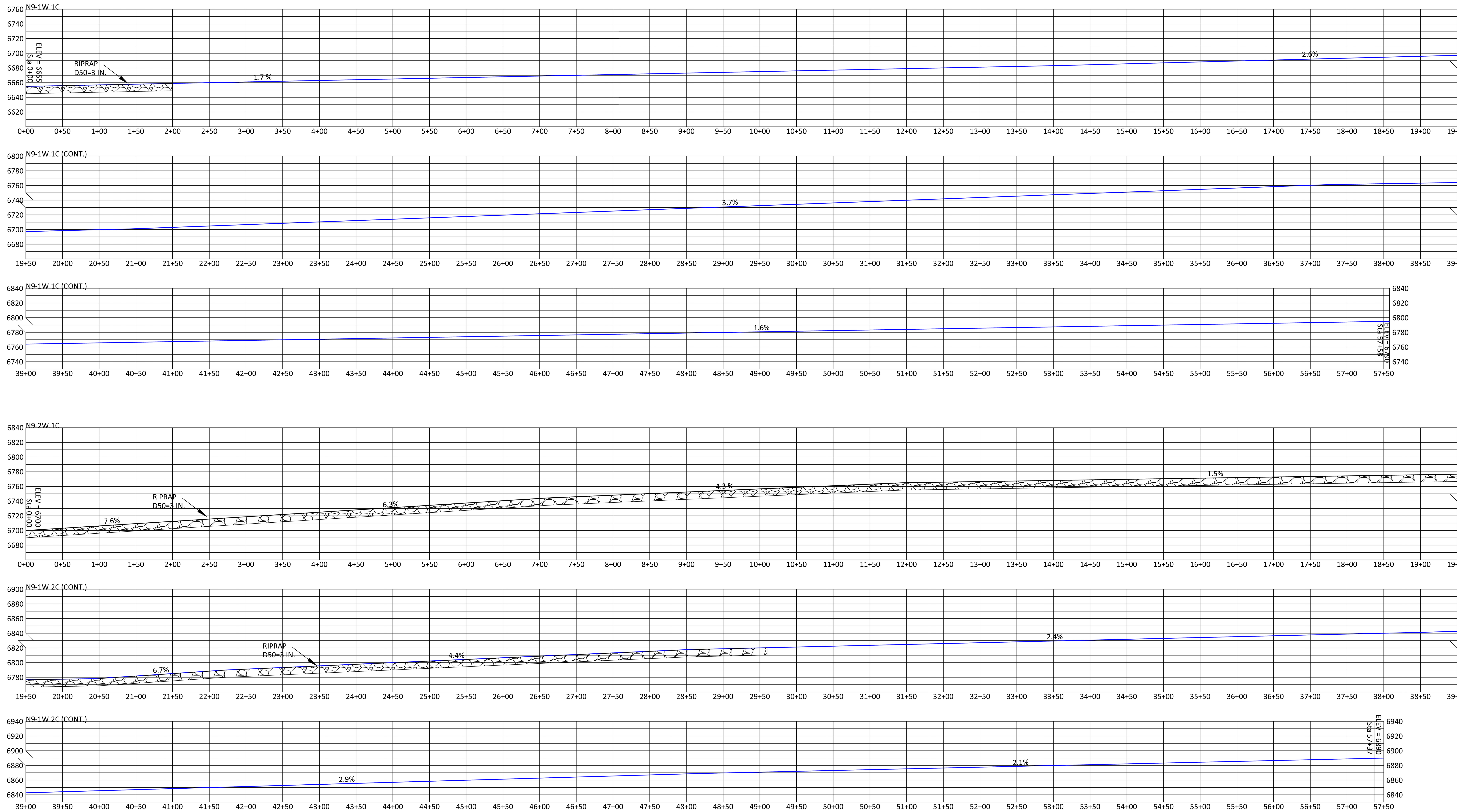
EXPIRES: 09/30/2026

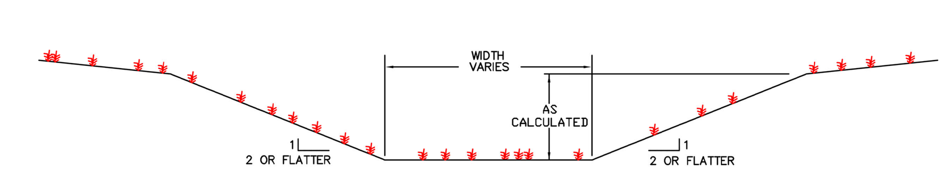
Gary Altsisi
ARIZONA P.E. 37842



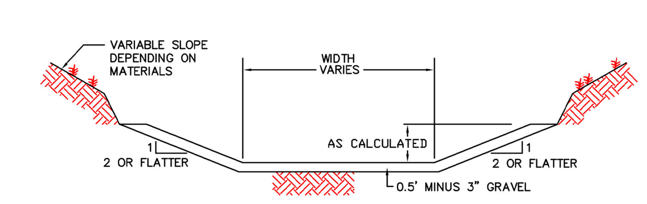


N9-3W.1C
Tc LENGTH=7,924 FT.
Tc ELEV.DIFF.=345 FT.
CHANNEL WIDTH=19 FT. (MIN.)
CHANNEL DEPTH=0.2 FT. (MIN.)
D50=N/A
CHANNEL SLOPE=2.5%
RECLAIMED AREA=16.8 AC.
UNDISTURBED AREA=284.2 AC.
TOTAL AREA=301.0 AC.
CN=66
N9-2W.1C
Tc LENGTH=10,380 FT.
Tc ELEV.DIFF.=303 FT.
CHANNEL WIDTH=18 FT. (MIN.)
CHANNEL DEPTH=0.6 FT. (MIN.)
D50=3.0 INCH
CHANNEL SLOPE=7.6%
RECLAIMED AREA=330.6 AC.
UNDISTURBED AREA=108.0 AC.
TOTAL AREA=438.6 AC.
CN=79
N9-1W.1C
Tc LENGTH=8,491 FT.
Tc ELEV.DIFF.=335 FT.
CHANNEL WIDTH=20 FT. (MIN.)
CHANNEL DEPTH=1.1 FT. (MIN.)
D50=3 INCH
CHANNEL SLOPE=1.7%
RECLAIMED AREA= 518.8 AC.
UNDISTURBED AREA=16.8 AC.
TOTAL AREA=535.6 AC.
CN=81
N9-6W.1C
Tc LENGTH=3,595 FT.
Tc ELEV.DIFF.=152 FT.
CHANNEL WIDTH=15 FT. (MIN.)
CHANNEL DEPTH=0.4 FT. (MIN.)
D50=3 INCH
CHANNEL SLOPE=7.4%
UNDISTURBED AREA=21.1 AC.
RECLAIMED AREA=111.3 AC.
TOTAL AREA=132.4 AC.
CN=78
N9-A Pond
N9-B Pond
N9-B2 Pond
N9-C Pond
N9-C1 Pond
N9-G Pond
N9-H Pond
N9-I Pond
TCP SITE
RAMP 25
RIPRAP D50=3 IN.
RIPRAP D50=6 IN.
6940'
891'
7003'
6845'
5,267'
6990'
6885'
809'
6700'
9,489'
6750'
1,158'
6827'
6675'
2437'
6655'
7,682'
N 14,000
N 12,000
N 10,000
N 8,000
N 6,000
N 4,000
E 20,000
E 22,000
E 24,000
E 26,000
E 28,000
ENGINEER'S CERTIFICATION
GARY ALTSISI
37842
ARIZONA, USA
EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842
N
REVISION
REV'D BY
DATE
KAYENTA MINE
Peabody
P.O. BOX 650
KAYENTA, ARIZONA 86033
MAP 2.6 (SHEET 1 OF 3)
N9 HYDROLOGY PARAMETERS
DESIGNED BY: G.A.
DRAWN BY: G.A.
APPROVED BY: G.A.
COUNTRY: USA
STATE: ARIZONA
PHOTO DATE: 2/12/25
DATE: 2/27/25
SCALE: 1" = 300'
DRAWING/SHEET: 1 of 3
C.I.: 5'
FEET
LEGEND
DRAINAGE
Tc – CHANNEL FLOW
DIRT ROAD
WATERSHED BOUNDARY
PROFILE CHANNEL
PERMIT BOUNDARY
UNDISTURBED AREA
TOPSOILED AREA
PROPOSED PHASE I AREA
RIPRAP
1,000' DISTANCE SECTION OF CHANNEL
6975' ELEVATION POINT ON CHANNEL

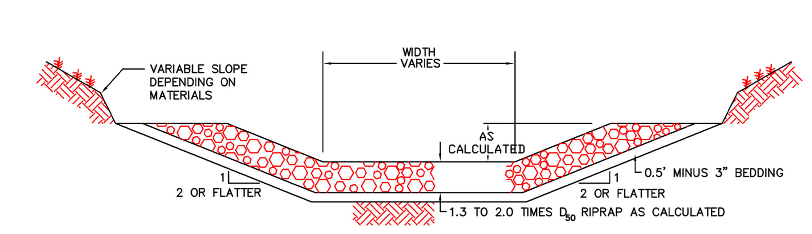




TYPICAL SECTION OF RECLAIMED TRAPEZOIDAL CHANNEL
DESIGN A
SPOIL/SOIL MIXED WITH VEGETATION
(NOT DRAWN TO SCALE)

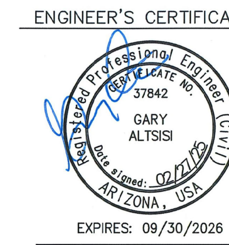


TYPICAL SECTION OF RECLAIMED TRAPEZOIDAL CHANNEL
DESIGN B
GRAVEL MIXED WITH VEGETATION
(NOT DRAWN TO SCALE)

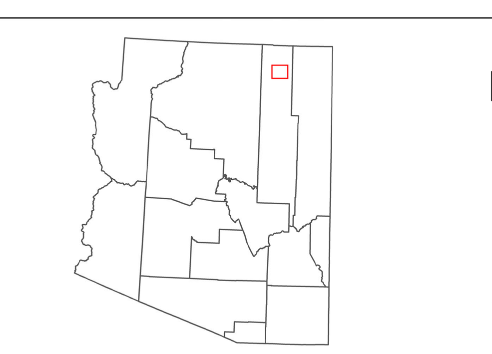


TYPICAL SECTION OF RECLAIMED TRAPEZOIDAL CHANNEL
DESIGN C
(NOT DRAWN TO SCALE)

ENGINEER'S CERTIFICATION



EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842



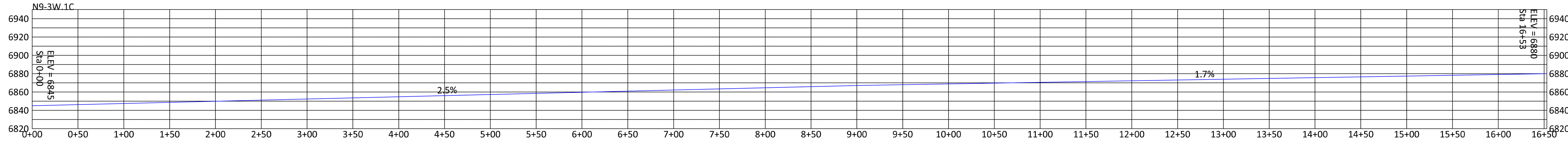
REVISION	REV'D BY	DATE

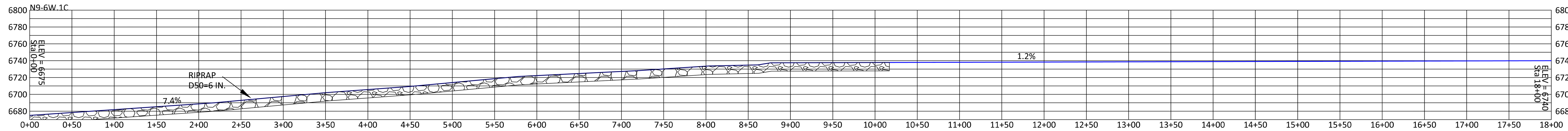
KAYENTA MINE
Peabody
P.O. BOX 650
KAYENTA, ARIZONA 86033

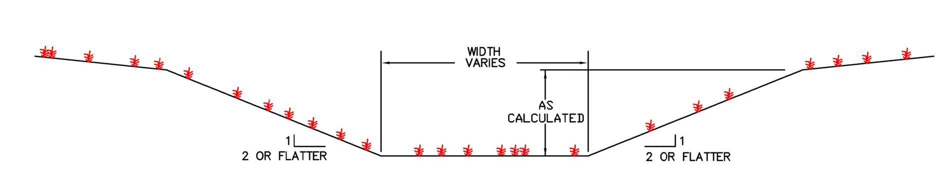
MAP 2.6 (SHEET 2 OF 3)
N9 HYDROLOGY PARAMETERS

DESIGNED BY:	G.A	COUNTRY:	USA
DRAWN BY:	G.A.	STATE:	ARIZONA
APPROVED BY:	G.A.	PHOTO DATE:	2/12/25
DATE:	2/27/25	DRAWING/SHEET:	2 of 3
SCALE:	1" = 50'	C.I.:	5'

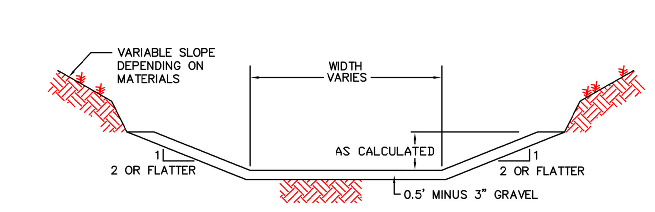
0 50 100 150 FEET



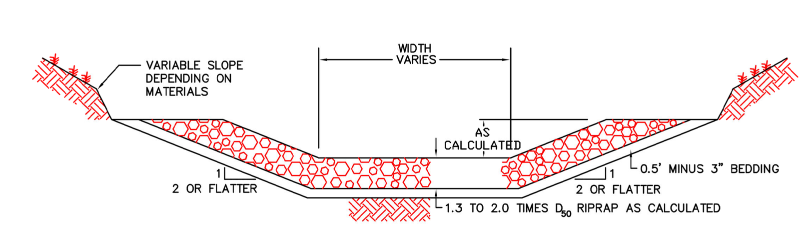




TYPICAL SECTION OF RECLAIMED TRAPEZOIDAL CHANNEL
DESIGN A
SPOIL/SOIL MIXED WITH VEGETATION
(NOT DRAWN TO SCALE)



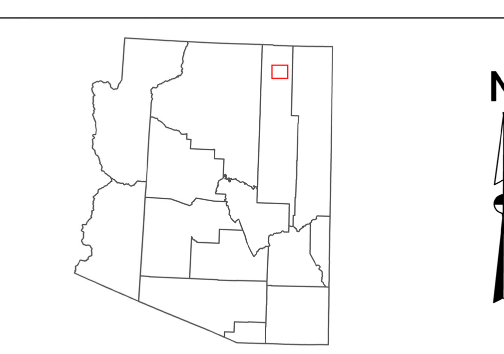
TYPICAL SECTION OF RECLAIMED TRAPEZOIDAL CHANNEL
DESIGN B
GRAVEL MIXED WITH VEGETATION
(NOT DRAWN TO SCALE)



TYPICAL SECTION OF RECLAIMED TRAPEZOIDAL CHANNEL
DESIGN C
(NOT DRAWN TO SCALE)

ENGINEER'S CERTIFICATION

EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842



REVISION	REV'D BY	DATE

KAYENTA MINE
Peabody
P.O. BOX 650
KAYENTA, ARIZONA 86033

MAP 2.6 (SHEET 3 OF 3)
N9 HYDROLOGY PARAMETERS

DESIGNED BY:	G.A	COUNTRY:	USA
DRAWN BY:	G.A.	STATE:	ARIZONA
APPROVED BY:	G.A.	PHOTO DATE:	2/12/25
DATE:	2/27/25	DRAWING/SHEET:	3 of 3
SCALE:	1" = 50'	C.I.:	5'

0 50 100 150 FEET

SECTION 3 – PHASE II BOND RELEASE SUPPORTING INFORMATION

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Maps

INTRODUCTION

The Phase II Bond Release information contained in this section includes historical revegetation information and results and analysis of vegetation sampling in support of the application. The Phase I bond release for the Reclaimed Liability Release Areas (RLRA) is included in Sections 1 and 2 of this application.

HISTORICAL REVEGETATION

Revegetation activities for the N9 RLRA included in this application were conducted during the years 2014 through 2018. Details of revegetation procedures and applied seed mixtures for initial seeding and reseeding have been previously reported to the regulatory authority in annual monitoring reports. This information and supporting maps are contained in the Minesoil Reconstruction and Revegetation Activities – Report, Black Mesa and Kayenta Mines for the years 1996 through 1999 as well as in Tab 2 of the Reclamation Status and Monitoring Report, Black Mesa and Kayenta Mines for the years 2000 through 2019. Revegetation procedures are summarized as follows. Upon completion of soil replacement, sites were deep ripped and then contour furrow disked to aid in surface stabilization and seedbed preparation. The sites were then seeded during the next available seeding season using the approved permanent seed mixture and appropriate seeding practices. Following seeding the sites were mulched with native grass hay at two tons per acre and then crimped to anchor the mulch. Map 3.1 shows the permanent program revegetation areas by year of seeding included in this Phase II application.

PHASE II VEGETATION SAMPLING

The sampling methods and results presented in the application address the requirements for Phase II bond release. Sampling methods are consistent with approved vegetation baseline and monitoring study methods for the Kayenta Mine as outlined in the AZ-0001F PAP, Chapter 9, Attachment 2. These methods have been used for all sampling at Kayenta Mine.

The Guideline to Bond Release Procedures for Permanent Programs Lands, Indian Programs Branch, Western Region Office of Surface Mining Reclamation and Enforcement (2017) states that the operator must demonstrate for Phase II bond release that “the reclaimed plant community is successfully established in accordance with 30 CFR 816.111 and the approved PAP.” 30 CFR 816.111 states that the vegetative cover must be:

1. Diverse, effective, and permanent;
2. Comprised of species native to the area, or of introduced species where desirable and necessary to achieve the approved postmining land use and approved by the regulatory authority;

3. At least equal in extent of cover to the natural vegetation of the area; and
4. Capable of stabilizing the soil surface from erosion.

This section includes the discussion of the first three requirements. The fourth requirement, sediment loss and erosion discussion is detailed in Section 4 of this application.

Phase II bond release requires statistically valid methods and random sampling of reclaimed and reference areas and comparison of the sampling results for these two areas. For purposes of permanent program vegetative cover evaluations, the J7, N7/8, and N14 sagebrush reference areas (SBRAs) determine the cover success standard. A minimum of 20 samples were collected in the RLRA and 15 samples in the SBRAs. An additional seven permanent transect locations were sampled within the RLRA to show trends over time and were included with the RLRA data as well. Sample adequacy was calculated from first-hit foliar vegetation cover sample values using the following formula:

$$N_{min} = \frac{t^2 * s^2}{d^2 * \bar{x}^2}$$

where:

N_{min} = minimum number of samples required

t = one-tailed t-value with n-1 degrees of freedom

s^2 = sample variance (n-1 degrees of freedom)

d = 0.1 (level of precision or desired detectable reduction)

$\bar{x}$ = sample mean

The vegetation sampling locations (RLRA & SBRA) are shown on Map 3.2. The vegetation data included in this application were collected in spring 2024 in the RLRA and SBRAs. Vegetation cover data were subjected to hypothesis testing as described in the PAP. Per permit specification, allowable ground cover was calculated for each RLRA and SBRA transect and used in sample adequacy and hypothesis testing calculations. Allowable ground cover was calculated as total ground cover minus the following:

- Rock cover
- Noxious weeds (Arizona or Navajo Nation A- or B-listed)
- Annual/biennial cover > 10% of the average total live vegetation cover across all transects
- Average litter cover across all transects in excess of the total of live vegetation and standing dead cover (litter - vegetation - standing dead)

VEGETATION DATA SUMMARY

Data summaries for the vegetation monitoring studies supporting this liability release application are presented in this section and summarized in Table 3.1. Noxious weeds (Arizona or Navajo Nation A- or B-listed) were removed from the allowable ground cover data used for vegetation analysis but not removed from ground cover data used for sediment loss and erosion evaluations discussed in Section 4 of this application. Raw data for all datasets are presented in Appendix 3.1 (RLRA) and Appendix 3.2 (SBRAs).

Table 3.1: Summary Statistics for the N9 RLRA and J7, N7/8, and N14 SBRAs

Site ID	Foliar Vegetation Cover	Total Ground Cover	Allowable Ground Cover	Grass Cover	Forb Cover	Shrub/ Subshrub Cover	Tree Cover	Total Species Present
				Phase II RLRAs				
N9 RLRA	20.9	55.1	49.0	13.6	2.8	4.6	0.0	55
				Sagebrush Reference Areas				
J7 SBRA	22.9	54.5	53.9	12.5	0.3	10.1	0.0	30
N7/8 SBRA	18.3	66.9	50.6	4.0	0.5	11.1	2.7	49
N14 SBRA	26.9	64.7	64.7	8.6	0.2	17.0	1.1	23

Sample Adequacy

A summary of sample adequacy calculations for allowable ground cover in the N9 RLRA as well as the J7, N7/8, and N14 SBRAs is presented in Table 3.2. Adequate samples were obtained in all sample areas.

Table 3.2: Sample Adequacy Calculations for the N9 RLRA and J7, N7/8, and N14 SBRAs

Site ID	Sample Size	t-statistic	Mean	Standard Deviation	Minimum Sample Size
		Phase II RLRA			
N9 RLRA	27	1.315	49.0	10.9	9
		Sagebrush Reference Areas			
J7 SBRA	15	1.345	53.9	8.4	5
N7/8 SBRA	15	1.345	50.6	9.64	7
N14 SBRA	15	1.345	64.7	9.7	5

RLRA Cover

Allowable ground cover averaged 49.0% and total foliar cover averaged 20.9% in the N9 RLRA (Table 3.1). Litter cover was 20.7%, rock cover was 5.3%, and total ground cover averaged 55.1% (Appendix 3.1).

The perennial grass component comprised most of the total vegetation cover with an average cover 13.3% (63.5% of the relative cover). The dominant species, western wheatgrass (*Agropyron smithii*), contributed 30.6% of the total relative vegetation cover. Three other native perennial wheatgrasses (*Agropyron* spp.) contributed another 18.4% of the relative cover. Shrubs and subshrubs, primarily fourwing saltbush, contributed 18.9% of the total relative vegetation cover. Forbs, primarily kochia (*Kochia scoparia*), contributed 13.3% of the total vegetation cover.

SBRA Cover

Allowable ground cover ranged from 50.6% in the N7/8 SBRA to 64.7% in the N14 SBRA in (Table 3.1). Average allowable ground cover for all three SBRAs was 56.4%. Total foliar cover ranged from a low of 18.3% in the N7/8 SBRA to a high of 26.9% in the N14 SBRA with an average of 22.7%. Total ground cover ranged from a low of 54.5% in the J7 SBRA to a high of 66.9% in the N7/8 SBRA with an average of 62.0%.

Litter cover was the greatest component of the ground cover after live vegetation and was relatively consistent between the three SBRAs. Litter cover ranged from 19.4% in the N14 SBRA to 22.3% in the J7 SBRA (Appendix 3.2) with an average of 20.6%. Rock cover was a large component of the ground cover in the N7/8 SBRA at 16.3% but the other SBRAs had little or no rock. Rock cover is not included in the allowable ground cover calculations.

Shrubs and subshrubs comprised an average of 56.1% of the relative cover across all three SBRAs and were the largest component of the vegetation cover in the N7/8 and N14 SBRAs and the second largest component in the J7 SBRA. The most common species in all three SBRAs was big sagebrush (*Artemisia tridentata*) which contributed an average of 38.8% of the relative cover. There was also a significant contribution from fourwing saltbush (*Atriplex canescens*) and Greene's rabbitbrush (*Chrysothamnus greenei*) in the J7 and N7/8 SBRAs.

Native perennial grasses were the largest component of the vegetation cover in the J7 SBRA and the second largest component in reference areas N7/8 and N14 SBRAs. Native perennial grasses comprised 36.2% of the relative vegetation cover on average. Blue grama (*Bouteloua gracilis*) was the most commonly encountered grass species in all three SBRAs and averaged 19.0% of the relative cover across all three SBRAs.

Species Diversity

Species diversity is measured by recording all species occurring within one meter on either side of each vegetation cover transect. The total number of species observed along all RLRA transects was 55 species in 2024 (Table 3.1). Of these 18 were grasses, 25 were forbs, and 12 were woody species (subshrubs, shrubs, cactus, and trees). The total number of species observed in the SBRAs ranged from 23 species in the N14 SBRA to 49 species in the N7/8 SBRA and averaged 34 species across all three SBRAs.

RLRA REVEGETATION SUCCESS CHARACTERIZATION

The data collected in the N9 RLRA demonstrates that it has developed vegetation cover that meets the requirements for Phase II bond release. An effective, diverse, and permanent vegetative cover has been established that is consistent with the post-mining land use. The vegetation cover on the RLRA is comparable to that observed on the SBRAs and it is anticipated that this RLRA is on the way to achieving the goals of final bond release when it reaches that stage of maturity.

Vegetation Cover

Both foliar cover and allowable ground cover in the N9 RLRA were similar to that observed in the J7 and N7/8 SBRAs and less than that observed in the N14 SBRA (Figure 3.1). The allowable ground cover from the RLRA was greater than 90% of the average SBRA when subjected to hypothesis testing per the PAP (Table 3.3).

Figure 3.1: Foliar and Allowable Ground Cover (Mean ± Standard Error) in the RLRA and SBRAs

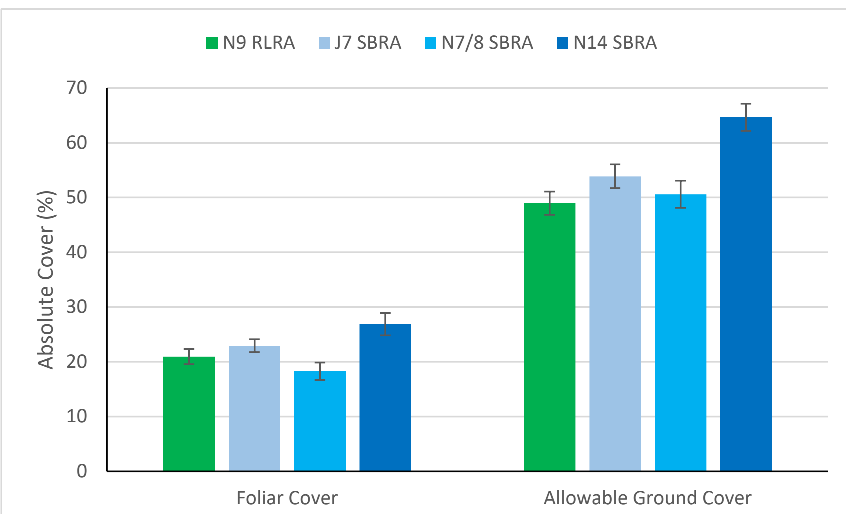


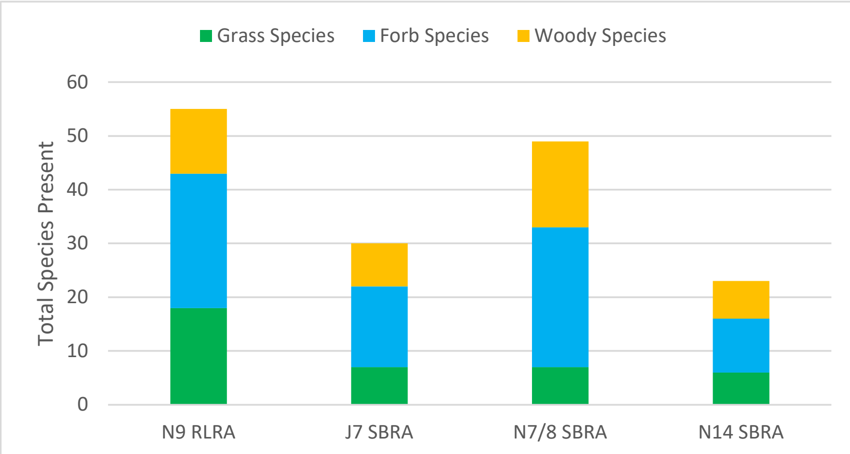
Table 3.3: Hypothesis Testing Results for N9 RLRA

Site ID	RLRA Mean	90% SBRA Mean	t-statistic	t-test value	Reclamation Pass?
N9 RLRA	48.98	50.74	-1.294	-0.770	Yes

Species Diversity

The total species diversity in the N9 RLRA was greater than all three SBRAs (Figure 3.2). As with the vegetation cover data, the species composition of the RLRA included more grasses and the SBRAs included more woody species. Given that this RLRA is only at the Phase II stage of bond release, there is ample evidence to suggest that the RLRA will meet Phase III standards in the future.

Figure 3.2: Total Number of Species Observed Along Transects in the RLRA and SBRAs



Utility for Post-Mining Land Use

Most of the vegetation cover (84.2% of the relative cover) observed in the N9 RLRA reflects approved seed mixtures. Seed mixtures were formulated to provide good forage production and nutrient levels and palatability for all classes of livestock and a variety of wildlife. While no production data were collected as a part of Phase II sampling, an average of 86.7% of the relative vegetation cover in the RLRA was comprised of species known to have high palatability for livestock, with another 12.0% of the cover made up of species with medium forage palatability.

Western wheatgrass was a primary species throughout the RLRA contributing an average of 30.6% of the relative cover. This species is highly palatable and offers the greatest utility when green in the spring, dropping off significantly as the grass matures (Cook et al. 1977). Western wheatgrass matures later than other cool season grasses extending the forage season. Several other native wheatgrasses as well as Russian wildrye (*Elymus junceus*) compliment western wheatgrass contributing an additional 26.7% of the relative vegetation cover. Russian wildrye has a very long season of use and high digestibility through much of the year. It retains good nutrient qualities as standing hay in the winter. Russian wildrye also exhibits good regrowth and recovery after grazing and when spring moisture and summer rains are likely. These qualities make this grass a valuable species throughout the year and compliment the other reclamation species in the PWCC grazing management program.

Warm season native grasses are found throughout the reclaimed area and contributed an average of 5.0% of the vegetation cover. All warm season grasses present in the RLRA's have good forage qualities during the growing season and blue grama maintains these qualities after the growing season (Cook et al., 1977). Blue grama has the greatest palatability, forage quality, and utility of the warm season grasses. Alkali sacaton (*Sporobolus airoides*) is a significant producer but has its greatest utility early in the season when green and palatable. Galleta (*Hilaria jamesii*) has a good presence in the reclaimed lands and during its green growing period, forage value is good but drops off quickly after maturity (Stubbendieck et al. 1982).

Many of the forbs and shrubs offer forage nutrition that compliments the grass dominated communities and aid in balancing the overall forage nutritional quality. Fourwing saltbush, commonly found throughout the RLRA, is an excellent source of nutrients for all classes of livestock throughout the year (Cook et al. 1977). It provides valuable forage and browse to livestock and wildlife in the summer and into the fall and winter. Winterfat (*Ceratoides lanata*) is a valuable browse species for livestock and wildlife, having high crude protein levels and providing succulent forage in the winter (Stubbendieck et al. 1982). Also, while not a native species, the commonly occurring annual species, kochia, can be a significant contributor to annual production during wetter springs and in the fall. This species is used by livestock, particularly when green, and has good nutrient qualities (Cook et al. 1977).

Trends over Time

Since 1992, PWCC has installed 128 permanent vegetation monitoring transects throughout the reclaimed areas on the mine to evaluate reclamation success over time. Seven of these transects are within the N9 RLRA (Map 3.2). While these seven sample points are not a statistically adequate sample, they do provide a general trend over time for the area. Cover data for these transects is presented in Table 3.4 and production data is presented in Table 3.5.

Between 2017 and 2024 each of these permanent transects was monitored at least four times and some were monitored up to 11 times. Two of the transects have been monitored at least once every year since 2017. In some years, the same transect was monitored in both the spring and fall to evaluate both cool season and warm season species development.

When SBRA data were collected in the same season, the average SBRA cover was compared to the permanent transect sample data to evaluate progress. Of the six seasons in the last four years from which cover data is available for both the RLRA and the SBRAs, the average cover of the RLRA permanent transects was greater than 90% of the average for the reference areas in five instances. Production data are not collected from the SBRAs; however, the N9 RLRA permanent transects average production was greater than the Phase III standard in five of the last six monitoring events.

Table 3.4: Permanent Transect Foliar Cover Data for N9 RLRA (2017-2024)

Permanent Transect	2017		2018		2019		2020		2021		2022		2023		2024	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
P106	34		6	6	27		30			20		42	11	41	17	45
P107	26		10	15	23		39			17		24	23	32	26	31
P116							19			18		22	15	19	17	23
P117							29			13		26	15	15	15	23
P118							25			24		40	25	37	20	39
P123													16	25	18	39
P124													16	16	29	37
Average	30.0		8.0	10.5	25.0		28.4			18.4		30.8	17.3	26.4	20.3	33.9
SBRA Average	44.1				30.9		22.2			19.4		33.5	18.9	28.0	22.7	24.2

Table 3.5: Permanent Transect Production Data for N9 RLRA (2017-2024)

Permanent Transect	2017		2018		2019		2020		2021		2022		2023		2024	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
P106	251		11	15	230		265			222		776	367	909	541	836
P107	824		27	329	189		350			695		772	108	907	257	847
P116							312			255		440	173	687	463	194
P117							221			136		356	280	467	451	341
P118							349			1152		868	272	1157	162	663
P123													339	1388	439	359
P124													410		483	534
Average	537.6		18.7	171.9	209.6		299.4			492.0		642.5	278.6	919.2	399.4	539.1
Phase III Standard										145.0		341.0	696.5	581.4	273.2	178.4

When the foliar cover data from the permanent transects is compared to the previous 12 months of precipitation data (June – May precipitation for Spring and October – September precipitation for fall), there is a general trend for greater cover in years with greater annual precipitation (Figure 3.3). The same trend generally held for production data (Figure 3.4).

Figure 3.3: Spring and Fall Foliar Cover vs. Annual Precipitation 2017-2024

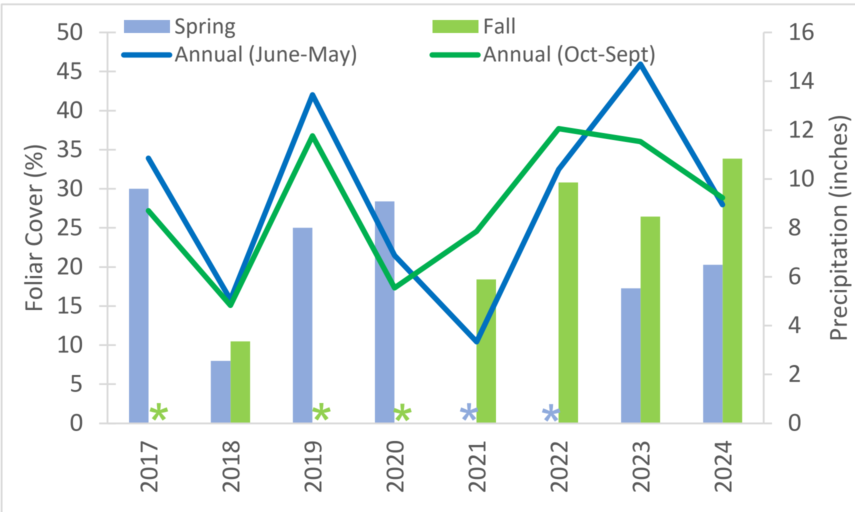
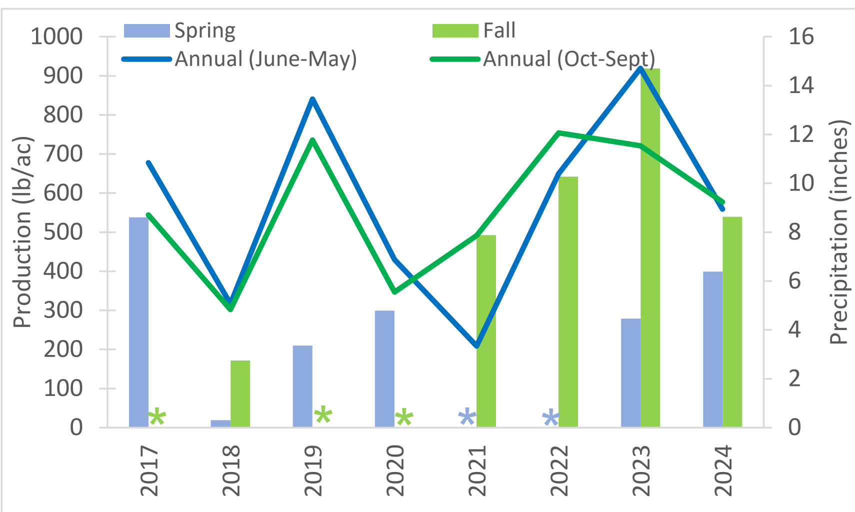


Figure 3.4: Spring and Fall Production vs. Annual Precipitation 2017-2024



LITERATURE CITED

Cook, C.W., R.D. Child, and L.L. Larson. 1977. Digestible Protein in Range Forages as an Index to Nutrient Content and Animal Response. Colorado State University Range Science Department Series No. 29.

Stubbendieck, J., S.L. Hatch, K.J. Kjar. 1982. North American Range Plants. University of Nebraska Press, Lincoln, Nebraska.

Appendix 3.1

RLRA Raw Data

N9 RLRA Cover Data - 2024

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover																											
						1		2		3		4		5		6		7		8		9		10		11		12		13		14	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
NATIVE ANNUAL & BIENNIAL FORBS																																	
Descurainia pinnata	0.00	3.70	0.00	0.00	0.00																												
Gilia aggregata	0.00	7.41	0.00	0.00	0.00	P														P													
Lappula redowskii	0.00	7.41	0.00	0.00	0.00																	P						P					
Lupinus brevicaulis	0.00	3.70	0.00	0.00	0.00																												
Machaeranthera canescens	0.00	7.41	0.00	0.00	0.00	P																						P					
TOTAL NATIVE ANN. & BIEN. FORBS	0.00	22.22	0.00	0.00	0.00	P														P		P						P					
INTRODUCED ANNUAL & BIENNIAL FORBS																																	
Chorispora tenella	0.04	3.70	0.18	0.04	0.17																	1											
Halogeton glomeratus	0.00	3.70	0.00	0.00	0.00															P													
Kochia scoparia	2.59	62.96	12.39	2.78	12.58	4				11		8		21		P						9	4	10		P		3				P	
Melilotus officinalis	0.00	3.70	0.00	0.00	0.00																												
Ranunculus testiculatus	0.00	3.70	0.00	0.00	0.00																	P											
Salsola iberica	0.07	14.81	0.35	0.07	0.34																	P						2					
Tragopogon dubius	0.00	3.70	0.00	0.00	0.00																												
TOTAL INTRO. ANN. & BIEN. FORBS	2.70	70.37	12.92	2.89	13.09	4				11		8		21		P				P		10	4	10		P		5				P	
INTRODUCED ANNUAL GRASSES																																	
Bromus tectorum	0.30	25.93	1.42	0.30	1.34											P				1								5					
TOTAL INTRODUCED ANNUAL GRASSES	0.30	25.93	1.42	0.30	1.34											P				1								5					
NATIVE PERENNIAL FORBS																																	
Astragalus calycosus var. scaposus	0.00	3.70	0.00	0.00	0.00																												
Astragalus praelongus	0.00	11.11	0.00	0.00	0.00																									P			
Astragalus wingatanus	0.00	3.70	0.00	0.00	0.00											P																	
Gaillardia aristata	0.00	3.70	0.00	0.00	0.00																												
Leucelene ericoides	0.00	3.70	0.00	0.00	0.00																												
Linum lewisii	0.00	14.81	0.00	0.00	0.00			P								P																	
Oxytropis lambertii	0.00	3.70	0.00	0.00	0.00																											P	
Penstemon palmeri	0.04	3.70	0.18	0.04	0.17											1																	
Ratibida columnaris	0.04	14.81	0.18	0.04	0.17			1																									
Sphaeralcea coccinea	0.00	14.81	0.00	0.00	0.00	P																										P	
TOTAL NATIVE PERENNIAL FORBS	0.07	40.74	0.35	0.07	0.34	P		1								1														P		P	
INTRODUCED PERENNIAL FORBS																																	
Astragalus cicer	0.00	11.11	0.00	0.00	0.00			P								P																	
Medicago sativa	0.00	3.70	0.00	0.00	0.00													P															
Onobrychis viciifolia	0.00	14.81	0.00	0.00	0.00													P															
TOTAL INTRO. PERENNIAL FORBS	0.00	22.22	0.00	0.00	0.00			P								P		P															
NATIVE PERENNIAL GRASSES (cool)																																	
Agropyron dasystachyum	1.30	74.07	6.19	1.30	5.87	1		4		3		2		P				P				2		3		P		P		1			
Agropyron smithii	6.41	100.00	30.62	6.52	29.53	8		15		7		17		6		P		3	1	5		9		7		6		5		5		P	
Agropyron spicatum	2.07	100.00	9.91	2.26	10.23	2	1	7	1	2		4		1		P		P		1		P		3		1		2		6		2	
Agropyron trachycaulum	0.48	48.15	2.30	0.52	2.35													P				1				1							
Festuca arizonica	0.00	3.70	0.00	0.00	0.00											P																	
Oryzopsis hymenoides	0.22	66.67	1.06	0.22	1.01	P						P		P		5		P		P		P				1		P		P		P	
Sitanion hystrix	0.00	11.11	0.00	0.00	0.00	P						P																					
TOTAL NATIVE PERENNIAL GRASSES (c)	10.48	100.00	50.09	10.81	48.99	11	1	26	1	12		23		7		5		3	1	6		12		13		9		7		12		2	

Continued on the next page

N9 RLRA – 2024 (Continued)

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover																											
						1		2		3		4		5		6		7		8		9		10		11		12		13		14	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
NATIVE PERENNIAL GRASSES (warm)																																	
Aristida purpurea	0.00	3.70	0.00	0.00	0.00																												
Bouteloua gracilis	0.04	74.07	0.18	0.07	0.34	P		P				P						P	1	P		P				P		P				P	
Buchloe dactyloides	0.07	37.04	0.35	0.07	0.34	1		P				P		P												P							
Hilaria jamesii	0.48	77.78	2.30	0.78	3.52	1		P				P				P		P	1	5	2	P				1		P		P		P	
Panicum virgatum	0.04	3.70	0.18	0.04	0.17																												
Sporobolus airoides	0.41	37.04	1.95	0.41	1.85							P						2		1						1		P				5	
Sporobolus cryptandrus	0.00	25.93	0.00	0.00	0.00	P										P												P					
TOTAL NATIVE PERENNIAL GRASSES (w)	1.04	85.19	4.96	1.37	6.21	2		P				P		P		P		2	2	6	2	P				2		P		P		5	
INTRODUCED PERENNIAL GRASSES (cool)																																	
Agropyron intermedium	0.00	22.22	0.00	0.00	0.00									P								P											
Bromus inermis	0.04	11.11	0.18	0.04	0.17																									P			
Elymus junceus	1.74	92.59	8.32	1.96	8.89	3	1	P		7		P				P		1		1	2	3		2		3		1		2		1	
TOTAL INTRO. PERENNIAL GRASSES (c)	1.78	100.00	8.50	2.00	9.06	3	1	P		7		P		P		P		1		1	2	3		2		3		1		2		1	
NATIVE SUBSHRUBS																																	
Artemisia frigida	0.00	3.70	0.00	0.00	0.00											P																	
Ceratoides lanata	0.07	44.44	0.35	0.11	0.50			P										P		1						P				P		P	
Chrysothamnus greenei	0.00	3.70	0.00	0.00	0.00																												
Gutierrezia sarothrae	0.15	44.44	0.71	0.15	0.67											P				2		P				1				P		P	
Senecio douglasii var. longilobus	0.00	3.70	0.00	0.00	0.00																												
TOTAL NATIVE SUBSHRUBS	0.22	62.96	1.06	0.26	1.17			P								P		P		3		P				1				P		P	
INTRODUCED SUBSHRUBS																																	
Kochia prostrata	0.04	18.52	0.18	0.04	0.17															1												P	
TOTAL INTRO. SUBSHRUBS	0.04	18.52	0.18	0.04	0.17															1												P	
NATIVE SHRUBS																																	
Artemisia tridentata	0.00	3.70	0.00	0.00	0.00											P																	
Atriplex canescens	3.96	100.00	18.94	3.96	17.95	4		P		P		P		2		2		6		5		8		3		4		P		7		3	
Atriplex confertifolia	0.26	62.96	1.24	0.30	1.34	3		2	1							P				1		P		P		P		P		P			
Chrysothamnus nauseosus	0.04	14.81	0.18	0.04	0.17																												
Cowania mexicana	0.04	3.70	0.18	0.04	0.17											1																	
TOTAL NATIVE SHRUBS	4.30	100.00	20.53	4.33	19.63	7		2	1	P		P		2		3		6		6		8		3		4		P		7		3	
NATIVE TREES																																	
Pinus edulis	0.00	3.70	0.00	0.00	0.00											P																	
TOTAL NATIVE TREES	0.00	3.70	0.00	0.00	0.00											P																	
Standing dead	8.30	88.89		8.30		2		3				1		2				23		6		1		1		13		7		7		15	
Litter	20.67	100.00		20.67		25		27		21		26		34		9		8		20		35		22		17		14		25		6	
Bare ground	44.85	100.00		44.85		46		39		43		41		30		13		57		43		20		43		45		59		47		65	
Rock	5.26	74.07		5.26				2		6		1		4		69				7		11		6		6		2				3	
TOTALS	100.00		100.00	101.15	100.00	100	2	100	2	100	0	100	0	100	0	100	0	100	3	100	4	100	4	100	0	100	0	100	0	100	0	100	0
TOTAL VEGETATION COVER	20.93	s=(7.26)		22.07	s=(7.82)	27	2	29	2	30	0	31	0	30	0	9	0	12	3	24	4	33	4	28	0	19	0	18	0	21	0	11	0
GROUND COVER (Veg+Litter+St.Dead+Rock)	55.15	s=(11.99)		56.30	s=(12.46)	54	2	61	2	57	0	59	0	70	0	87	0	43	3	57	4	80	4	57	0	55	0	41	0	53	0	35	0
Allowable Ground Cover (per permit)	**48.98**	**s=(10.94)**				**53.1**		**58.1**		**50.1**		**57.1**		**65.1**		**17.1**		**42.1**		**49.1**		**68.1**		**50.1**		**48.1**		**38.1**		**52.1**		**31.1**	
SPECIES DENSITY (# of species/100 sq.m.)	13.56	s=(3.54)				16		13		6		12		8		20		13		15		17		7		15		16		12		14	

Noxious Cover	0.04	To calculate Allowable Cover (per permit):
Annual Cover	2.96	Subtract average absolute cover of noxious species (AZ & NN)
Excess Annual Cover	0.87	If average annual relative cover is greater than 10%, substract the average excess
Excess Litter (St Dead+Veg-Litter) (minus nc	0.00	If average litter cover exceeds live vegetation + standing dead, substract average excess litter (veg+stdead-litter)

Continued on the next page

N9 RLRA – 2024 (Continued)

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover 15		16		17		18		19		20		P106		P107		P116		P117		P118		P123		P124	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
NATIVE ANNUAL & BIENNIAL FORBS																															
Descurainia pinnata	0.00	3.70	0.00	0.00	0.00															P											
Gilia aggregata	0.00	7.41	0.00	0.00	0.00																										
Lappula redowskii	0.00	7.41	0.00	0.00	0.00																										
Lupinus brevicaulis	0.00	3.70	0.00	0.00	0.00	P																									
Machaeranthera canescens	0.00	7.41	0.00	0.00	0.00																										
TOTAL NATIVE ANN. & BIEN. FORBS	0.00	22.22	0.00	0.00	0.00	P														P											
INTRODUCED ANNUAL & BIENNIAL FORBS																															
Chorispora tenella	0.04	3.70	0.18	0.04	0.17																										
Halogeton glomeratus	0.00	3.70	0.00	0.00	0.00																										
Kochia scoparia	2.59	62.96	12.39	2.78	12.58			2		P		P	1	1		1		P		P											
Melilotus officinalis	0.00	3.70	0.00	0.00	0.00																					P					
Ranunculus testiculatus	0.00	3.70	0.00	0.00	0.00																										
Salsola iberica	0.07	14.81	0.35	0.07	0.34									P						P											
Tragopogon dubius	0.00	3.70	0.00	0.00	0.00					P																					
TOTAL INTRO. ANN. & BIEN. FORBS	2.70	70.37	12.92	2.89	13.09			2		P		P	1	1		1		P		P						P					
INTRODUCED ANNUAL GRASSES																															
Bromus tectorum	0.30	25.93	1.42	0.30	1.34	P				1								1		P											
TOTAL INTRODUCED ANNUAL GRASSES	0.30	25.93	1.42	0.30	1.34	P				1								1		P											
NATIVE PERENNIAL FORBS																															
Astragalus calycosus var. scaposus	0.00	3.70	0.00	0.00	0.00																	P									
Astragalus praelongus	0.00	11.11	0.00	0.00	0.00							P																P			
Astragalus wingatanus	0.00	3.70	0.00	0.00	0.00																										
Gaillardia aristata	0.00	3.70	0.00	0.00	0.00																	P									
Leucelene ericoides	0.00	3.70	0.00	0.00	0.00					P																					
Linum lewisii	0.00	14.81	0.00	0.00	0.00							P				P															
Oxytropis lambertii	0.00	3.70	0.00	0.00	0.00																										
Penstemon palmeri	0.04	3.70	0.18	0.04	0.17																										
Ratibida columnaris	0.04	14.81	0.18	0.04	0.17									P		P						P									
Sphaeralcea coccinea	0.00	14.81	0.00	0.00	0.00					P		P																			
TOTAL NATIVE PERENNIAL FORBS	0.07	40.74	0.35	0.07	0.34					P		P		P		P						P						P			
INTRODUCED PERENNIAL FORBS																															
Astragalus cicer	0.00	11.11	0.00	0.00	0.00																	P									
Medicago sativa	0.00	3.70	0.00	0.00	0.00																										
Onobrychis viciifolia	0.00	14.81	0.00	0.00	0.00							P										P				P					
TOTAL INTRO. PERENNIAL FORBS	0.00	22.22	0.00	0.00	0.00							P										P				P					
NATIVE PERENNIAL GRASSES (cool)																															
Agropyron dasystachyum	1.30	74.07	6.19	1.30	5.87	P		1						7		5						3		P		P		2		1	
Agropyron smithii	6.41	100.00	30.62	6.52	29.53	3		3		5	1	8		10		8		5		8	1	7		5		1		6		11	
Agropyron spicatum	2.07	100.00	9.91	2.26	10.23	1		4	1	2	1	P		P		P		1		1		4		6		1	1	2		3	
Agropyron trachycaulum	0.48	48.15	2.30	0.52	2.35	3		2		P		3				P		P						2		P		1		P	1
Festuca arizonica	0.00	3.70	0.00	0.00	0.00																										
Oryzopsis hymenoides	0.22	66.67	1.06	0.22	1.01			P		P		P		P												P		P		P	
Sitanion hystrix	0.00	11.11	0.00	0.00	0.00							P																			
TOTAL NATIVE PERENNIAL GRASSES (c)	10.48	100.00	50.09	10.81	48.99	7		10	1	7	2	11		17		13		6		9	1	14		13		2	1	11		15	1

Continued on the next page

N9 RLRA – 2024 (Continued)

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover 15		16		17		18		19		20		P106		P107		P116		P117		P118		P123		P124	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
NATIVE PERENNIAL GRASSES (warm)																															
Aristida purpurea	0.00	3.70	0.00	0.00	0.00													P													
Bouteloua gracilis	0.04	74.07	0.18	0.07	0.34	1				P		P		P				P		P		P		P		P		P		P	
Buchloe dactyloides	0.07	37.04	0.35	0.07	0.34	P								P				P				P								1	
Hilaria jamesii	0.48	77.78	2.30	0.78	3.52	P				1	1	P		P				2	1	2	3	P		P		P				1	
Panicum virgatum	0.04	3.70	0.18	0.04	0.17													1													
Sporobolus airoides	0.41	37.04	1.95	0.41	1.85							1						P		1						P					
Sporobolus cryptandrus	0.00	25.93	0.00	0.00	0.00	P												P		P		P									
TOTAL NATIVE PERENNIAL GRASSES (w)	1.04	85.19	4.96	1.37	6.21	1				1	1	1		P				3	1	3	3	P		P		P		P		2	
INTRODUCED PERENNIAL GRASSES (cool)																															
Agropyron intermedium	0.00	22.22	0.00	0.00	0.00							P		P														P		P	
Bromus inermis	0.04	11.11	0.18	0.04	0.17					1																		P			
Elymus junceus	1.74	92.59	8.32	1.96	8.89	P		1		1		1		3		5	1	4		5	2	P		1		2				P	
TOTAL INTRO. PERENNIAL GRASSES (c)	1.78	100.00	8.50	2.00	9.06	P		1		2		1		3		5	1	4		5	2	P		1		2		P		P	
NATIVE SUBSHRUBS																															
Artemisia frigida	0.00	3.70	0.00	0.00	0.00																										
Ceratoides lanata	0.07	44.44	0.35	0.11	0.50					P								P		1	1	P				P				P	
Chrysothamnus greenei	0.00	3.70	0.00	0.00	0.00																			P							
Gutierrezia sarothrae	0.15	44.44	0.71	0.15	0.67	P				P		1						P		P						P					
Senecio douglasii var. longilobus	0.00	3.70	0.00	0.00	0.00					P																					
TOTAL NATIVE SUBSHRUBS	0.22	62.96	1.06	0.26	1.17	P				P		1						P		1	1	P		P		P				P	
INTRODUCED SUBSHRUBS																															
Kochia prostrata	0.04	18.52	0.18	0.04	0.17	P														P				P							
TOTAL INTRO. SUBSHRUBS	0.04	18.52	0.18	0.04	0.17	P														P				P							
NATIVE SHRUBS																															
Artemisia tridentata	0.00	3.70	0.00	0.00	0.00																										
Atriplex canescens	3.96	100.00	18.94	3.96	17.95	1		P		2		5		P		7		3		8		3		P		16		7		11	
Atriplex confertifolia	0.26	62.96	1.24	0.30	1.34			P		P		P				P		P				P		P						1	
Chrysothamnus nauseosus	0.04	14.81	0.18	0.04	0.17	P				P				P										1							
Cowania mexicana	0.04	3.70	0.18	0.04	0.17																										
TOTAL NATIVE SHRUBS	4.30	100.00	20.53	4.33	19.63	1		P		2		5		P		7		3		8		3		1		16		7		12	
NATIVE TREES																															
Pinus edulis	0.00	3.70	0.00	0.00	0.00																										
TOTAL NATIVE TREES	0.00	3.70	0.00	0.00	0.00																										
Standing dead	8.30	88.89		8.30		13		7		25		18				1		31		11		2		8		19		7		1	
Litter	20.67	100.00		20.67		24		9		16		11		27		23		12		22		33		20		15		31		26	
Bare ground	44.85	100.00		44.85		54		71		44		50		48		42		39		38		47		57		46		43		41	
Rock	5.26	74.07		5.26						2		2		4		8		1		3		1						1		3	
TOTALS	100.00		100.00	101.15	100.00	100	0	100	1	100	3	100	1	100	0	100	1	100	1	100	7	100	0	100	0	100	1	100	0	100	1
TOTAL VEGETATION COVER	20.93	s=(7.26)		22.07	s=(7.82)	9	0	13	1	13	3	19	1	21	0	26	1	17	1	26	7	17	0	15	0	20	1	18	0	29	1
GROUND COVER (Veg+Litter+St.Dead+Rock)	55.15	s=(11.99)		56.30	s=(12.46)	46	0	29	1	56	3	50	1	52	0	58	1	61	1	62	7	53	0	43	0	54	1	57	0	59	1
Allowable Ground Cover (per permit)	**48.98**	**s=(10.94)**				**45.1**		**28.1**		**53.1**		**47.1**		**47.1**		**49.1**		**59.1**		**58.1**		**51.1**		**42.1**		**53.1**		**55.1**		**55.1**	
SPECIES DENSITY (# of species/100 sq.m.)	13.56	s=(3.54)				15		9		19		18		14		10		17		15		16		12		14		10		13	

Noxious Cover	0.04	To calculate Allowable Cover (per permit):
Annual Cover	2.96	Subtract average absolute cover of noxious species (AZ & NN)
Excess Annual Cover	0.87	If average annual relative cover is greater than 10%, substract the average excess
Excess Litter (St Dead+Veg-Litter) (minus nc	0.00	If average litter cover exceeds live vegetation + standing dead, substract average excess litter (veg+stdead-litter)

Appendix 3.2

Sagebrush Reference Area Raw Data

J7 Sagebrush Reference Area

N7/8 Sagebrush Reference Area

N14 Sagebrush Reference Area

J7 SBRA – 2024

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover 1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
NATIVE ANNUAL & BIENNIAL FORBS																																			
Chenopodium leptophyllum	0.00	46.67	0.00	0.00	0.00					P				P		P						P		P						P				P	
Cryptantha minima	0.00	26.67	0.00	0.00	0.00	P				P		P								P															
Descurainia richardsonii	0.00	6.67	0.00	0.00	0.00																	P													
Eriogonum cernuum	0.00	6.67	0.00	0.00	0.00													P																	
Lappula redowskii	0.00	20.00	0.00	0.00	0.00							P										P												P	
Lupinus brevicaulis	0.00	26.67	0.00	0.00	0.00					P		P								P				P											
Plantago patagonica	0.00	13.33	0.00	0.07	0.26							P							1															P	
Townsendia annua	0.00	66.67	0.00	0.00	0.00			P		P		P				P		P		P		P				P						P		P	
TOTAL NATIVE ANN. & BIEN. FORBS	0.00	93.33	0.00	0.07	0.26	P		P		P		P		P		P		P	1	P		P		P		P				P		P		P	
INTRODUCED ANNUAL & BIENNIAL FORBS																																			
Salsola iberica	0.00	13.33	0.00	0.00	0.00											P								P											
TOTAL INTRO. ANN. & BIEN. FORBS	0.00	13.33	0.00	0.00	0.00											P								P											
NATIVE ANNUAL GRASSES																																			
Festuca octoflora	0.00	6.67	0.00	0.00	0.00							P																							
TOTAL NATIVE ANNUAL GRASSES	0.00	6.67	0.00	0.00	0.00							P																							
NATIVE PERENNIAL FORBS																																			
Allium macropetalum	0.00	6.67	0.00	0.00	0.00											P																			
Calochortus nuttallii	0.00	6.67	0.00	0.00	0.00													P																	
Cymopterus purpurascens	0.00	26.67	0.00	0.00	0.00			P				P										P						P							
Delphinium scaposum	0.00	33.33	0.00	0.00	0.00	P												P		P								P		P					
Leucelene ericoides	0.00	80.00	0.00	0.00	0.00	P		P						P		P		P		P				P		P		P		P		P		P	
Sphaeralcea coccinea	0.27	80.00	1.16	0.27	1.03			P				P		1		P		1		P		P		1				P		P		1		P	
TOTAL NATIVE PERENNIAL FORBS	0.27	93.33	1.16	0.27	1.03	P		P				P		1		P		1		P		P		1		P		P		P		1		P	
NATIVE PERENNIAL GRASSES (cool)																																			
Oryzopsis hymenoides	0.00	53.33	0.00	0.00	0.00	P		P						P						P						P		P		P		P			
Sitanion hystrix	5.93	100.00	25.87	7.33	28.35	9	2	2	1	8	1	3		7	1	9	2	10	4	9		6	4	4	1	3		4	2	2	2	5		8	1
TOTAL NATIVE PERENNIAL GRASSES (c)	5.93	100.00	25.87	7.33	28.35	9	2	2	1	8	1	3		7	1	9	2	10	4	9		6	4	4	1	3		4	2	2	2	5		8	1
NATIVE PERENNIAL GRASSES (warm)																																			
Bouteloua gracilis	5.07	100.00	22.09	5.67	21.91	4		3		14	1	5		3		6	2	5		3		9	1	3	1	7	1	3	1	4		1	1	6	1
Hilaria jamesii	1.33	100.00	5.81	2.07	7.99	P		P	2	1		1		2	1	3		1		P		3	4	3	2	1		4	1	P		1	1	P	
Muhlenbergia torreyi	0.00	13.33	0.00	0.00	0.00					P														P											
Sporobolus cryptandrus	0.20	53.33	0.87	0.20	0.77	P				P		1						P		1		P		P										1	
TOTAL NATIVE PERENNIAL GRASSES (w)	6.60	100.00	28.78	7.93	30.67	4		3	2	15	1	7		5	1	9	2	6		4		12	5	6	3	8	1	7	2	4		2	2	7	1
NATIVE SUBSHRUBS																																			
Ceratoides lanata	0.60	46.67	2.62	0.60	2.32	1		5						1												P		2		P		P			
Chrysothamnus greenei	3.40	100.00	14.83	3.47	13.40	3		7	1	P		2		1		5		6		3		1		4		4		5		5		4		1	
Gutierrezia sarothrae	0.00	80.00	0.00	0.00	0.00	P				P		P		P		P		P				P		P		P		P		P				P	
TOTAL NATIVE SUBSHRUBS	4.00	100.00	17.44	4.07	15.72	4		12	1	P		2		2		5		6		3		1		4		4		7		5		4		1	
NATIVE SHRUBS																																			
Artemisia tridentata	5.27	100.00	22.97	5.33	20.62	5		2		6		11		5		7	1	6		5		3		5		7		5		1		6		5	
Atriplex canescens	0.87	46.67	3.78	0.87	3.35			2										2		1		4								2		P		2	
TOTAL NATIVE SHRUBS	6.13	100.00	26.74	6.20	23.97	5		4		6		11		5		7	1	8		6		7		5		7		5		3		6		7	

Continued on the next page

J7 SBRA - 2024 (Continued)

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover 1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
SUCCULENTS																																			
Coryphantha vivipara	0.00	13.33	0.00	0.00	0.00							P														P									
Opuntia phaeacantha	0.00	20.00	0.00	0.00	0.00	P								P																		P			
Sclerocactus parviflorus	0.00	6.67	0.00	0.00	0.00									P																					
TOTAL SUCCULENTS	0.00	33.33	0.00	0.00	0.00	P						P		P												P						P			
LICHEN/FUNGUS																																			
Lichen spp.	0.27	100.00	1.16	0.27	1.03	2		1		P		P		P		P		P		P		P		P		P		P		1		P		P	
TOTAL LICHEN	0.27	100.00	1.16	0.27	1.03	2		1		P		P		P		P		P		P		P		P		P		P		1		P		P	
Standing dead	8.33	100.00		8.33		3		7		7		5		4		14		4		6		18		12		4		11		8		10		12	
Litter	22.33	100.00		22.33		16		18		29		25		29		19		20		24		21		20		18		20		15		33		28	
Bare ground	45.53	100.00		45.53		56		48		35		46		47		37		45		48		35		48		56		44		62		39		37	
Rock	0.60	26.67		0.60		1		5				1																2							
TOTALS	100.00		100.00	102.93	100.00	100	2	100	4	100	2	100	0	100	2	100	5	100	5	100	0	100	9	100	4	100	1	100	4	100	2	100	2	100	2
TOTAL VEGETATION COVER	22.93	s=(4.54)		25.87	s=(5.88)	22	2	21	4	29	2	23	0	20	2	30	5	31	5	22	0	26	9	20	4	22	1	23	4	14	2	18	2	23	2
GROUND COVER (Veg+Litter+St.Dead+Rock)	54.47	s=(8.12)		57.40	s=(9.33)	44	2	52	4	65	2	54	0	53	2	63	5	55	5	52	0	65	9	52	4	44	1	56	4	38	2	61	2	63	2
Allowable Ground Cover (per permit)	**53.87**	**s=(8.41)**				**43.0**		**47.0**		**65.0**		**53.0**		**53.0**		**63.0**		**55.0**		**52.0**		**65.0**		**52.0**		**44.0**		**54.0**		**38.0**		**61.0**		**63.0**	
SPECIES DENSITY (# of species/100 sq.m.)	14.00	s=(1.25)				14		13		13		17		14		13		15		15		15		14		12		13		14		13		15	

Noxious Cover	0
Annual Cover	0.00
Excess Annual Cover	0.00
Excess Litter (St Dead+Veg-Litter) (minus nc	0.00

To calculate Allowable Cover (per permit):
Subtract average absolute cover of noxious species (AZ & NN)
If average annual relative cover is greater than 10%, substract the average excess
If average litter cover exceeds live vegetation + standing dead, substract average excess litter (veg+stdead-litter)

N7/8 SBRA - 2024

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover																													
						1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
NATIVE ANNUAL & BIENNIAL FORBS																																			
Euphorbia glyptosperma	0.00	20.00	0.00	0.00	0.00											P		P																P	
Gilia aggregata	0.00	6.67	0.00	0.00	0.00			P																											
Gilia leptomeria	0.00	6.67	0.00	0.00	0.00			P																											
Lappula redowskii	0.00	13.33	0.00	0.00	0.00					P																P									
Lupinus brevicaulis	0.00	20.00	0.00	0.00	0.00	P												P														P			
Machaeranthera canescens	0.00	13.33	0.00	0.00	0.00							P																						P	
TOTAL NATIVE ANN. & BIEN. FORBS	0.00	60.00	0.00	0.00	0.00	P		P		P		P				P		P								P						P		P	
INTRODUCED ANNUAL GRASSES																																			
Bromus tectorum	0.00	20.00	0.00	0.00	0.00																			P				P						P	
TOTAL INTRODUCED ANNUAL GRASSES	0.00	20.00	0.00	0.00	0.00																			P				P						P	
NATIVE PERENNIAL FORBS																																			
Allium macropetalum	0.00	6.67	0.00	0.00	0.00									P																					
Arabis fendleri	0.00	6.67	0.00	0.00	0.00			P																											
Astragalus calycosus var. scaposus	0.00	73.33	0.00	0.00	0.00	P		P		P										P		P		P		P		P		P		P		P	
Astragalus preussii	0.00	13.33	0.00	0.00	0.00	P														P															
Astragalus wingatanus	0.00	73.33	0.00	0.00	0.00	P		P								P		P		P		P		P		P		P				P		P	
Calochortus nuttallii	0.00	13.33	0.00	0.00	0.00																			P		P									
Castilleja chromosa	0.00	6.67	0.00	0.00	0.00																									P					
Cryptantha flava	0.00	6.67	0.00	0.00	0.00															P															
Cymopterus purpurascens	0.07	93.33	0.36	0.07	0.36	P		P				P		P		P		P		1		P		P		P		P		P		P		P	
Cymopterus purpureus	0.00	66.67	0.00	0.00	0.00	P		P										P		P		P		P		P		P		P				P	
Lesquerella intermedia	0.00	26.67	0.00	0.00	0.00			P								P				P				P											
Leucelene ericoides	0.20	86.67	1.09	0.20	1.07			P		P		P		P		P		P		P		P				1		P		1		1		P	
Pedicularis centranthera	0.07	6.67	0.36	0.07	0.36															1															
Penstemon linarioides	0.00	6.67	0.00	0.00	0.00															P															
Phlox longifolia	0.00	26.67	0.00	0.00	0.00	P		P						P								P													
Psilostrophe sparsiflora	0.00	20.00	0.00	0.00	0.00															P				P				P							
Sphaeralcea coccinea	0.13	93.33	0.73	0.13	0.71	P		P		P		P		P		P		P		P				1		P		P		1		P		P	
Stanleya pinnata	0.00	6.67	0.00	0.00	0.00															P															
Townsendia exscapa	0.00	6.67	0.00	0.00	0.00																	P													
TOTAL NATIVE PERENNIAL FORBS	0.47	100.00	2.55	0.47	2.50	P		P		P		P		P		P		P		2		P		1		1		P		2		1		P	
INTRODUCED PERENNIAL FORBS																																			
Onobrychis viciifolia	0.00	13.33	0.00	0.00	0.00																									P				P	
TOTAL INTRO. PERENNIAL FORBS	0.00	13.33	0.00	0.00	0.00																									P				P	
NATIVE PERENNIAL GRASSES (cool)																																			
Oryzopsis hymenoides	0.47	93.33	2.55	0.53	2.86	2				P		P		P		3	1	P		P		P		1		1		P		P		P		P	
Sitanion hystrix	0.47	100.00	2.55	0.53	2.86	P		P		1		P		1		P		P		1		P		P		1		P		2	1	1		P	
TOTAL NATIVE PERENNIAL GRASSES (c)	0.93	100.00	5.11	1.07	5.71	2		P		1		P		1		3	1	P		1		P		1		2		P		2	1	1		P	
NATIVE PERENNIAL GRASSES (warm)																																			
Bouteloua gracilis	2.00	100.00	10.95	2.07	11.07	3		2		2		2		1		1		2		1		1		5		1		2		7	1	P		P	
Hilaria jamesii	1.07	86.67	5.84	1.07	5.71	3		P						2		2		P		P		3		P		2		P		1		3		P	
Sporobolus cryptandrus	0.00	40.00	0.00	0.00	0.00			P				P		P						P		P		P											
TOTAL NATIVE PERENNIAL GRASSES (w)	3.07	100.00	16.79	3.13	16.79	6		2		2		2		3		3		2		1		4		5		3		2		8	1	3		P	

Continued on the next page

N7/8 SBRA - 2024 (Continued)

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover																													
						1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
INTRODUCED PERENNIAL GRASSES (cool)																																			
Agropyron desertorum	0.00	6.67	0.00	0.00	0.00																	P													
TOTAL INTRO. PERENNIAL GRASSES (c)	0.00	6.67	0.00	0.00	0.00																	P													
NATIVE SUBSHRUBS																																			
Ceratoides lanata	0.00	13.33	0.00	0.00	0.00			P								P																			
Chrysothamnus greenei	1.87	100.00	10.22	1.93	10.36	P		2		1		3		2		3		3		P		3	1	P		P		3		1		5		2	
Eriogonum microthecum	0.00	6.67	0.00	0.00	0.00																			P											
Gutierrezia sarothrae	1.67	100.00	9.12	1.73	9.29	2		P		1	1	1		2		1		P		2		P		2		1		3		3		4		3	
Senecio douglasii var. longilobus	0.07	6.67	0.36	0.07	0.36																											1			
TOTAL NATIVE SUBSHRUBS	3.60	100.00	19.71	3.73	20.00	2		2		2	1	4		4		4		3		2		3	1	2		1		6		4		10		5	
NATIVE SHRUBS																																			
Artemisia tridentata	6.00	100.00	32.85	6.07	32.50	11		4		7	1	8		6		4		10		5		5		5		7		6		7		4		1	
Atriplex canescens	1.33	93.33	7.30	1.33	7.14	P		P		P		5		2		1		2		P				P		2		2		4		1		1	
Chrysothamnus viscidiflorus	0.13	6.67	0.73	0.13	0.71																							2							
Ephedra viridis	0.00	6.67	0.00	0.00	0.00																	P													
Tetradymia canescens	0.07	13.33	0.36	0.07	0.36																							1						P	
TOTAL NATIVE SHRUBS	7.53	100.00	41.24	7.60	40.71	11		4		7	1	13		8		5		12		5		5		5		9		11		11		5		2	
NATIVE TREES																																			
Juniperus osteosperma	0.27	33.33	1.46	0.27	1.43	P								2						P						1		1							
Pinus edulis	2.40	93.33	13.14	2.40	12.86	2		5		3		1		1		1		1				1		2		6		P		3		9		1	
TOTAL NATIVE TREES	2.67	100.00	14.60	2.67	14.29	2		5		3		1		3		1		1		P		1		2		7		1		3		9		1	
SUCCULENTS																																			
Coryphantha vivipara	0.00	13.33	0.00	0.00	0.00																									P		P			
Echinocereus triglochidiatus	0.00	6.67	0.00	0.00	0.00																	P													
Opuntia phaeacantha	0.00	20.00	0.00	0.00	0.00			P						P																P					
Sclerocactus whipplei	0.00	13.33	0.00	0.00	0.00			P														P													
TOTAL SUCCULENTS	0.00	33.33	0.00	0.00	0.00			P						P								P								P		P			
BRYOPHYTES																																			
Moss spp.	0.20	33.33	1.09	0.20	1.07	1								P		P						1								1					
TOTAL BRYOPHYTES	0.20	33.33	1.09	0.20	1.07	1								P		P						1								1					
LICHEN/FUNGUS																																			
Lichen spp.	0.00	6.67	0.00	0.00	0.00							P																							
TOTAL LICHEN	0.00	6.67	0.00	0.00	0.00							P																							
Standing dead	12.20	100.00		12.20		15		17		12		23		17		14		17		5		15		15		7		9		5		4		8	
Litter	19.93	100.00		19.93		16		14		12		14		25		17		10		33		21		34		22		24		17		29		11	
Bare ground	33.33	100.00		33.33		37		51		29		32		29		36		42		31		40		15		36		42		15		12		53	
Rock	16.27	100.00		16.27		9		5		32		11		10		17		13		20		11		20		12		5		33		26		20	
TOTALS	100.20		100.00	100.60	100.00	101	0	100	0	100	2	100	0	100	0	100	1	100	0	100	0	101	1	100	0	100	0	100	0	101	2	100	0	100	0
TOTAL VEGETATION COVER	18.27	s=(6.2)		18.67	s=(6.35)	23	0	13	0	15	2	20	0	19	0	16	1	18	0	11	0	13	1	16	0	23	0	20	0	30	2	29	0	8	0
GROUND COVER (Veg+Litter+St.Dead+Rock)	66.87	s=(12.28)		67.27	s=(12.52)	64	0	49	0	71	2	68	0	71	0	64	1	58	0	69	0	61	1	85	0	64	0	58	0	86	2	88	0	47	0
Allowable Ground Cover (per permit)	**50.60**	**s=(9.64)**				**55.0**		**44.0**		**39.0**		**57.0**		**61.0**		**47.0**		**45.0**		**49.0**		**50.0**		**65.0**		**52.0**		**53.0**		**53.0**		**62.0**		**27.0**	
SPECIES DENSITY (# of species/100 sq.m.)	18.47	s=(3.02)				19		23		12		14		18		17		16		23		21		20		18		20		19		17		20	

Noxious Cover	0.00
Annual Cover	0.00
Excess Annual Cover	0.00
Excess Litter (St Dead+Veg-Litter) (minus nc	0.00

To calculate Allowable Cover (per permit):
Subtract average absolute cover of noxious species (AZ & NN)
If average annual relative cover is greater than 10%, substract the average excess
If average litter cover exceeds live vegetation + standing dead, substract average excess litter (veg+stdead-litter)

N14 SBRA - 2024

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover																													
						1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
NATIVE ANNUAL & BIENNIAL FORBS																																			
Lappula redowskii	0.00	13.33	0.00	0.00	0.00													P																P	
Machaeranthera canescens	0.00	73.33	0.00	0.00	0.00	P		P		P		P		P						P		P		P				P				P		P	
TOTAL NATIVE ANN. & BIEN. FORBS	0.00	80.00	0.00	0.00	0.00	P		P		P		P		P				P		P		P		P				P				P		P	
NATIVE PERENNIAL FORBS																																			
Allium macropetalum	0.00	13.33	0.00	0.00	0.00									P						P															
Arabis fendleri	0.00	53.33	0.00	0.00	0.00			P				P		P		P		P				P						P		P					
Calochortus nuttallii	0.00	6.67	0.00	0.00	0.00																			P											
Cymopterus purpurascens	0.00	93.33	0.00	0.00	0.00	P		P		P		P		P		P		P		P				P		P		P		P		P		P	
Leucelene ericoides	0.20	93.33	0.74	0.20	0.66	1		P		P		P		P		P		P		P		P		P		1		1				P		P	
Phlox longifolia	0.00	6.67	0.00	0.00	0.00													P																	
Sphaeralcea coccinea	0.00	66.67	0.00	0.00	0.00	P		P		P		P										P		P		P		P				P		P	
Townsendia exscapa	0.00	6.67	0.00	0.00	0.00																	P													
TOTAL NATIVE PERENNIAL FORBS	0.20	100.00	0.74	0.20	0.66	1		P		P		P		P		P		P		P		P		P		1		1		P		P		P	
NATIVE PERENNIAL GRASSES (cool)																																			
Agropyron smithii	0.00	6.67	0.00	0.00	0.00															P															
Oryzopsis hymenoides	0.07	26.67	0.25	0.07	0.22					P						P				P												1			
Sitanion hystrix	2.07	100.00	7.69	2.73	9.05	1		2		P		P	1	2		2	1	2		2		3	1	3		4	2	2	2	1	2	3	1	4	
Stipa comata	0.00	6.67	0.00	0.00	0.00																											P			
TOTAL NATIVE PERENNIAL GRASSES (c)	2.13	100.00	7.94	2.80	9.27	1		2		P		P	1	2		2	1	2		2		3	1	3		4	2	2	2	1	2	4	1	4	
NATIVE PERENNIAL GRASSES (warm)																																			
Bouteloua gracilis	6.47	100.00	24.07	8.80	29.14	4		4		5	3	4		5		4		7	1	5		5	1	11	5	8	4	8	4	11	7	11	3	5	7
Hilaria jamesii	0.00	13.33	0.00	0.00	0.00							P																						P	
TOTAL NATIVE PERENNIAL GRASSES (w)	6.47	100.00	24.07	8.80	29.14	4		4		5	3	4		5		4		7	1	5		5	1	11	5	8	4	8	4	11	7	11	3	5	7
NATIVE SUBSHRUBS																																			
Chrysothamnus greenei	0.20	66.67	0.74	0.20	0.66			P		P		P				1		P		P				1						P		P		1	
Gutierrezia sarothrae	0.53	93.33	1.99	0.60	1.99	P		P		P		P		1		1		P	1	P		2		1		1				1		P		1	
TOTAL NATIVE SUBSHRUBS	0.73	93.33	2.73	0.80	2.65	P		P		P		P		1		2		P	1	P		2		2		1				1		P		2	
NATIVE SHRUBS																																			
Artemisia tridentata	16.27	100.00	60.55	16.53	54.75	11		15		6		14		14		16	1	17		13	1	17	1	20		24		23	1	19		16		19	
Atriplex canescens	0.00	6.67	0.00	0.00	0.00	P																													
TOTAL NATIVE SHRUBS	16.27	100.00	60.55	16.53	54.75	11		15		6		14		14		16	1	17		13	1	17	1	20		24		23	1	19		16		19	
NATIVE TREES																																			
Pinus edulis	1.07	93.33	3.97	1.07	3.53			P		P		5		2		1		P		1		1		3		2		P		1		P		P	
TOTAL NATIVE TREES	1.07	93.33	3.97	1.07	3.53			P		P		5		2		1		P		1		1		3		2		P		1		P		P	
SUCCULENTS																																			
Coryphantha vivipara	0.00	13.33	0.00	0.00	0.00															P												P			
Opuntia phaeacantha	0.00	13.33	0.00	0.00	0.00	P																		P											
TOTAL SUCCULENTS	0.00	26.67	0.00	0.00	0.00	P														P				P								P			
BRYOPHYTES																																			
Moss spp.	0.07	40.00	0.25	0.13	0.44			P								1	1									P		P		P		P			
TOTAL BRYOPHYTES	0.07	40.00	0.25	0.13	0.44			P								1	1									P		P		P		P			

Continued on the next page

N14 SBRA - 2024 (Continued)

PLANT SPECIES	AVERAGE COVER (%)	FREQUENCY (%)	RELATIVE VEGETATION COVER (%)	AVERAGE COVER-ALL (%)	RELATIVE VEGETATION COVER-ALL (%)	Percent Foliar Cover																													
						1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
						1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
LICHEN/FUNGUS																																			
Lichen spp.	0.33	100.00	1.24	0.33	1.10	P		P		P		P		1		P		1		1		1		P		P		P		1		P		P	
TOTAL LICHEN	0.33	100.00	1.24	0.33	1.10	P		P		P		P		1		P		1		1		1		P		P		P		1		P		P	
Standing dead	18.00	100.00		18.00		17		18		25		12		20		17		20		36		21		9		11		13		20		13		18	
Litter	19.40	100.00		19.40		17		27		16		11		20		12		23		10		11		25		27		22		23		25		22	
Bare ground	35.33	100.00		35.33		49		34		48		54		35		45		30		32		39		27		22		31		23		31		30	
Rock	0.00	0.00		0.00																															
TOTALS	100.00		100.00	103.40	100.00	100	0	100	0	100	3	100	1	100	0	100	3	100	2	100	1	100	3	100	5	100	6	100	7	100	9	100	4	100	7
TOTAL VEGETATION COVER	26.87	s=(7.94)		30.20	s=(10.16)	17	0	21	0	11	3	23	1	24	0	25	2	26	2	21	1	28	3	39	5	40	6	34	7	33	9	31	4	30	7
GROUND COVER (Veg+Litter+St.Dead+Rock)	64.67	s=(9.67)		68.07	s=(11.63)	51	0	66	0	52	3	46	1	65	0	55	3	70	2	68	1	61	3	73	5	78	6	69	7	77	9	69	4	70	7
Allowable Ground Cover (per permit)	**64.67**	**s=(9.67)**				**51.0**		**66.0**		**52.0**		**46.0**		**65.0**		**55.0**		**70.0**		**68.0**		**61.0**		**73.0**		**78.0**		**69.0**		**77.0**		**69.0**		**70.0**	
SPECIES DENSITY (# of species/100 sq.m.)	12.07	s=(1.44)				11		13		12		13		11		12		12		14		11		13		10		11		10		15		13	

Noxious Cover	0
Annual Cover	0.00
Excess Annual Cover	0.00
Excess Litter (St Dead+Veg-Litter) (minus nc	0.00

To calculate Allowable Cover (per permit):

Subtract average absolute cover of noxious species (AZ & NN)

If average annual relative cover is greater than 10%, substract the average excess

If average litter cover exceeds live vegetation + standing dead, substract average excess litter (veg+stdead-litter)

ATTACHMENT 3.1

CERTIFICATION

PEABODY WESTERN COAL COMPANY
KAYENTA MINE, N9 COAL RESOURCE AREA, PHASE II BOND RELEASE APPLICATION
NAVAJO COUNTY, ARIZONA

I HEREBY CERTIFY that, to the best of my knowledge and belief, all applicable reclamation activities described in the attached Phase II Bond Release Application, dated March 6, 2025 have been accomplished in accordance with the reclamation requirements of the Act, the regulatory program, and the approved reclamation plan contained in the AZ-0001F Permit.

Peabody Western Coal Company

By: [signature]

Randy Lehn
Director Operations Support – Kayenta Mine

STATE OF ARIZONA

NAVAJO COUNTY

Signed or attested before me this 6th day of March 2025, by Randy Lehn, Director Operations Support of Kayenta Mine owned by Peabody Western Coal Company, a Delaware Corporation, on behalf of said Kayenta Mine.

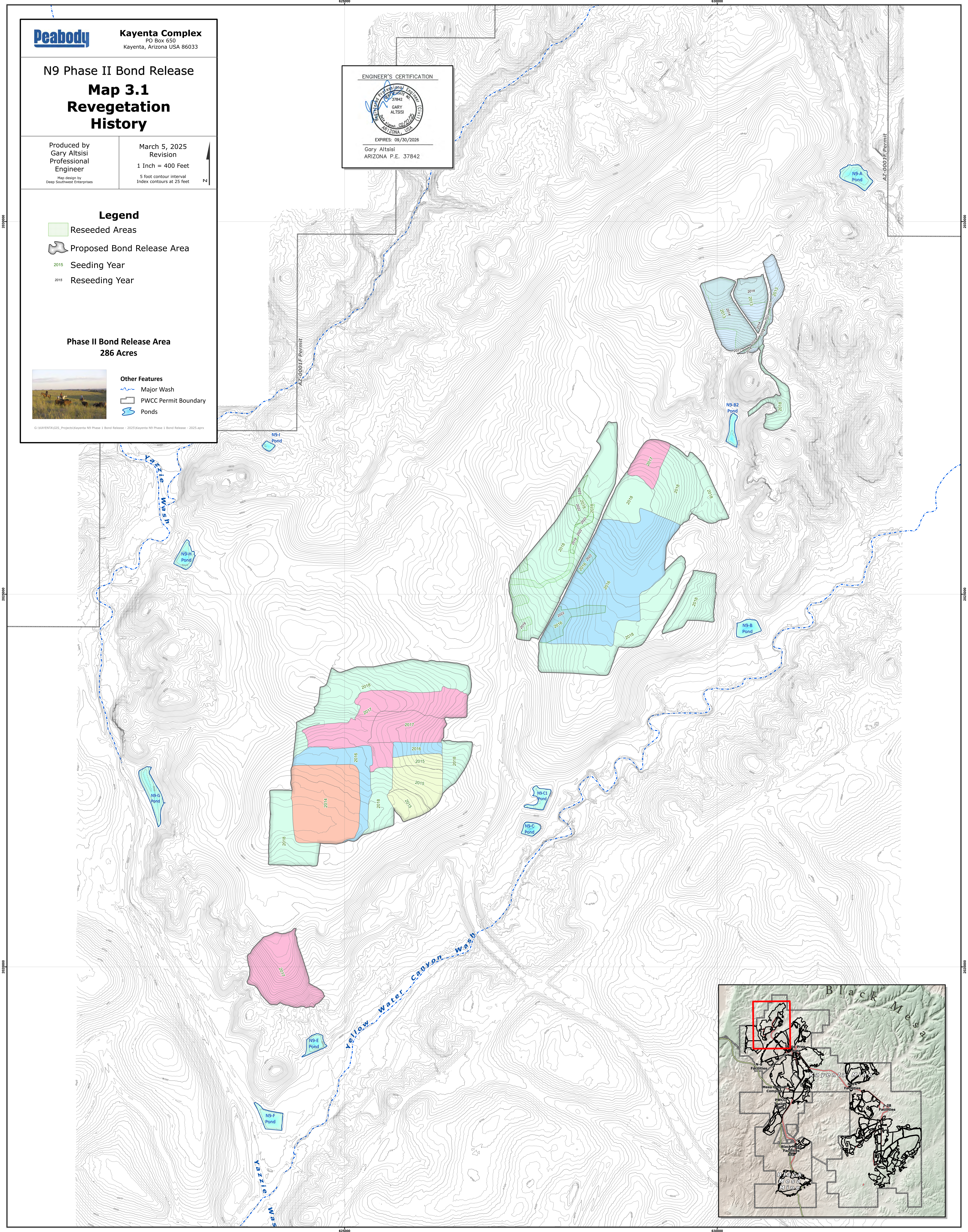
SUSIE CRANK
Notary Public - Arizona
Navajo County
Commission # 664886
My Comm. Expires Apr 5, 2028

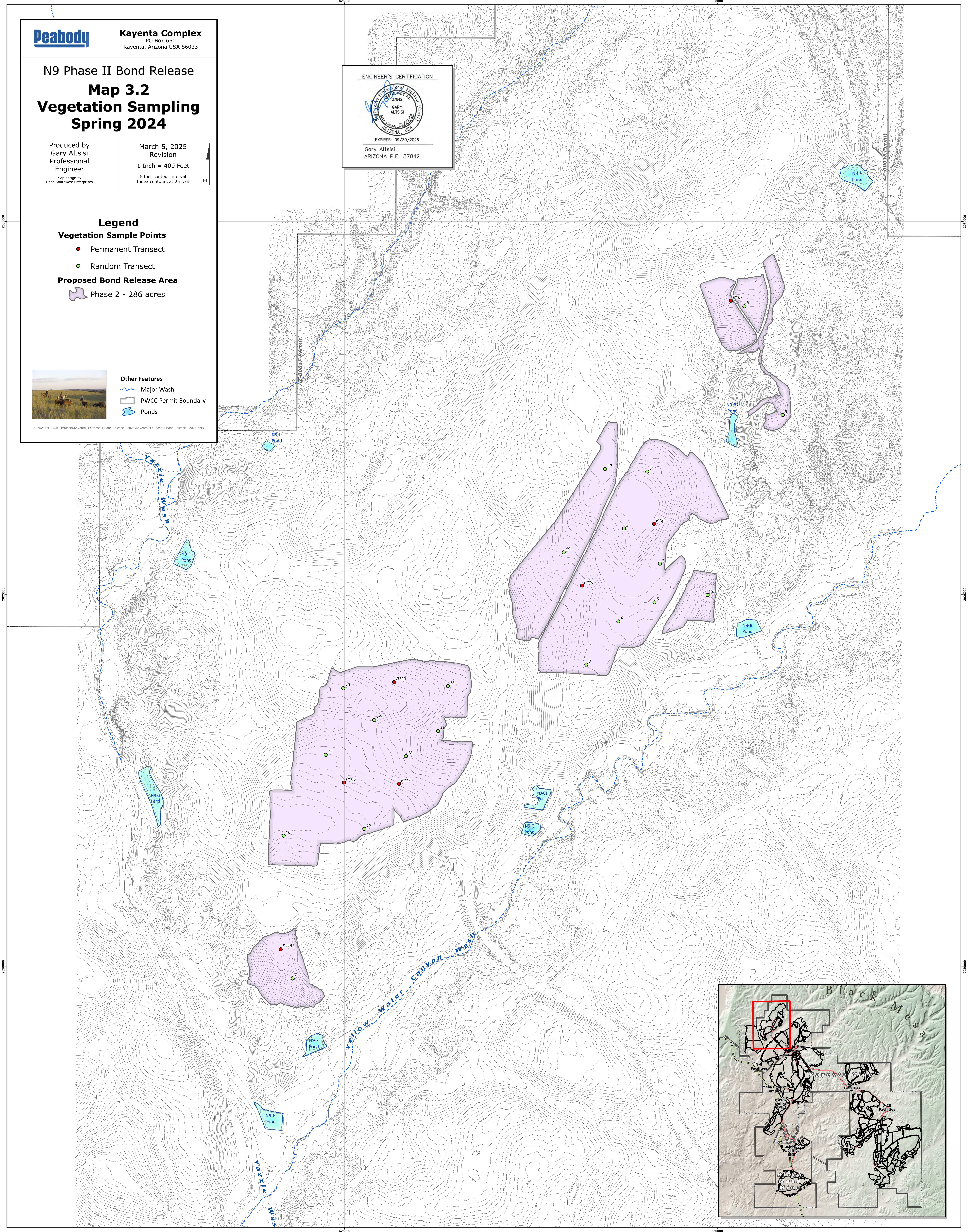
Susie Crank

Notary Public

My commission expires:

April 5, 2028


Peabody
Kayenta Complex
PO Box 650
Kayenta, Arizona USA 86033
N9 Phase II Bond Release
Map 3.1
Revegetation History
Produced by
Gary Altsisi
Professional Engineer
Map design by
Deep Southwest Enterprises
March 5, 2025
Revision
1 Inch = 400 Feet
5 foot contour interval
Index contours at 25 feet
N
Legend
Reseeded Areas
Proposed Bond Release Area
Seeding Year
Reseeding Year
Phase II Bond Release Area
286 Acres
Other Features
Major Wash
PWCC Permit Boundary
Ponds
ENGINEER'S CERTIFICATION
GARY
ALTSISI
37842
ARIZONA, USA
EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842
AZ-0001F Permit
Yazzie Wash
Yellow Water Canyon Wash
N9-A Pond
N9-B Pond
N9-B2 Pond
N9-C Pond
N9-C1 Pond
N9-E Pond
N9-F Pond
N9-G Pond
N9-H Pond
N9-I Pond
625000
630000
Black Mesa
Kayenta Mine



Peabody
Kayenta Complex
PO Box 650
Kayenta, Arizona USA 86033
N9 Phase II Bond Release
Map 3.2
Vegetation Sampling
Spring 2024
Produced by
Gary Altsisi
Professional
Engineer
Map design by
Deep Southwest Enterprises
March 5, 2025
Revision
1 Inch = 400 Feet
5 foot contour interval
Index contours at 25 feet
N
Legend
Vegetation Sample Points
Permanent Transect
Random Transect
Proposed Bond Release Area
Phase 2 - 286 acres
Other Features
Major Wash
PWCC Permit Boundary
Ponds
ENGINEER'S CERTIFICATION
Registered Professional Engineer (Civil)
37842
GARY
ALTSISI
ARIZONA, USA
EXPIRES: 09/30/2026
Gary Altsisi
ARIZONA P.E. 37842
625000
630000
AZ-0001F Permit
N9-A Pond
N9-B2 Pond
N9-B Pond
N9-I Pond
N9-H Pond
N9-G Pond
N9-C1 Pond
N9-C Pond
N9-E Pond
N9-F Pond
Yazzie Wash
Yellow Water Canyon Wash
P107
P124
P116
P123
P106
P117
P118
Black Mesa

Section 4. Phase II Bond Release Supporting Information

Suspended Solids Outside of the Permit Area

TABLE OF CONTENTS

Section 4. Phase II Bond Release Supporting Information

Suspended Solids Outside of the Permit Area

Introduction

Beginning in the early 1980's, Peabody Western Coal Company (PWCC) collected numerous measurements of suspended solids (Total Suspended Solids – TSS) in runoff events at sites established on the main washes and at small watersheds located on both reclaimed and un-mined areas within the leasehold. TSS values collected in runoff from runoff plots and small flumes contributed to the development of a surface water model (EASI) used to predict runoff and sediment loads from both un-mined and reclaimed mined lands at the Kayenta Mine. The following sections summarize the development of the EASI model and reference recent EASI modeling reports for reclaimed parcels adjacent to or within the Phase II parcels subject to this Phase II application in N9. Comparisons of measured and predicted sediment discharges and TSS concentrations collected at main channel monitoring sites, small un-mined watersheds, and in small, reclaimed parcels located within the Black Mesa and Kayenta Mines are also summarized. Based on the following discussions, PWCC is confident that runoff from these parcels will not contribute additional suspended solids to stream flow outside the permit area.

EASI Model Development

PWCC initiated a Small Watershed Study (SWS) monitoring program on Black Mesa in 1985, and continued monitoring through 1992. Details regarding study objectives and monitoring associated with the study are provided in Attachment 4 in Chapter 16, Hydrologic Monitoring Program in the AZ-0001F Permit Application Package (PAP). Several small watersheds located within reclaimed and undisturbed areas were instrumented with supercritical flow flumes and continuous flow recorders for collecting runoff, sediment (TSS) and water quality data. Rainfall data were collected using Belfort automated tipping bucket rain gauges located at the centroids of each watershed and direct reading rain gauges set up at various locations within each watershed. Total overland runoff and sediment yield data for individual storm events were collected from hillslopes in each watershed using runoff plots. Small flumes were also installed downstream of the plots and were instrumented with continuous stage recorders and automated samplers to measure runoff rates and TSS concentrations during runoff events. In addition, runoff rates and TSS concentrations were collected at sites located in the main channels (e.g., Moenkopi Wash) over many years as part of historic monitoring commitments contained in the Hydrologic Monitoring Program during the 1980s into the mid-1990s. The data results were utilized to calibrate the physically based runoff and sediment yield model named EASI (Erosion And Sediment Impacts - Zevenbergen et al., 1990; WET, 1990). EASI has been used to support Termination of Jurisdiction (TOJ) applications for mined areas reclaimed under the initial program rules (30 CFR Part 715) and bond release applications for mined areas reclaimed under the permanent program rules (30 CFR Part 816). The modeling results were used to support the first TOJ application submitted for the Kayenta Complex in March 1994 for the N1/N2 and J27 interim program reclaimed areas (PWCC, 1994). The 1994 TOJ application included the final report for the modeling project completed in August of 1993 (RCE, 1993).

The model was calibrated and verified using a two-step process and site-specific data collected as part of the Small Watershed Study. The EASI model was first calibrated and validated using total runoff volumes and sediment yields measured in the runoff plots along with rainfall data, followed by simulation of actual runoff hydrographs and corresponding sediment concentrations collected from the flumes considering measured storm durations and intensities. Soils and vegetative cover data measured in each plot and at select points in each watershed were also used in the model development process. Parameters that influence the model’s predictions of runoff and sediment were calculated from observed data or estimated through model testing. Other theoretical parameters such as rainfall interception storage and Manning’s “n” were estimated based on previous experience in the application of EASI at other surface mines in the Colorado Plateau region (WET, 1990).

EASI Model Sensitivity Analysis

The 1993 report provides a discussion of the influence of several key input parameters on its ability to duplicate measured hillslope and channel responses. Runoff and sediment yields (TSS) predicted by EASI are controlled by the short-duration, high-intensity rainfall events common to the area. The model tends to underpredict runoff and sediment yield response for small rainfall events (< 0.1 inches), especially on hillslopes where antecedent moisture, looseness of surface soils, wind and temperature can vary appreciably. For larger events, the small watershed study runoff plot and flume data were in good agreement with EASI model predictions based on the calibration and validation process utilized for optimizing model inputs.

The sensitivity of the EASI model to several input parameters was performed after completing the calibration and validation work. The analysis evaluated calibrated values for soil hydraulic conductivity, total ground cover, and both overland flow (hillslope) and channel flow detachment coefficients (erosion) by varying the input parameter values by percentages. Model response to these variations was evaluated on a unit runoff (inches) and sediment yield (tons/acre) basis at both hillslope and watershed scales. The analysis indicates runoff is not appreciably affected by cover at either a hillslope or watershed scale. For larger events, rainfall intensities are far higher than infiltration rates.

However, sediment yield from pre-mining and reclaimed hillslopes is highly sensitive to total ground cover and less sensitive to infiltration (hydraulic conductivity) and erosion (detachment coefficients). On a watershed scale, the differences between pre-mine and reclaimed sediment yield are less pronounced because channel sediment transport processes dominate at the watershed outlet.

Many of the required EASI model input parameters used for modeling runoff and sediment yield from watersheds at the Kayenta Mine were developed during the calibration and validation process because direct measurements were difficult to obtain and not readily available. However, ground cover percentages for modeling un-mined and reclaimed areas are based on field measurements of vegetative ground cover, litter and rock. These values are measured directly in the field and are required for demonstrating successful establishment of vegetation growth in the reclaimed parcels subject to this Phase II bond release application. Because predictions of sediment yields (including TSS concentrations) using EASI are sensitive to values of total ground cover, and are readily available, it follows that measurements of total ground cover in reclaimed areas may be used to indicate whether reclaimed areas are generating sediment yields, expressed as tons/acre on a unit basis or as individual TSS concentrations (mg/L), that may result in appreciable contributions of suspended solids to streamflow outside the permit area.

Table 4.1 presents average total ground cover used in previous EASI models to predict sediment yields in numerous reclaimed areas throughout the leasehold and provides a general description of the reclaimed areas modeled, drainage area, and average total ground cover used for modeling purposes. The values range from 38.2 percent to 65.6 percent. Of note, the EASI models that were developed for all reclaimed areas listed predicted average annual sediment yields less than or equal to pre-mining conditions. Importantly, the processes that dominate the sediment yield predictions involve sediment transport in channels, not erosion from hillslopes. Measurements of total ground cover during 2024 in the N9 reclaimed parcel subject to this application was 55.2 percent.(see Table 3.2 in Section 3.0). Accordingly, absent application of the EASI model to these parcels, the average total ground cover values indicate average annual sediment yields from these areas will be less than or equal to conditions that were present prior to mining these parcels.

Table 4.1. Total Ground Cover Values for Reclaimed Conditions used in Previous EASI Sediment Models

Reclaimed Area Modeled	Model Date (Month-Year)	Drainage Area (acres}	Total Ground Cover[1] (percent}
N1/N2	Aug-93	2732.5	41.2
J27	Aug-93	178.9	43.9
N7/N8	Jul-01	946.0	53.9
N14	Jul-08	1580.6	46.5
J21-D/J21-E	Aug-08	68.9	65.6
J16-E/J16-F	Aug-08	148.5	61.0
N6-C/N6-D/N6-F	Aug-08	280.9	38.2
J7-CD/J7-E/J7-F	Aug-08	99.8	48.5
J21-A	Apr-09	111.2	52.7
N6-G	Apr-09	37.9	55.6
J7-K/J7-M	Jun-09	37.3	55.2
N5-D/N5-E	Aug-09	28.3	48.9
J1/N6 and N6 East Central	Sep-09	1533.3	46.2
J21	Sep-10	2832.0	59.4
J7-A/J7-B1/J7-G/J7-H/ J7-I/J7-J/J7-R/J7-R1	Feb-11	440.0	55.2
J19	Sep-11	943.4	55.8
J3	Nov-12	95.5	39.9
J7	Nov-12	1194.7	48.7
Total Drainage Area Modeled =		**13289.7**	**49.9**[2]

[1] Total Ground Cover = Vegetation Ground Cover + Litter + Rock
[2] Weighted average of total ground cover over all 18 EASI models.

Following the 1994 TOJ application submittal, seventeen additional EASI models were developed for reclaimed parcels located within the Kayenta and Black Mesa Mines, including reclaimed watersheds upstream of temporary sediment ponds that were permitted as outfalls in the Kayenta Complex NPDES Permit No. NN-0022179. As of 2016, a total of 13,289.7 acres of reclaimed areas had been modeled using EASI. The combined total of topsoiled and seeded areas at both mines at the end of 2016 was 15,584 acres, of which approximately 85 percent were modeled using EASI. The following sections discuss EASI models that have been developed proximate to the N9 reclaimed parcels subject to this application.

Suspended Solids Outside of the Permit Area

J1/N6 EASI Sediment Yield Model

Attachment 4.1 contains an EASI model report entitled "Surface Water Modeling of the Reclaimed Parcels at Black Mesa Complex J1/N6 and N6 East Central Coal Resource Areas" (Ayres, 2009) for reclaimed areas situated south of the N9 reclaimed parcels. The results indicate average annual runoff (0.28 inches) generated from reclaimed hillslopes and low-order channels is less than pre-mining conditions (0.42 inches). The difference is attributed to the creation of several internal draining impoundments in the eastern portion of the N6 post-mining landscape. The model results indicate post-mine (reclaimed parcels) average annual sediment yields are about 65 percent less that pre-mine levels. Hillslope and sub-watershed erosion rates, which are significant for sustaining the post-mining land use, are 29 percent lower for the reclaimed landscape. Reclamation methods utilized in the N9 reclaimed parcels were like those evaluated in the J1/N6 EASI model. In addition, physical properties of the reclaimed watersheds within the J1/N6 areas, including mean channel slope, drainage density and mean hillslope gradients were similar to pre-mining conditions.

N14 EASI Sediment Yield Model

Attachment 4.2 contains the EASI model entitled "Surface Water Modeling of Reclaimed N14 Coal Resource Area at Kayenta Mine" (Ayres, 2008). The model results indicate post-mine (reclaimed parcels) average annual sediment yields are about 29 percent less than pre-mine levels. Hill slope and sub-watershed erosion rates, which are significant for sustaining the post-mining land use, are 30 percent lower for the reclaimed landscape The reduction of sediment yield is due to the decrease of hill slope erosion combined with channel erosion control measures for the post-mine landscape. Reclamation methods used in the N9 reclaimed parcels were like those evaluated in the N14 EASI model.

Total Suspended Solids

Soils replaced within the N9 reclaimed parcels, naturally occurring soils in surrounding undisturbed areas within the leasehold overall and in the arid/semiarid Southwest typically lack cohesion. Un-mined stream channels within and adjacent to the Kayenta Mine and PWCC leasehold consist of steep sided, deeply incised arroyos with loosely consolidated channel banks and fine-grained sand bed channels. Figure 4.1 from Blatt, Middleton, and Murray (1972) shows these types of soils (unconsolidated clays, silts and fine-grained sands) are easiest to keep in suspension. The gray band shown in Figure 4.1 represents the flow velocity ranges necessary to keep particle types and sizes in suspension. Above the gray band are the velocities necessary to erode or entrain soil particles, whereas velocities below the gray band would be insufficient to transport the particles and deposition would occur. The bandwidths for the clay and silt particle sizes are quite wide because considerably higher velocities are necessary to erode consolidated and cohesive clays and silts. For the unconsolidated non-cohesive silts, clays and fine-grained sands found on the leasehold, velocities of less than 2 feet/second will erode and keep the particles in suspension. Typical flow velocities measured historically in the stream channels on the leasehold including Dinnebito Wash (sites CG34 and SW34) and the main channels along Yucca Flat Wash, Coal Mine Wash, and Moenkopi Wash where monitoring sites SW155, SW25, and SW26 are located, respectively, range from 8 to 12 feet/second.

In the semiarid Southwest, much of the precipitation is effective in terms of producing runoff. Most of the rainfall occurs in short duration, very high intensity storms that rapidly overcome soil infiltration and generate larger amounts of runoff. Total annual rainfall on the PWCC leasehold ranges from 6 to 12 inches. Figure 4.2, from Langbein and Schumm (1958), shows the relationship of annual sediment yield to effective annual precipitation and cover in the U.S. Note the highest annual sediment yields occur where there is a combination of approximately 12 inches of effective precipitation and desert/shrub type cover. Both factors are consistent for the leasehold and for the undisturbed areas adjacent to the N9 reclaimed parcels. Because of the soil and rainfall characteristics and the vegetative cover for this geomorphic region, stream flows on the leasehold more closely approximate debris flows than they do stream flows.

Suspended Solids Outside of the Permit Area

Section 2.0, Comparisons with Measured Sediment Transport, in both EASI model reports provided in Attachments 4.1 (Ayres, 2009) and 4.2 (Ayres, 2011) contain a discussion of measured sediment discharge and TSS concentrations along with EASI-model derived sediment discharge and TSS concentrations. Measured values were collected over many years at main channel stream monitoring sites and at SWS flumes. Each EASI model report compares predicted values for sediment discharge and TSS concentrations for reclaimed areas modeled with measured values based on data plots (see Figures 2.1 and 2.2 in each model report). Overlap of model predictions for both pre- and post-mine conditions with measured data strongly indicate EASI model predictions are representative and reasonable. In addition, the plots indicate sediment loads and concentrations are dependent on the channel sediment transport capacity for small un-mined and reclaimed channels as well as larger channels draining larger basins. Channel sources of sediment in the semi-arid environment of the leasehold are virtually unlimited. Accordingly, channel transport capacity and channel-derived sediment limits and governs sediment discharge and TSS concentrations from the small tributaries and large sand-bed channels (e.g., Moenkopi Wash).

Section 4. Phase II Bond Release Supporting Information

Suspended Solids Outside of the Permit Area

Section 2.2 of each EASI model report (Attachments 4.1 and 4.2) also discusses statistical analysis of the sediment discharge and sediment concentration plots provided in Figures 2.1 and 2.2. The analysis involved applying non-parametric statistics to determine if channels in reclaimed areas have similar sediment transport characteristics as background (un-mined) channels. The analysis showed data collected at un-mined SWS flumes can be combined with the main channel monitoring site data, and that sediment is being conveyed at or near capacity. In addition, reclaimed channel sediment discharge and TSS concentrations show the same characteristics of the data collected at un-mined SWS flumes and main channel monitoring sites even though the flow ranges are lower. The data plots and statistical analysis indicate that channel flows within and adjacent to the leasehold achieve the sediment transport capacity of the channel regardless of whether they are located within reclaimed areas or in small and large basins that drain background watersheds not impacted by surface coal mining activities. Accordingly, runoff from any of the reclaimed parcels located within the N9 parcels subject to this Phase II bond release application are not contributing additional TSS to streamflow outside the permit area.

Alluvial Valley Floors

Chapter 17, Protection of the Hydrologic Balance, in the AZ-0001F PAP provides a summary of early investigations of the existence of alluvial valley floors (AVFs) within or adjacent to the leasehold. The findings clearly indicate there are no AVFs within or adjacent to the leasehold.

Surface and Subsurface Water Pollution

The regulations set forth under 30 CFR Parts 780 and 816 require operators to minimize impacts to the prevailing hydrologic balance. PWCC conducted mining and reclamation activities at the N9 reclaimed parcels subject to this Phase II bond release application in accordance with plans and procedures approved by the Office of Surface Mining Reclamation and Enforcement (OSMRE) as provided in the PAP for Surface Mining Permit AZ-0001F, many of which were developed to ensure impacts to the hydrologic balance in the vicinity were minimized. The changes to ground water (subsurface) are largely based on long term monitoring of ground water in monitoring wells completed in the Wepo Formation and adjacent alluvial deposits along Yellow Water Canyon Wash and Yazzie Wash. Changes to surface water (surface) are based on long term monitoring of runoff at stream sites located on Yellow Water Canyon Wash and Yazzie Wash. Changes in water chemistry discussed above cover decades of monitoring in many cases and are within magnitudes and ranges representative of naturally occurring or background values. In summary, no pollution of surface or subsurface sources of water has been found within or adjacent to the subject reclaimed N9 parcels shown on Map 1.1.

References Cited

Ayres Associates, 2009. “Surface Water Modeling of the Reclaimed Parcels at Black Mesa Complex J1/N6 and N6 East Central Coal Resource Areas”, Prepared for Peabody Western Coal Company.

Ayres Associates, 2008. “Surface Water Modeling of Reclaimed N14 Coal Resource Area at Kayenta Mine”, Prepared for Peabody Western Coal Company.

Blatt, H., Middleton, G., and Murray, R., 1972. Origin of Sedimentary Rocks, Prentice-Hall, Englewood, New Jersey, 634 p.

Langbein, W.B. and Schumm, S.A., 1958. Yield of Sediment in Relation to Mean Annual Precipitation, American Geophysical Union, Trans., Volume 39, p. 1076-1084.

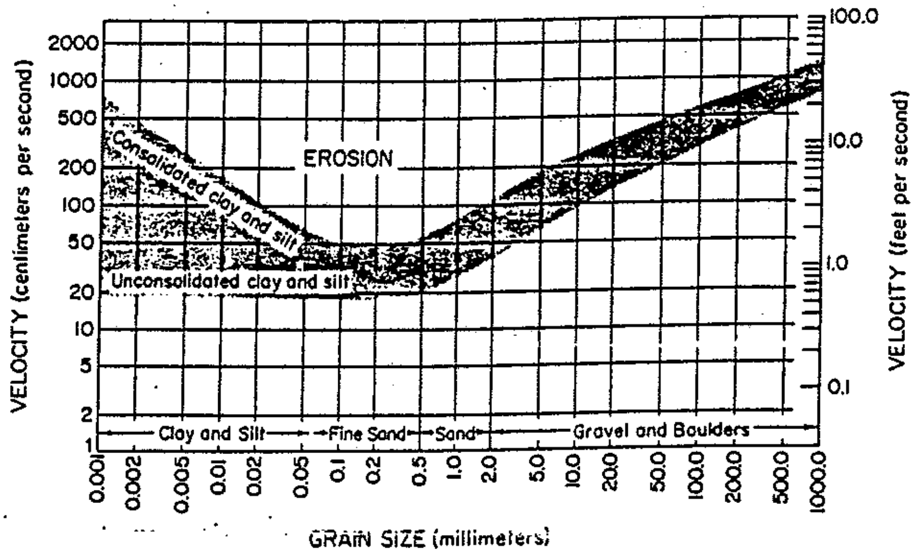
Peabody Western Coal Company (PWCC), 1994. “Application for Release of Reclamation Liability N-1/N-2 and J-27 Interim Program Indian Lands”, submitted to the Office of Surface Mining Reclamation and Enforcement Albuquerque Field Office on March 31, 1994.

Resource Consultants & Engineers, Inc. (RCE), 1993. “Surface Water Modeling of Reclaimed Parcels at the Black Mesa Complex”, Prepared for Peabody Western Coal Company.

Water Engineering & Technology, Inc. (WET), 1990. “Determination of Background Sediment Yield and Development of a Methodology for Assessing Alternative Sediment Control Technology at Surface Mines in the Semiarid West,” Prepared for Office of Surface Mining and the National Coal Association, Fort Collins, CO.

Zevenbergen, L.W., Peterson, M.R., and Watson, C.C., 1990. “Computer Simulation of Watershed Runoff and Sedimentation Processes”, Proceedings of the Billings Symposium; Planning, Rehabilitation and Treatment of Disturbed Lands.

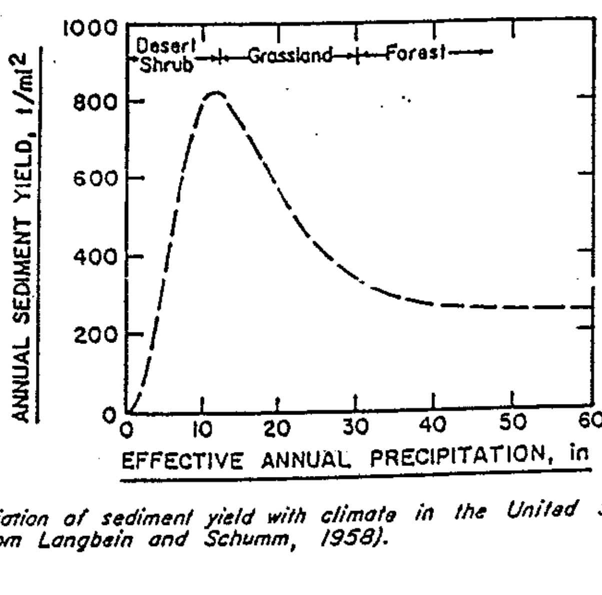
Figure 4.1



Hjulstrom's diagram, showing critical velocity for movement of quartz grains on a plane bed at a water depth of one meter, as modified by Sundborg (1956). The shaded area indicates the scatter of experimental data. There are very few reliable data in the clay and silt region.

(from Blatt, Middleton and Murray, 1972)

Figure 4.2



Variation of sediment yield with climate in the United States (from Langbein and Schumm, 1958).

SURFACE WATER MODELING OF THE RECLAIMED PARCELS AT BLACK MESA COMPLEX J1/N6 AND N6 East Central COAL RESOURCE AREAS

Prepared for

Peabody Western Coal Co.
Highway 160, Navajo Route 41
Kayenta, Arizona 86033

AYRES ASSOCIATES

SURFACE WATER MODELING OF THE RECLAIMED PARCELS AT BLACK MESA COMPLEX J1/N6 AND N6 EAST CENTRAL COAL RESOURCE AREAS

Prepared for

Peabody Western Coal Co.
Highway 160, Navajo Route 41
Kayenta, Arizona 86033

AYRES ASSOCIATES
P.O. Box 270460
Fort Collins, Colorado 80527
(970) 223-5556, FAX (970) 223-5578

Ayres Project No. 32-1304.01
PEA-N6EC.DOC

September 2009

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. RECLAIMED PARCEL MODELING

1.1 Introduction

The purpose of this project is to use a previously calibrated and validated runoff and erosion model EASI - Erosion And Sediment Impacts (Zevenbergen et al. 1990; WET 1990) for the Black Mesa and Kayenta Mines (combined as Black Mesa Complex in December 2008) to predict mean annual runoff and sediment yields from the reclaimed parcel J1/N6 and N6 East Central. Since the model for the J1/N6 Coal Resource Area (CRA) was completed in 2001, the objectives of this project are to review the completed J1/N6 model, develop a model for the neighboring N6 East Central CRA, and incorporate the newly developed N6 East Central model into the existing J1/N6 model. The response of the reclaimed parcels was evaluated relative to undisturbed (premine) conditions in the corresponding undisturbed watersheds. All soils and rainfall input to the model are to be taken from models calibrated in the previous study (RCE 1993). The input variables that were calibrated to the mine areas and used in this study include soil infiltration parameters, erodibility parameters, and the grain size distribution. Parameters that are specific to this study are vegetative canopy and ground cover percentages from data collected on site. The model serves a tool for assessing the success of reclamation efforts to protect hydrologic balance (30 CFR 715.17 and 30 CFR 816.41).

The model calibration was conducted in a previous study (RCE 1993) using data obtained from instrumented watersheds and small hillslope plots collected under natural rainfall conditions. For a detailed discussion of data collection and model calibration, please refer to the previous study (RCE 1993).

1.2 Background

The J1/N6 and N6 East Central CRA that is the focus of this project was reclaimed between 1981 and 2007. This reclaimed area is now eligible for termination of jurisdiction from the Office of Surface Mining Regulation and Enforcement (OSMRE). The fundamental purpose of this study was to quantify the expected behavior and hydrologic response of the current conditions of reclaimed areas relative to the conditions that existed prior to the occurrence of mining activities.

Runoff and sediment yield response from the reclaimed lands should be managed by implementing Best Management Practices (BMP's) in conjunction with an OSM approved sediment control plan in order to not adversely impact the prevailing hydrologic balance and to limit additional contributions of suspended sediment to streamflow or runoff outside the mine permit areas. BMP's include regrading, replacing salvaged topsoil, revegetation, and other controls such as riprapped channel bottoms, check dams, and where practicable, contour terraces. The natural watersheds on the mesa contribute significant quantities of sediment to the channel system. It is expected that the postmine condition will also produce comparable amounts of sediment without adversely impacting the hydrologic balance.

This section describes the data and procedures used to evaluate the CRA J1/N6 and N6 East Central. This area was modeled to determine the average annual hydrologic response following the completion of reclamation activities and maturation of the reclaimed area vegetation taking into account BMP's implemented as part of the reclamation process. Infiltration, runoff, and erosion processes from both hillslopes and channels within the CRA were modeled using EASI. Results were determined for concentration points at the outlets of the reclaimed watersheds. The locations of these points are shown in **Exhibit 1**. Modeling was also conducted to determine hydrologic response under premine conditions based on the topography, soils, cover, and other conditions that typified the undisturbed watersheds draining to each concentration point. **Exhibit 2** shows the modeling endpoints for the J1/N6 and N6 East Central premining watersheds.

1.3 Data

1.3.1 Soils

Soils data used for the current study (CRA J1/N6 and N6 East Central) were based on data developed from the calibration of models used in the previous study for Coal Resource Areas (CRAs) N1/N2 and J27 (RCE 1993). The composition of postmine soil in the current study is depicted along with the composition of postmine soils from the previous study in **Figure 1.1**. This figure shows that the soil composition of CRA J1/N6 and N6 East Central is very similar to soils evaluated during model calibration. Therefore, the soil properties developed in the previous study are valid for this modeling project. These properties include calibrated parameters, such as infiltration and erodibility coefficients, and measured soil size distributions. **Table 1.1** lists the premine and postmine soils data used during EASI modeling of CRA J1/N6 and N6 East Central.

1.3.2 Vegetation

Vegetative cover data representative of both pre- and postmine conditions in CRA J1/N6 and N6 East Central were supplied by PWCC. For the premine condition, land was characterized as being covered by sagebrush or pinon juniper. The spatial distribution of vegetative cover for the J1/N6 and N6 East Central CRA premine condition appears in **Figure 1.2**. Average cover properties for CRAs N1/N2 and J27 of the previous study and CRA J1/N6 and N6 East Central of the current study appear in **Table 1.2**. For the postmine condition, the reclaimed area was assigned the postmine cover type and the unmined area was assigned the same cover type as the premine condition. **Table 1.3** lists the pre- and postmine vegetative cover data used in the EASI model runs generated for the J1/N6 and N6 East Central CRA. Note that if a unit contained significant portions of both sagebrush and pinon juniper cover types, it was classified as half pinon juniper and half sagebrush.

1.3.3 Topography

Pre- and postmine topography was supplied by PWCC in the form of ArcGIS geodatabase. Basin delineations, hillslope delineations, subwatershed delineations, as well as areas, slopes, and lengths of all units of the study area were defined and calculated using ArcGIS software. **Figures 1.3 and 1.4** show the watershed delineation and numbers assigned to the basins used in the EASI model for the post- and premine conditions, respectively. Channel dimensions input to EASI were based on the topography supplied and limited field observations.

1.4 Methodology

Runoff and sediment yield in the semiarid western United States is largely governed by the occurrence of high-intensity, short-duration rainstorms of limited areal extent (Renard and Simaton 1975). Research has indicated that relatively few events may produce the greatest erosion (e.g., Hjelmfelt et al. 1986 reported that only 3 to 4% of rainfall events accounted for 50% of long-term sediment yields). Although there is perhaps a relatively limited physical basis for definition of an "average annual" runoff or sediment yield in a semiarid environment due to the extreme variability in response and importance of single infrequent events, such a term does provide a useful basis for long-term comparison between reclaimed and undisturbed conditions.

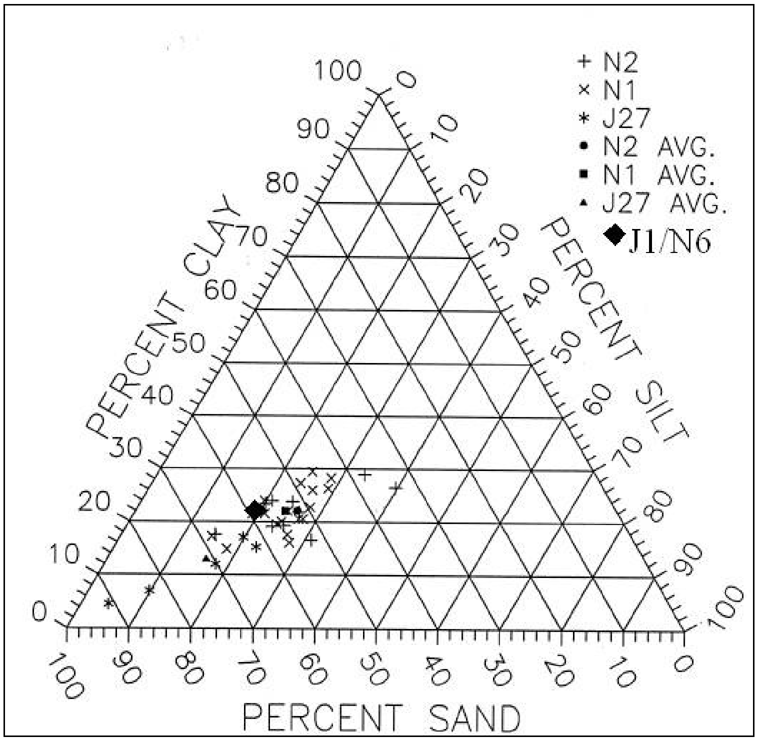


Figure 1.1. Reclaimed area soils trilinear graph.

Table 1.1. Soils Data.			
Condition	Premine	Postmine	Rock Chutes
Rainfall detachment	0.005	0.005	0
Overland flow detachment	0.44	0.44	0
Channel flow detachment	0.5	0.5	0
Initial soil moisture, %	70	70	70
Final soil moisture, %	90	90	90
Soil porosity, %	45	45	46
Temperature, *F	70	70	70
Hydraulic conductivity, in/hr	0.23	0.29	0.3
Capillary suction, in	3.7	2.6	2.6
	Particle Size Distribution (all conditions)		
	Size, mm	% Finer	
	0.001	0	
	0.004	18.0	
	0.016	27.4	
	0.062	36.6	
	0.125	56.2	
	0.250	64.3	
	0.500	72.4	
	1.000	80.5	
	2.000	88.6	
	4.000	92.4	
	16.000	100	

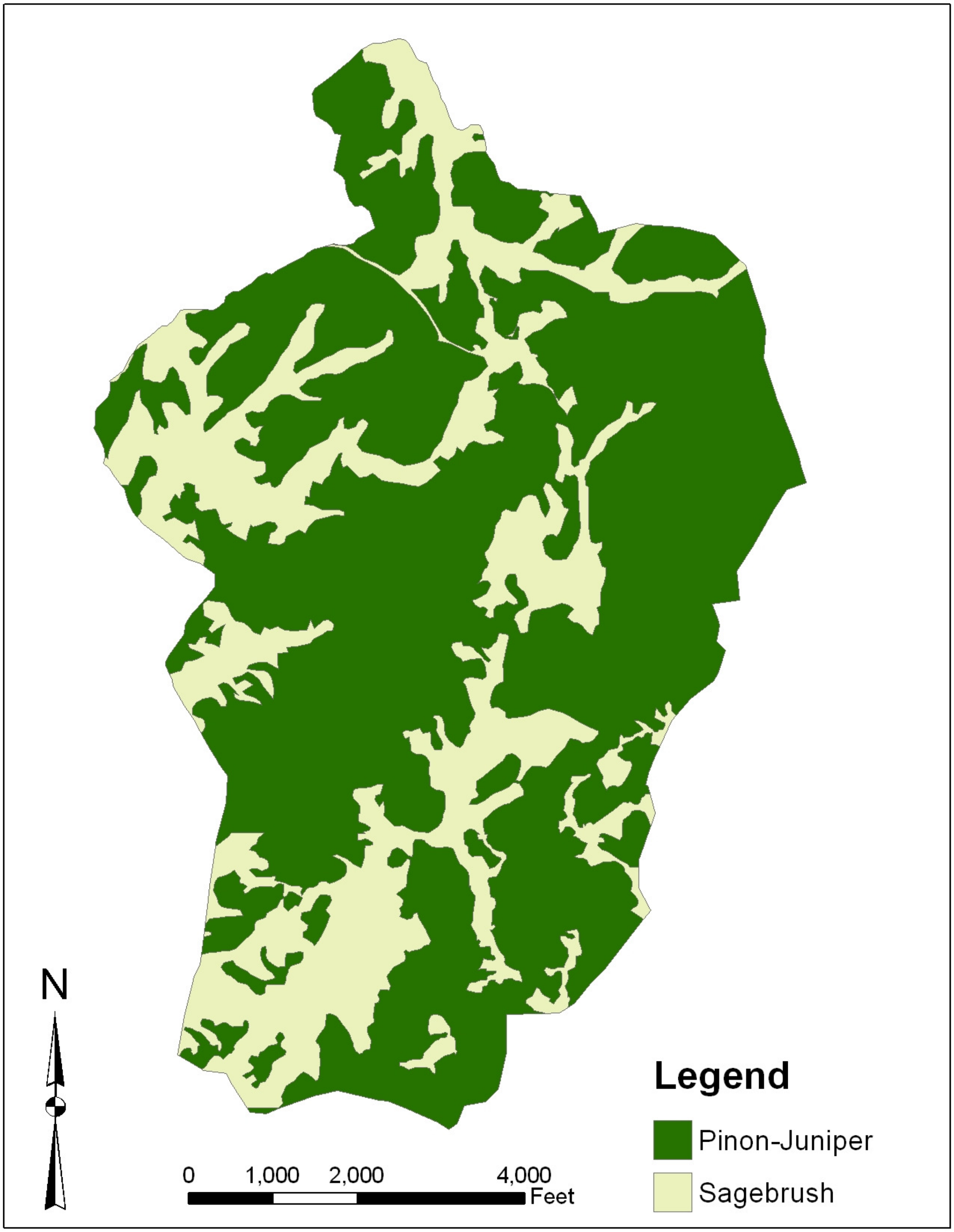


Figure 1.2. Vegetative cover for CRA J1/N6 and N6 East Central premine condition.

Table 1.2. Cover Sampling Data.								
Area	Condition	Cover Type	Nonstratified Vegetation Cover (%)	Vegetation Canopy Cover (%)	Vegetation Ground Cover (%)	Litter* (%)	Rock (%)	Total Ground Cover (%)
N1/N2	Postmine	Postmine	25.6	1.4	24.2	13.6	4.2	41.9
J1/N6	Postmine	Postmine	20.6	0.3	20.4	21.6	4.2	46.2
N1/N2/J27	Premine	Pinon Juniper	32.7	31.1	3.0	44.0	19.7	66.7
J1/N6	Premine	Pinon Juniper	16.9	14.6	2.7	18.8	17.3	38.8
N1/N2	Premine	Sagebrush	25.1	16.0	10.3	25.3	18.1	53.7
J27	Premine	Sagebrush	30.6	9.7	22.0	24.0	1.6	47.6
J1/N6	Premine	Sagebrush	12.4	1.3	11.2	24.7	2.5	38.3
*Including standing dead litter								

Table 1.3. Cover Data for J1/N6 and N6 East Central Watersheds.				
Condition	Pinon Juniper	Sagebrush	Half Pinon Juniper-Half Sagebrush	Postmine
Canopy cover, %	14.6	1.3	8.0	0.3
Ground cover, %	38.8	38.3	38.5	46.2
Canopy storage, in	0.05	0.05	0.05	0.05
Ground storage, in	0.05	0.05	0.05	0.05
Depression storage, in	0.03	0.03	0.03	0.03
Impervious area, %	0	0	0	0
Manning n	0.07	0.07	0.07	0.05

To make comparisons between reclaimed lands and associated undisturbed lands at the Black Mesa Mining Complex on the basis of average annual sediment yield, a procedure was used that considers the importance of infrequent storm events in defining sediment yield in the semiarid west. First, however, the site-specific rainfall data available for the Black Mesa Mining Complex were used to evaluate the frequency and magnitude of the measured events relative to existing predictions for rainfall depth-duration (Miller et al. 1973). The analysis of the rainfall data was performed as part of a previous study of the N1/N2 and J27 CRAs (Resource Consultants and Engineers 1993).

Comparisons between runoff and sediment yield from undisturbed and reclaimed areas in CRA J1/N6 and N6 East Central were developed for specific modeling endpoints shown in Exhibits 1 and 2. Mining and reclamation activities did not exactly replicate the topography, drainage network, or drainage areas that existed prior to mining. Consequently, direct comparisons of total runoff and sediment yield cannot be made between undisturbed and reclaimed response at a given point in a watershed. Comparisons were made on the basis of unit rates of runoff (inches) and sediment yield (tons/acre) at the various modeling computation endpoints. Although the same disturbance boundary was used to define the extent of both pre- and postmine conditions, the topographic differences that resulted after mining and reclamation occurred in the J1/N6 and N6 East Central CRA dictated that some areas would be included or excluded from the modeling. The total area modeled for premine conditions is 1499.7 acres (Exhibit 2) and for postmine conditions is 1533.3 acres (Exhibit 1).

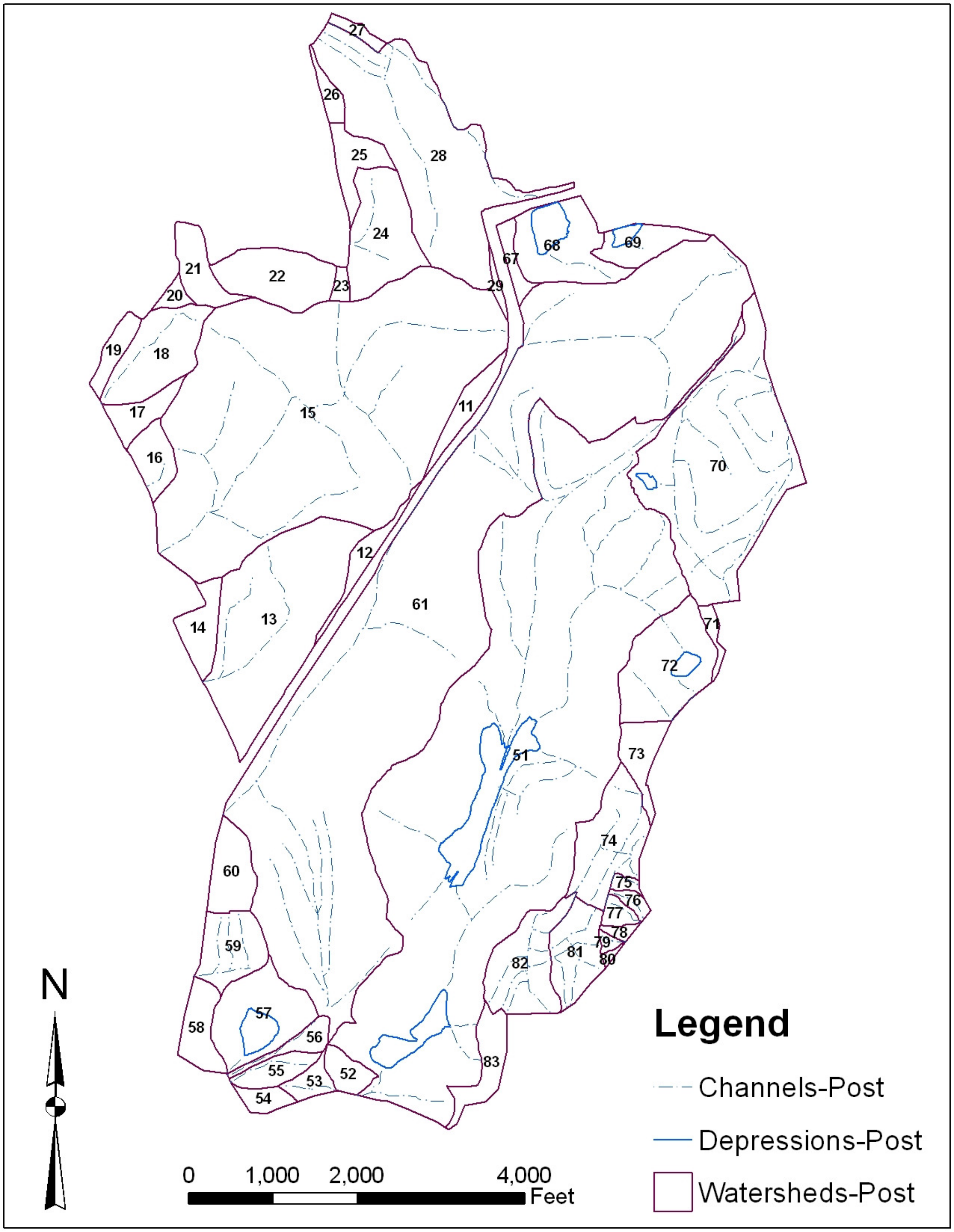


Figure 1.3. J1/N6 and N6 East Central postmine basins.

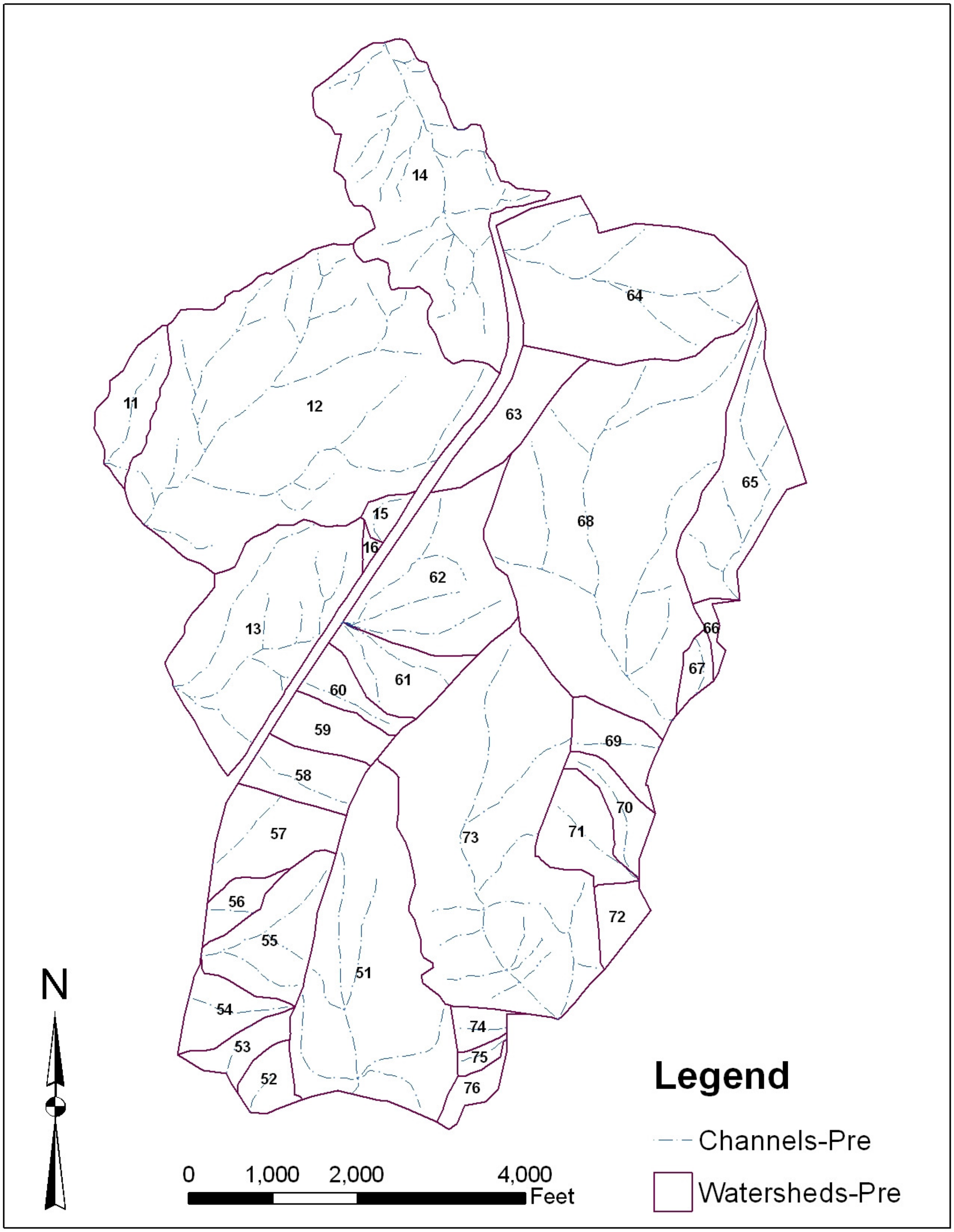


Figure 1.4. J1/N6 and N6 East Central premine basins.

1.4.1 Synthetic Rainfall

Synthetic storms of 2-, 5-, 10-, 25-, 50-, and 100-year return periods were used as input to the EASI model. Actual hyetographs were taken from the previous study (RCE 1993) and are based on both local data collection and the NOAA Atlas (Miller et al. 1973).

1.4.2 Computation of Average Runoff and Sediment Yield

The EASI model was used to evaluate runoff and sediment yield from a series of storm events having recurrence intervals of 2-, 5-, 10-, 25-, 50-, and 100 years. To define average annual conditions, the average annual runoff and sediment yield generated from storm events were computed using the commonly used equation of Lagasse et al. (1985).

1.5 Results

Figures 1.3 and 1.4 show the post- and premine basin delineations. Since the individual subareas differ in number, acreage and outlet locations, a direct comparison is not possible on a subarea basis. Therefore, the best way to compare the results is on an average basis for the CRA. **Table 1.4** shows pre- and postmine drainage area, runoff, and sediment yield for the J1/N6 and N6 East Central CRA. Runoff is defined as the total volume of water leaving the CRA on an average annual basis and, therefore, does not include water stored in depression areas and ponds. For the premine condition, this is equal to the amount of water that drains off the hillslopes and subwatersheds because there are no ponds or significant depressions. For the postmine condition, this is equal to the amount of hillslope runoff less the amount stored in ponds. Similarly, the sediment yield is the amount of eroded material that leaves the CRA on an average annual basis computed using the equation of Lagasse et al. (1985). The sediment yield is the production from the hillslope areas and erosion from the channels. The amount of erosion is the sediment yield from the hillslopes and subwatersheds only and does not include channel erosion, channel deposition or sediment trapped in ponds. Sediment yield can be greater or less than erosion, depending on the amount of channel erosion and the capacity of the channel network to convey sediment off the leasehold.

For the postmine condition, sediment yield is substantially less than the premine condition. Sediment yield is approximately one-third of the premine amount. Runoff is the same as the premine amount for the N6 East Central CRA, while runoff for postmine is much smaller than the premine amount for the J1/N6 CRA. The amount of hillslope runoff is virtually the same between pre- and postmine conditions and the difference between the runoff leaving the CRA is due to ponds and depressions storing water in the postmine condition. Hillslope and subwatershed erosion rates are lower for reclaimed (postmine) conditions due to more effective hydrologic cover and channel erosion control measures.

1.6 Discussion

Table 1.5 gives an overview of the geometric properties of the pre- and postmine topographies for the J1/N6 and N6 East Central CRA. The geometric properties for the postmine condition are similar to the premine condition.

Table 1.4. Average Runoff and Sediment Yield Results.					
Area	Condition	Drainage Area (ac)	Runoff (in)	Sediment Yield (t/ac/yr)	Erosion (t/ac/yr)
J1/N6	Premine	1024.8	0.42	3.79	1.74
J1/N6	Postmine	1039.7	0.22	1.32	1.22
N6 East Central	Premine	474.9	0.42	3.68	0.80
N6 East Central	Postmine	493.6	0.42	1.61	0.65
Combined	Premine	1499.7	0.42	3.76	1.44
Combined	Postmine	1533.3	0.28	1.41	1.03

Table 1.5. Average Physical Properties of the J1/N6 and N6 East Central CRA.		
	Premine	Postmine
Total Area (ac)	1499.7	1533.3
Total Channel Length (ft)	112,844	116,293
Mean Channel Slope	0.0563	0.0576
Drainage Density (mi/mi^2)	9.1	9.2
Mean Hillslope Length (ft)	269	320
Mean Hillslope Gradient	0.1171	0.1149

2. COMPARISONS WITH MEASURED SEDIMENT TRANSPORT

As discussed in Section 1, PWCC has monitored flow and sediment on the main channels, principal tributaries and small watersheds within the leasehold. These data, along with the runoff plots, were used to calibrate the EASI model soil erodibility and infiltration input variables. **Figures 2.1** and **2.2** show sediment transport and sediment concentration versus discharge for measured unmined (background), measured reclaimed, J1/N6 and N6 East Central's modeled unmined (premine) and modeled reclaimed (postmine) data. Although there is significant scatter shown in the data (as is expected with any sediment transport conditions), there are several conclusions that can be drawn from this data.

The open symbols in both figures depict measured data and whether the data were collected from reclaimed areas (the small watershed study) or from unmined or background surface water monitoring stations. The range of flows is generally greater for the background data but there is significant overlap between the two data sets between 0.1 cfs and 100 cfs. This is because the reclaimed data are from small watersheds and the unmined data are from channels draining larger basins. These data show the same trend for sediment transport and sediment concentration over the entire range of flows and very close agreement in the area of discharge overlap. This, in itself, is strong evidence that (1) the sediment yields are channel transport capacity limited, (2) overlap of model predictions for both pre- and postmine conditions with measured data strongly indicate that EASI model predictions are representative and reasonable, and (3) sediment yields from reclaimed areas will not be additive to yields on the receiving streams.

The closed symbols depict data from J1/N6 and N6 East Central's pre- and postmine EASI model runs. They represent data generated by EASI for both subwatersheds and channels for peak discharges resulting from 2-, 5-, 10-, 25-, 50- and 100-year storms. Using the peak flows from extreme events results in discharges that generally exceed 10 cfs. The trend of the model-derived data is similar and the ranges of concentration and sediment transport are similar to the measured data and between pre- and postmine conditions.

The sediment discharge plot (Figure 2.1) shows a stronger trend because it is plotting discharge (sediment) against discharge (flow). This is expected because the sediment discharge does depend on flow discharge. The concentration plot (Figure 2.2) shows the two separate variables and, therefore, a less significant trend. PWCC believes that data measurement may have some influence on the scatter (outliers were removed), but the process variability is probably the major influence. The majority of the data, however, fall in a group centered on 100 cfs and 100,000 mg/l, both in the observed data and in the model results. These plots support the use of the EASI model, the results of the modeling, the conclusion that sediment yields from reclaimed areas are not additive to receiving stream sediment loads, and that sediment impacts to the prevailing hydrologic balance have been minimized.

From Figures 2.1 and 2.2 it is apparent that sediment loads and concentrations are dependent on the channel sediment transport capacity for both pre- and postmine conditions. Channel sources of sediment in this arid environment are virtually unlimited. Therefore, channel transport capacity and channel derived sediment limits and governs sediment yields from the small tributaries, large channels and the CRA as a whole. The similarity of sediment discharge (or concentration) between pre- and postmine conditions appears to be inconsistent with the lower rates of sediment yield shown in Table 1.4.

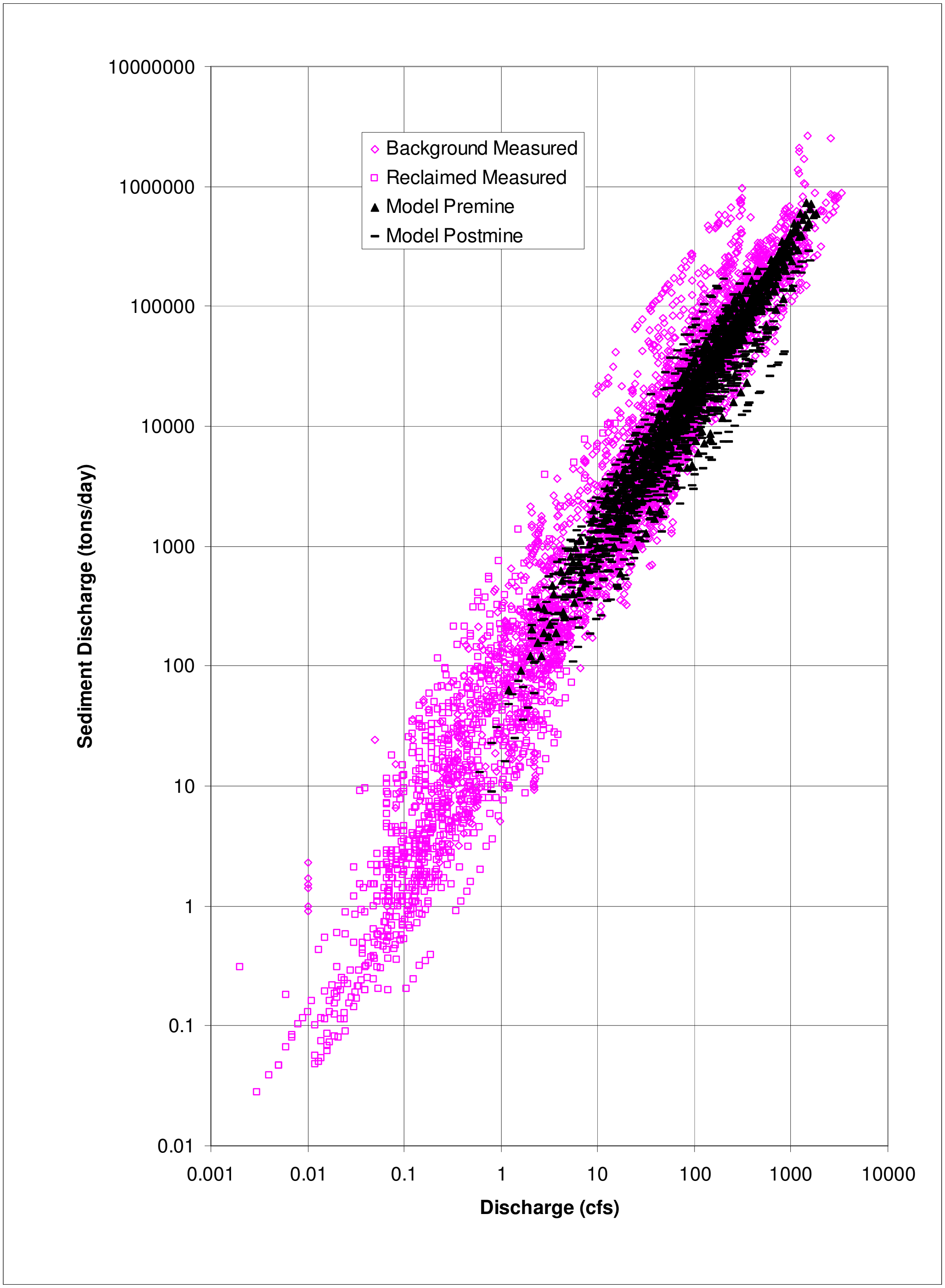


Figure 2.1. Observed and modeled sediment discharge and water discharge.

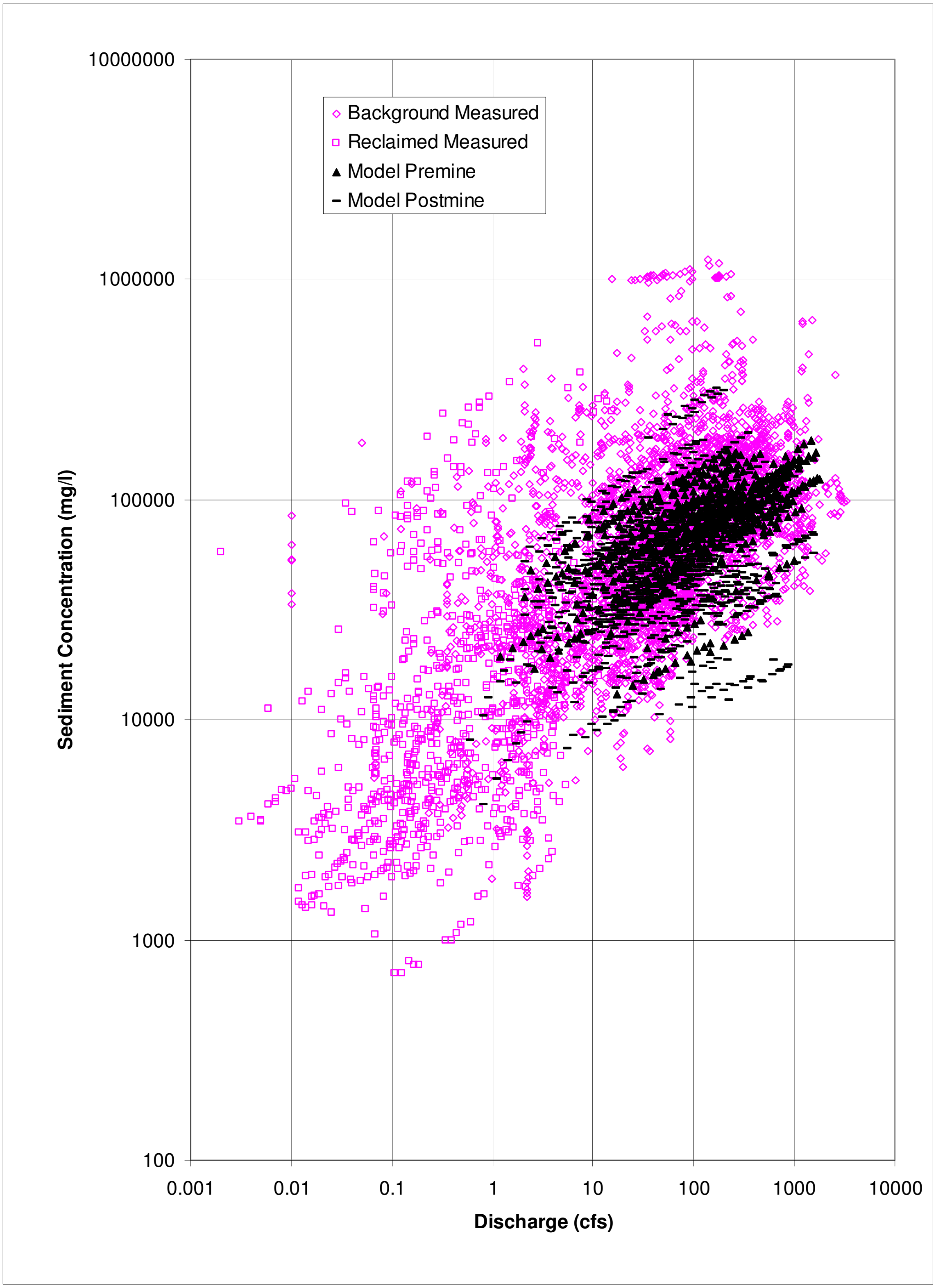


Figure 2.2. Observed versus modeled sediment concentration and discharge.

However, the sediment yield shown in Table 1.4 is the amount of sediment leaving the CRA whereas the sediment discharge shown in Figure 2.1 is the peak rate of sediment in transport occurring in any channel on the CRA, whether the channel is located upstream or downstream of a pond. Therefore, with or without the ponds trapping sediment or storing water, the mine reclamation is not contributing additional sediment to the receiving streams and sediment impacts to the prevailing hydrologic balance have been minimized.

Smith and Best (2000) analyzed the measured data (background and reclaimed) shown in Figure 2.1 to develop an approach that can be used to determine if channels in reclaimed areas have similar sediment transport characteristics as background channels. The method that they used was to develop Sen lines (Sen 1968) and confidence intervals around the data. The slope of the Sen line is a non-parametric statistic computed as the median slope of all possible slopes determined from pairing all the data points. The Sen line is drawn through the median coordinate of the data. Smith and Best first showed that the large channel flume data (background) and the small watershed background data could be combined. They concluded that since the data from one data set fall within the Sen line bounds of the other data set then the two data sets are merely extensions of each other and could be combined. Also, because the main channel and background small watershed site data could be combined, it indicated there is an unlimited supply of sediment and the channels are conveying sediment at (or near) capacity. The Sen line and bounds are shown with the background measured data in **Figure 2.3**.

They then plotted the reclaimed measured data (**Figure 2.4**) with the Sen line and bounds from the background data to show that the reclaimed data have the same characteristics even though the flow range of the measurements is lower. The data indicate that channel flows in this environment achieve the sediment transport capacity of the channel, whether in reclaimed or background conditions.

Using the same approach with the modeled data generated for the CRA, **Figures 2.5 and 2.6** show the pre- and postmine computed sediment transport rates with the Sen lines and bounds. One difference between the plots is that the measured data occur throughout the flow hydrograph whereas the modeled data are tabulated at the peak of the simulation flow hydrograph. The premine data plot (Figure 2.5) shows the data grouped densely around the Sen line and well within the bounds. The postmine data (Figure 2.6) also plot closely around the Sen line and well within bounds. On these graphs data plotting below the Sen line indicate that there is less sediment in transport for a given discharge.

Several conclusions can be drawn from these data plots: (1) EASI model well replicates erosion and sediment transport processes at the mine site for background and reclaimed conditions, (2) all data show similar trends and are within the same bounds, (3) data trends indicate that channels are transporting sediment at or near capacity, and (4) amounts of sediment leaving the CRA for postmine conditions are similar to premine conditions and within the range expected for the background conditions. Therefore, the overall conclusion is that the postmine reclaimed condition in the J1/N6 and N6 East Central CRA is not contributing additional suspended solids to receiving streams, and related impacts to the hydrologic balance have been minimized.

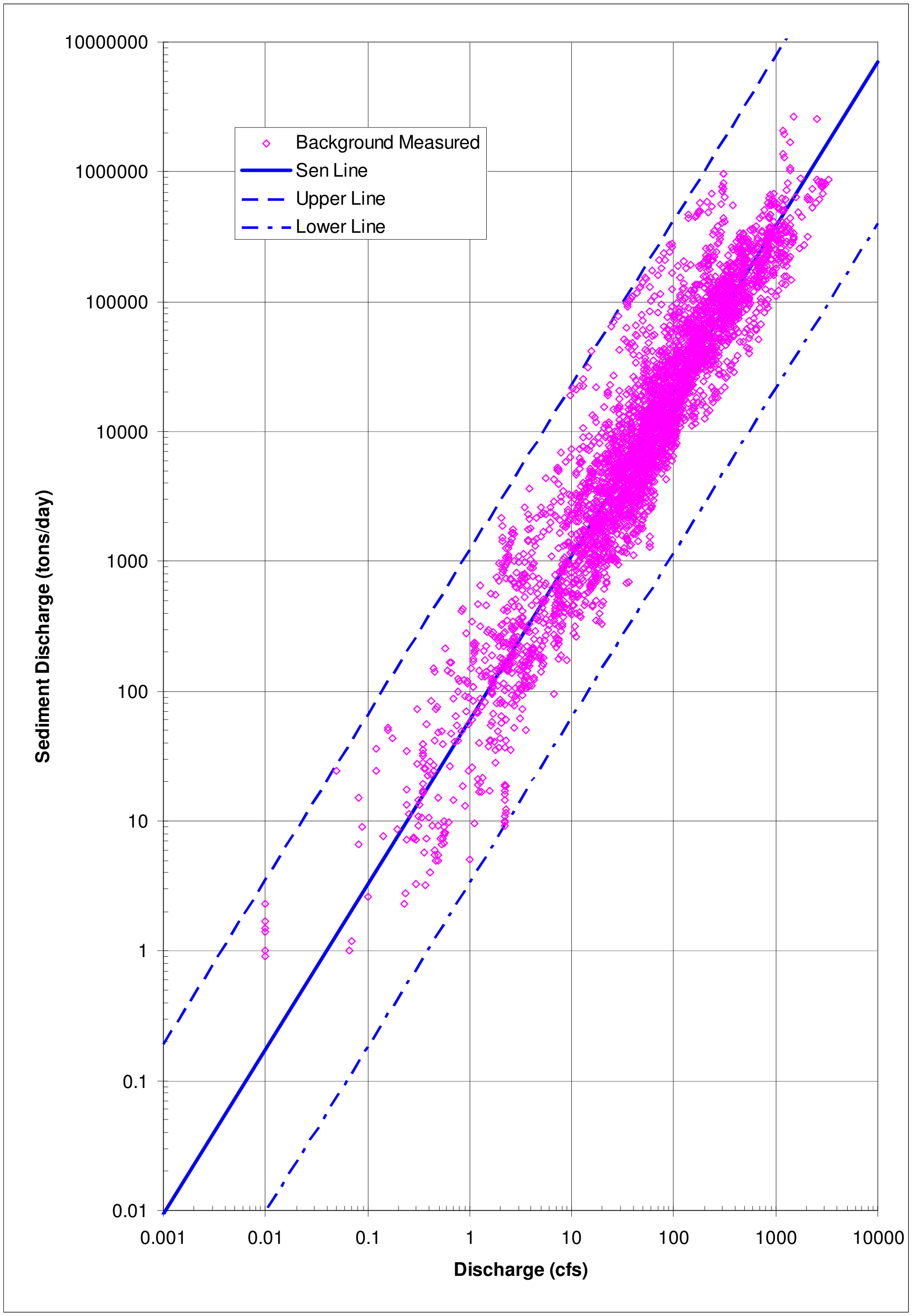


Figure 2.3. Background measured sediment and water discharge.

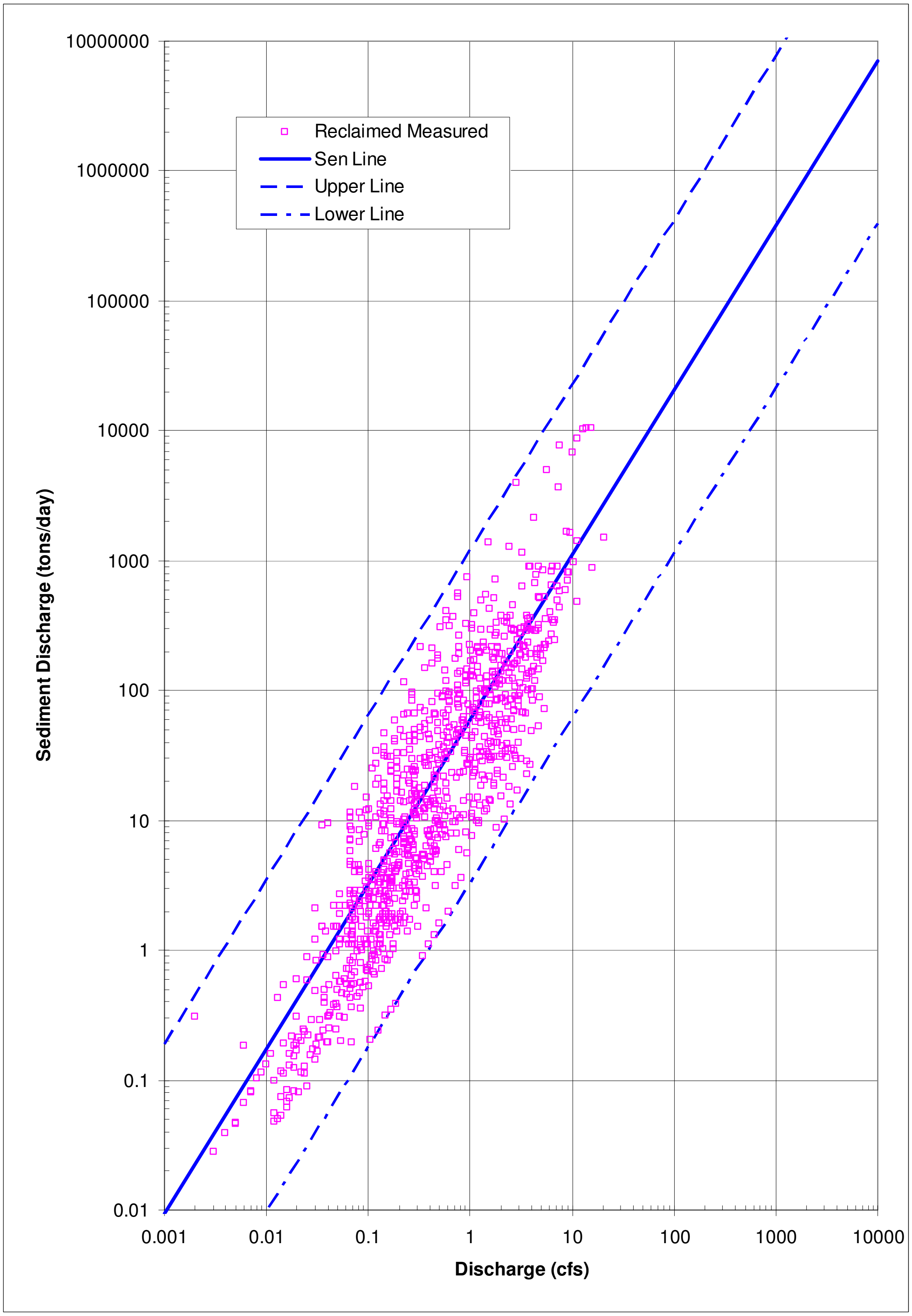


Figure 2.4. Reclaimed measured sediment and water discharge.

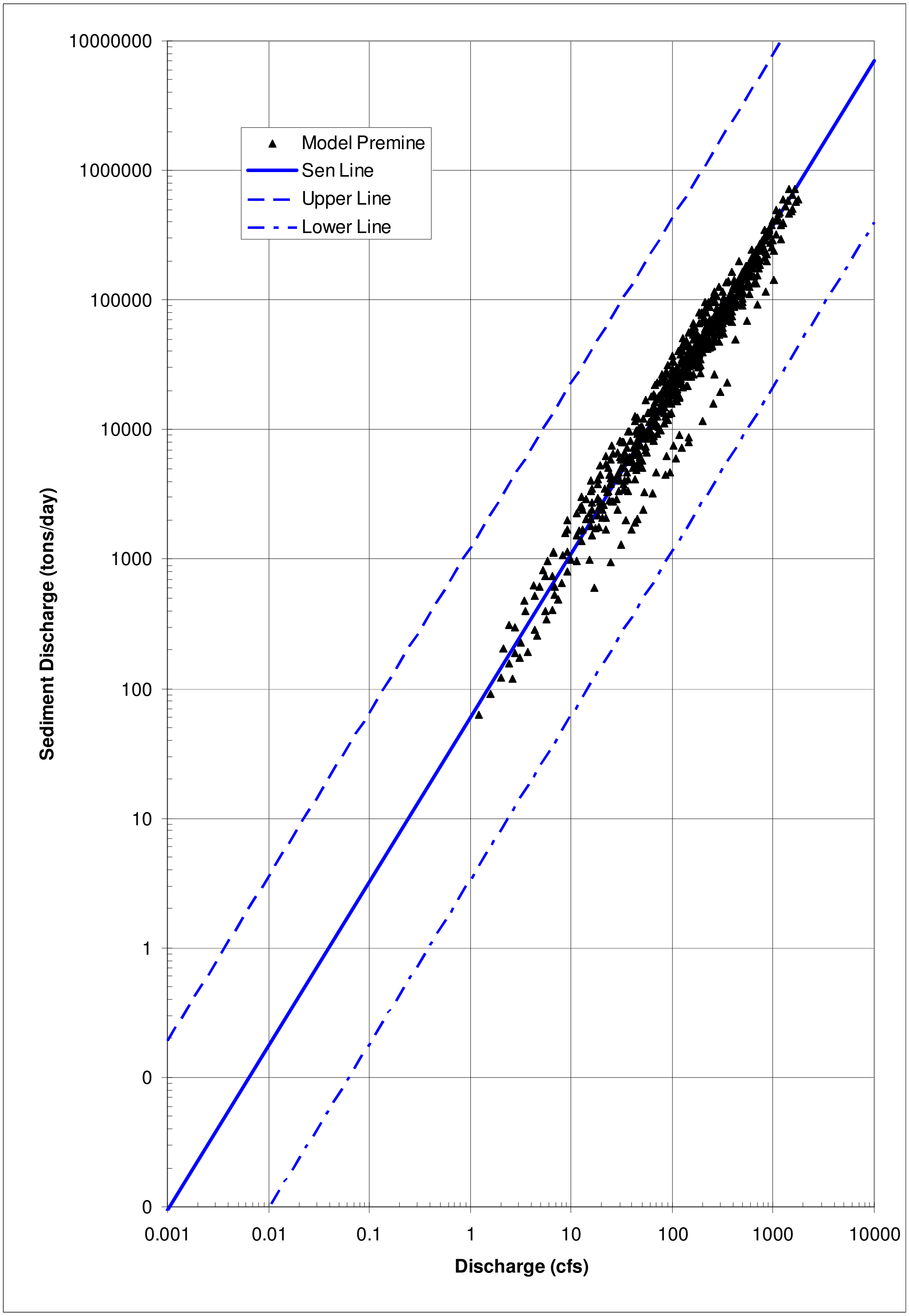


Figure 2.5. Modeled premine sediment and water discharge for J1/N6 and N6 East Central.

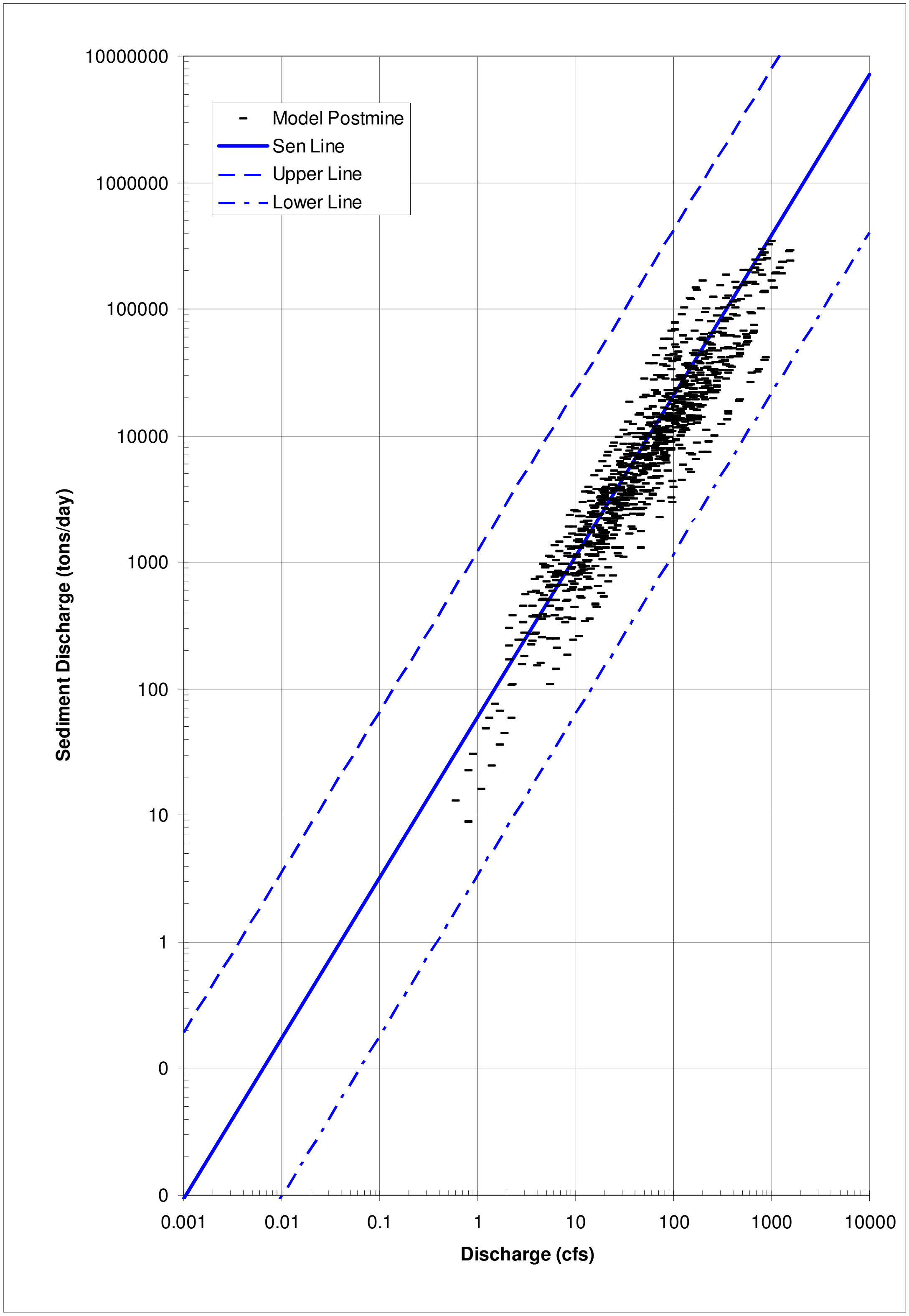


Figure 2.6. Modeled postmine sediment and water discharge for J1/N6 and N6 East Central.

3. REFERENCES

Hjelmfelt, A.T., Kramer, L.A., and Spomer, R.G., 1986. Role of large events in average soil loss in Proceedings of the Fourth Federal Interagency Sedimentation Conference, March 24-27, 1986, Las Vegas, Nevada, p. 3-1 to 3-9.

Lagasse, P.F., Schall, J.D., and Peterson, M.R., 1985. Erosion Risk Analysis for a Southwestern Arroyo, Journal of Urban Planning and Management, American Society of Civil Engineers, v. III, no. I, November, 1985, Paper No. 20165.

Miller, J.F., Frederick, R.H., and Tracey, R.J., 1973. "NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States," Volume VIII - Arizona, National Oceanic and Atmospheric Administration.

Renard, K.G. and Simaton, J.R., 1975. "Thunderstorm Precipitation Effects on the Rainfall-Erosion Index of the Universal Soil Loss Equation" in Volume 5 of Hydrology and Water Resources in Arizona and the Southwest, American Water Resources Assn., Arizona Section Arizona Academy of Science, Hydrology Section, Proceedings of April 11-12 meeting, Tempe Arizona, v. 47-55.

Resource Consultants & Engineers, Inc., 1993. "Surface Water Modeling of Reclaimed Parcels at the Black Mesa Complex," prepared for Peabody Western Coal Co.

Sen, P.K., 1968. "Estimates of Regression Coefficient Based on Kendall's tau: Journal of American Statistical Association, v. 63, p. 1379-1389.

Smith, T. and Best, A., 2000. "Assessing Sedimentation and Protection of the Hydrologic Balance in Disturbed and Reclaimed Areas at the Black Mesa and Kayenta Mines, Arizona, Using Baseline Sediment Data Collected in Receiving Streams," presentation given at the Billings Mined Land Reclamation Symposium in 2001, Billings, MT.

Water Engineering & Technology, Inc. (WET), 1990. "Determination of Background Sediment Yield and Development of a Methodology for Assessing Alternative Sediment Control Technology at Surface Mines in the Semiarid West," prepared for Office of Surface Mining and the National Coal Association, Fort Collins, CO.

Zevenbergen, L.W., Peterson, M.R., and Watson, C.C., 1990. "Computer simulation of watershed runoff and sedimentation processes," Proceedings of the Billings Symposium; Planning, Rehabilitation and Treatment of Disturbed Lands.

EXHIBIT 1

Postmine Topography

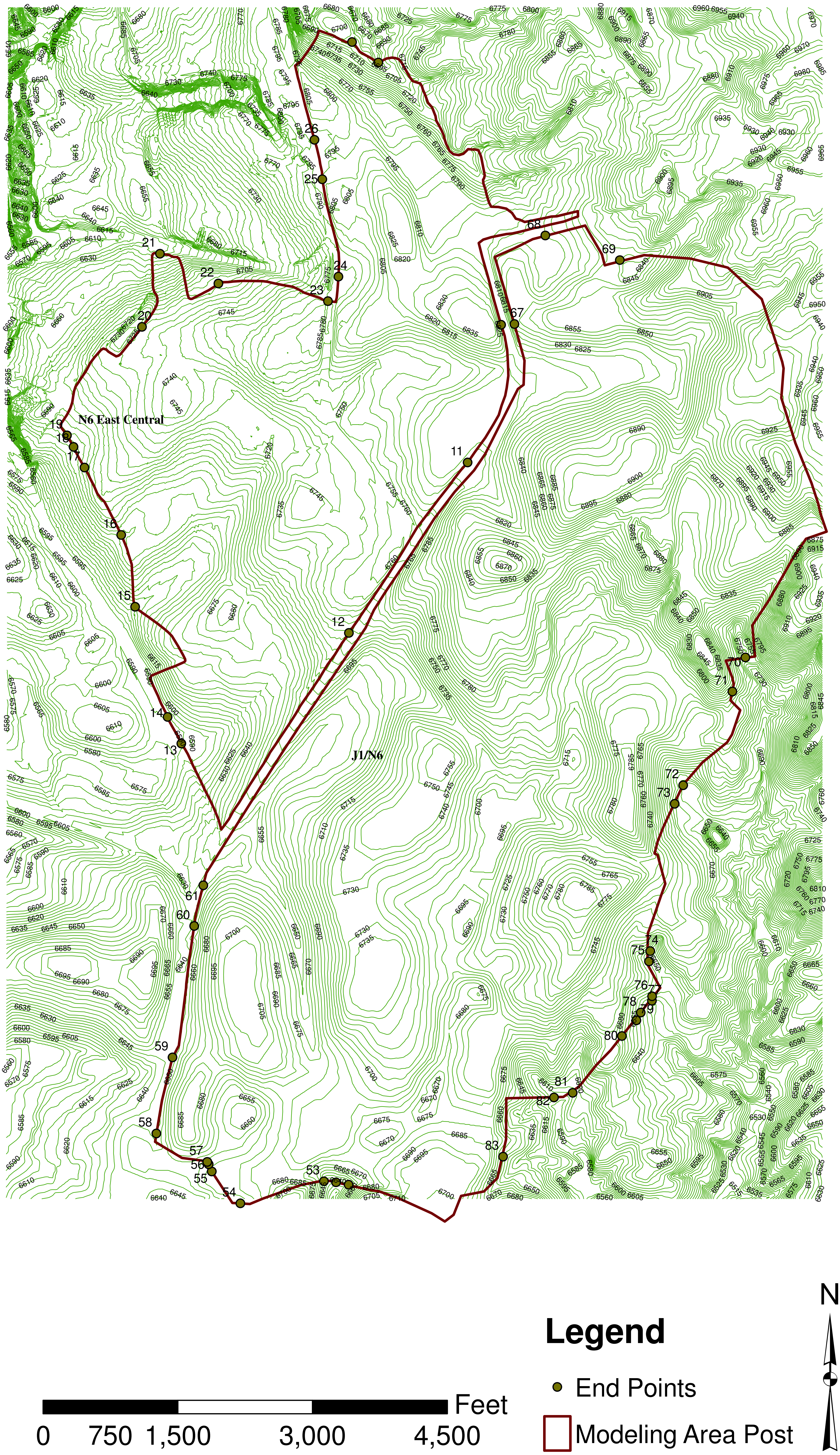


Exhibit 1. Postmine Topography
(5 foot contour)

EXHIBIT 2
Premine Topography

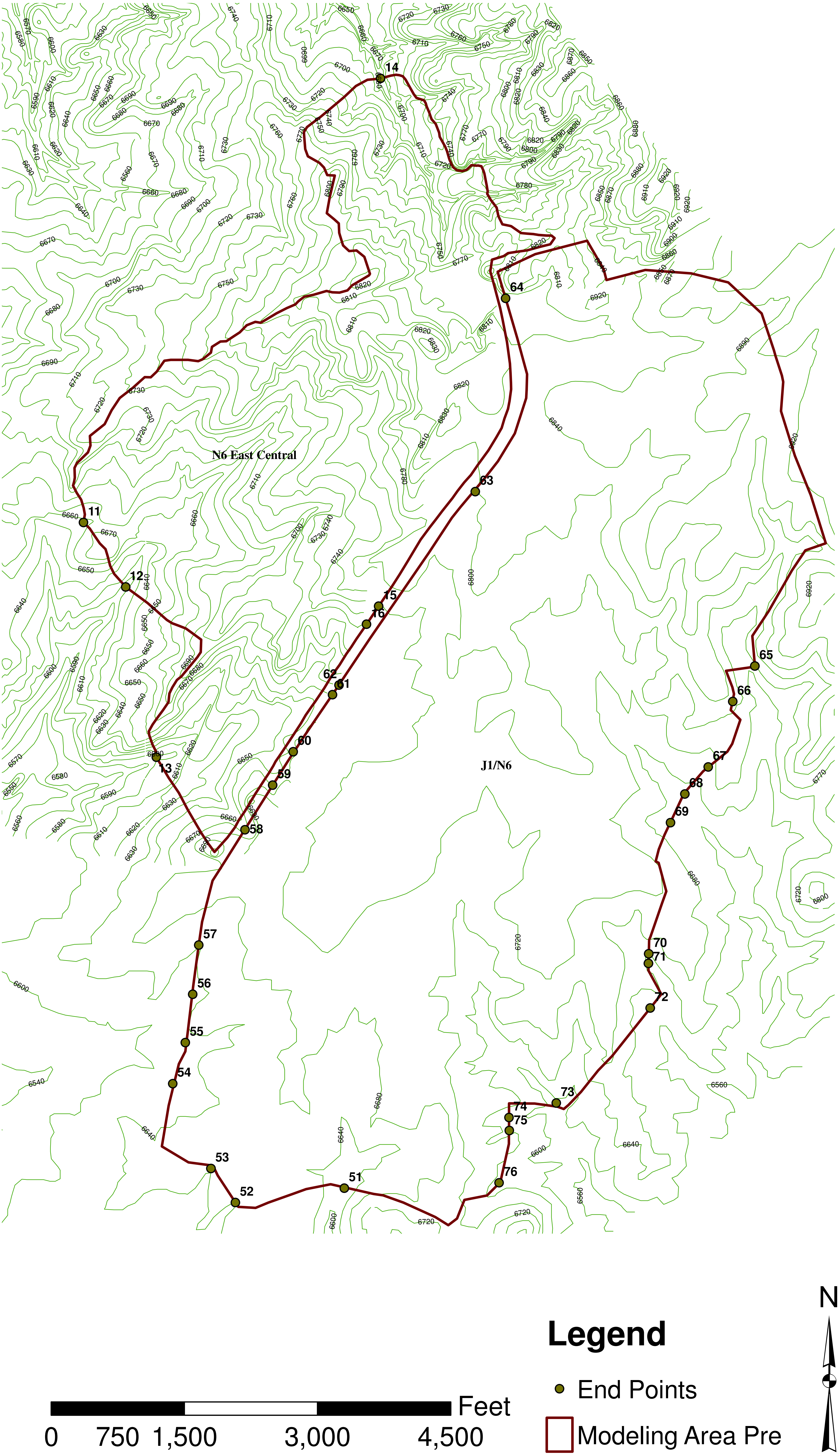


Exhibit 2. Premine Topography (10 & 40 foot contour)

SURFACE WATER MODELING OF THE RECLAIMED N14 COAL RESOURCE AREA AT KAYENTA MINE

Prepared for

Peabody Western Coal Co.
Highway 160, Navajo Route 41
Kayenta, Arizona 86033

SURFACE WATER MODELING OF THE RECLAIMED N14 COAL RESOURCE AREA AT KAYENTA MINE

Prepared for

Peabody Western Coal Co.
Highway 160, Navajo Route 41
Kayenta, Arizona 86033

AYRES ASSOCIATES

P.O. Box 270460
Fort Collins, Colorado 80527
(970) 223-5556, FAX (970) 223-5578

Ayres Project No. 32-1304.00
PEABODY7.DOC

July 2008

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Background

Peabody Western Coal Company (PWCC) operates the Black Mesa and Kayenta surface coal mines, located approximately 25 miles southwest of Kayenta, Arizona. The mines are located on portions of the Hopi and Navajo Indian Tribal Lands. Mining operations occur on a physiographic feature known as the Black Mesa, which rises significantly higher in elevation than the surrounding areas. The mesa ranges in elevation from 6000 to 8000 feet while the surrounding areas range from 5000 to 5500 feet. The area is drained to the southwest via Moenkopi and Dinnebito washes to the Little Colorado River. The areas of present and future mining activity are located in the northeastern portion of the mesa at an elevation of 6200 to 7300 feet.

PWCC conducted a surface water monitoring program, also referred to as the Small Water Study (SWS) in three reclaimed coal resource areas denoted as J1/N6, N2, and J27 and in one undisturbed watershed denoted as J3. The SWS monitoring network consisted of 24 runoff plots, 7 flumes and 6 recording rain gages. The reclaimed coal resource areas in which monitoring was conducted resulted from sequential mining-related activities that began with vegetation removal and salvage of native topsoil. Following the removal of overburden and subsequent coal extraction, the spoiled overburden materials were regraded to form stable postmining topography. The regraded spoil was then covered with salvaged topsoil, disced, and revegetated with seed mixes selected to stabilize the landform and meet the proposed postmining land uses of livestock grazing and wildlife habitat.

Since 1980, PWCC has also monitored flow, suspended sediment, and water quality at 13 stream-gaging stations located on the eight main channels and principal tributaries transecting the PWCC leasehold. **Figure 1.1** shows the general location of the study area. In addition to hydrologic data, information has been collected describing vegetation parameters of cover, production and density, soil textural composition, and watershed topography.

1.2 Purpose

The purpose of this project was to evaluate the hydrologic and sediment yield response of reclaimed coal resource area N14 at the Kayenta Mine using a physical process-based watershed runoff and sediment yield model applicable to the conditions encountered at the mine site. Calibration and validation of the model were performed in a previous study (RCE 1993) using site-specific data collected under the SWS program. The response of the reclaimed coal resource areas was evaluated relative to undisturbed (premine) conditions in the corresponding undisturbed watersheds. The model serves as a tool for assessing the success of reclamation efforts to protect hydrologic balance (30 CFR 715.17 and 30 CFR 816.41).

The model selected for this project was EASI (Zevenbergen et al. 1990). This model is an enhanced version of the MULTSED model (Simons et al. 1978; Fullerton 1983), which has been demonstrated to be applicable for characterization of the effects of land disturbance and reclamation activities conducted at surface coal mine sites (WET 1990).

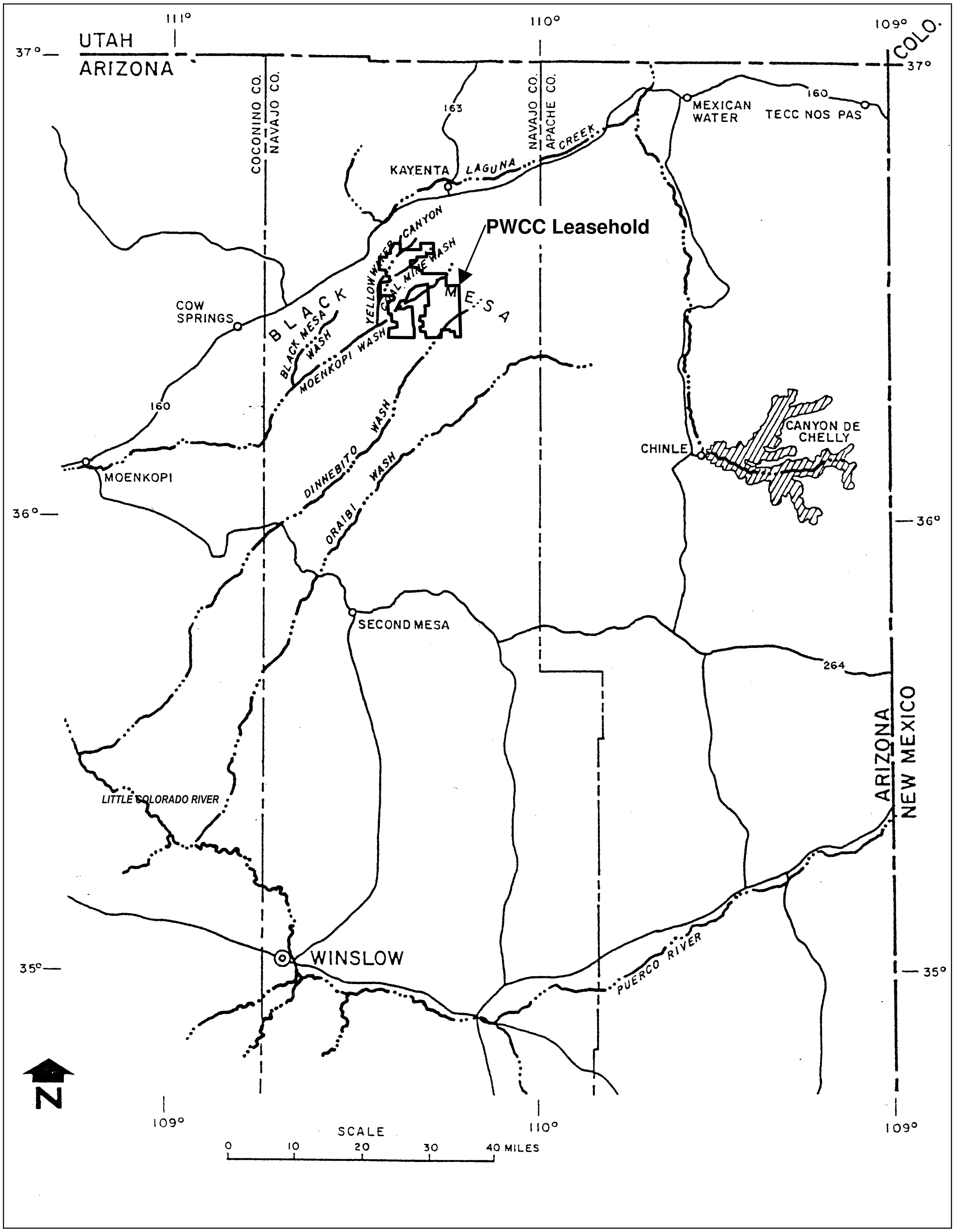


Figure 1.1. Location map.

1.3 Scope of Work

The objective defined by PWCC for this project is to use a previously calibrated and validated surface water model for the Black Mesa and Kayenta Mines to predict mean annual runoff and sediment yields from the reclaimed land parcel N14. This objective included computation of runoff and sediment yields under premine conditions for the same area. All soils and rainfall input to the model are to be taken from models calibrated in the previous study (RCE 1993). The input variables that were calibrated to the mine areas and used in this study include soil infiltration parameters, erodibility parameters, and the grain size distribution. Parameters that are specific to this study are vegetative canopy and ground cover percentages from data collected on site.

2. EASI MODEL CALIBRATION AND VALIDATION

2.1 Purpose

The purpose of the calibration/validation process was to develop a model that could be used to evaluate water and sediment runoff for a range of conditions that could not be directly evaluated under field conditions. Computer modeling of hydrologic processes is a commonly used method to evaluate watershed response and assess impacts of land-use change. When properly calibrated, the EASI model provides a means to make relative comparisons of response under pre- and postmine conditions.

The model calibration was conducted in a previous study (RCE 1993) using data obtained from instrumented watersheds and small hillslope plots collected under natural rainfall conditions. For a detailed discussion of data collection and model calibration, please refer to the previous study (RCE 1993).

2.2 Overview of EASI Model

The watershed runoff and sedimentation modeling program, Erosion And Sedimentation Impacts (EASI) was developed to aid in the analysis and development of various erosion and sedimentation control practices. It combines a sophisticated watershed modeling program with a user-friendly interface. EASI can be used to represent and analyze a complex watershed as a network of hillslopes, subwatersheds, channels, and ponds, each with uniquely identified soil, rainfall, land-use management, and topographic, or geometric characteristics. **Figure 2.1** shows a simple watershed as it would be represented within the EASI program. EASI calculates the runoff and sediment yield for each hillslope or nonpoint source area, determines the sediment transport capacity for the channels and trap efficiency for ponds, and deposits excess sediment or scours channels, depending on whether a sediment surplus or deficit exists. By analyzing erosion and sediment transport processes throughout the catchment, the model addresses nonpoint source areas and potential impacts throughout the channel network.

The EASI model represents an enhanced version of the program MULTSED (Simons et al. 1978), originally developed at Colorado State University under sponsorship of the U.S. Forest Service and the Environmental Protection Agency. Development of EASI entailed numerous modifications and enhancements to MULTSED. Among other features, EASI allows for modeling of complex hillslope geometry, incorporates level pool routing through ponds, provides flexibility in defining network connections, and includes computational algorithms to increase execution speed. EASI also provides a means for development of database files describing rainfall events, soil properties, and watershed management activities, as well as graphical and textual presentation of model results.

EASI was designed for simulation of single precipitation events with low base flow in relation to storm-generated runoff. Therefore, the model is ideally suited to simulate runoff and sediment yield in an arid to semiarid environment where ephemeral streams are common. The physiography of the Black Mesa Mining Complex embodies these conditions.

The following sections provide a brief overview of the major component processes simulated in EASI and their relative importance in the computation of runoff and sediment yield.

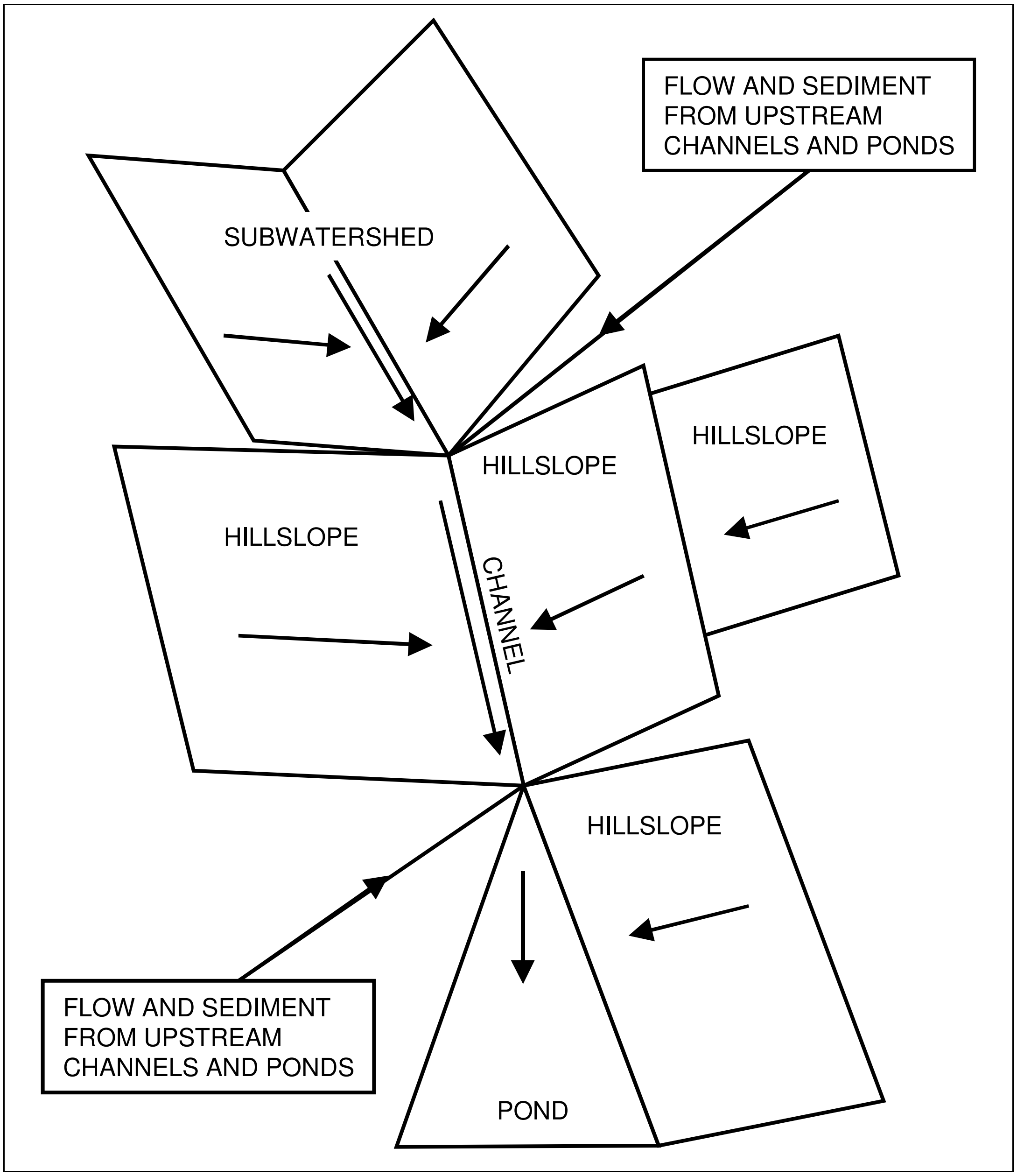


Figure 2.1. Example watershed representation within the EASI model.

2.2.1 Infiltration and Other Rainfall Abstractions

Short-duration, high-intensity summer thunderstorms dominate the runoff-producing events in the semiarid west. Such events produce runoff when the rainfall intensity exceeds the rate at which the soil can absorb water. This rate is dependant on soil properties, including porosity, antecedent soil moisture, capillary suction, and hydraulic conductivity. The Green and Ampt infiltration equation (Green and Ampt 1911) is used in the EASI model. This equation uses the soil characteristics to predict the soil infiltration rate throughout a storm, thereby determining the amount of surface runoff.

Rainfall which is trapped by surface vegetation (interception) or which accumulates in surface depressions (depression storage) is also unavailable for runoff. Canopy cover includes shrubs and trees. Ground cover includes grasses and other vegetation as well as rocks located on the ground surface. Depression storage includes natural depressions and man-made depressions (such as furrows and surface pitting). The aerial percentages of vegetative canopy and ground covers, the potential interception depth of the vegetation, and the average depression storage depth are required input to the EASI model.

2.2.2 Hillslope and Channel Flow Routing

Rainfall in excess of interception, infiltration, and depression storage generates runoff on hillslopes. Within the EASI model, the flow is routed down the hillslope using a finite difference solution to the kinematic wave flow representation. This modification to the original MULTSED model allows the analysis of complex hillslope geometries by cascading water and sediment from one hillslope to another. The hillslope is treated as a planar surface of constant slope and roughness. The roughness of the hillslope is represented by Manning's flow resistance parameter. Hillslopes supply water to channels, which in turn convey the water through the watershed. Channels are described by slope gradient, Manning's flow resistance parameter, and cross-section geometry. In the EASI model, channels can be either triangular, rectangular, or trapezoidal in cross section. The kinematic wave flow representation is also used for flow routing in channels. Channel infiltration can be significant in semiarid watersheds; this process is also simulated using the Green and Ampt infiltration equation.

2.2.3 Pond Flow Routing

Ponds store and retain runoff from upstream sources and also trap sediment. In the EASI model, MULTSED was modified to allow flow from hillslopes into ponds. If the storage and outflow characteristics of a pond are known, the impacts on watershed hydrologic and sediment responses can be predicted. The user provides a table of pond storage and outflow versus water surface elevation. If the outflow characteristics of the pond are not known, the user may input primary and emergency spillway characteristics (including inlet elevations, pipe sizes, spillway lengths, etc.) and the program will determine the outflow characteristics internally. EASI uses the level pool technique for routing flow through a pond (Chow 1951).

2.2.4 Soil Erosion

Soil erosion occurs when soil particles are detached by either raindrop impact or runoff forces. The susceptibility of soil to detachment is controlled by the cohesiveness, particle size, structure, and type of the soil. For noncohesive sandy soils, detachment of individual particles is not required prior to transport. In that case, the amount of erosion is limited by the capacity of flow to transport the soil. The EASI model requires detachment coefficients for raindrop impact and surface flow. The detachment coefficients may be determined through calibration or can be estimated using soil type and other soil characteristics as a guide. Based on the hillslope soil and channel sediment characteristics along with rainfall intensities and runoff rates, the model determines the total amount of sediment available for transport in each part of the watershed.

2.2.5 Sediment Transport

In the EASI model, sediment is transported on hillslopes and in channels by size fraction (ten size gradations are used ranging from primary clay to gravel sizes) using a sediment transport relationship composed of the Meyer-Peter, Muller bed-load equation (USBR 1960) and the Einstein suspended-load function (Einstein 1950). Because the amount of detached soil may be more or less than the amount of sediment which can be transported by the flow, the model can simulate supply-limited or capacity-limited sediment transport conditions. For example, a subwatershed containing hillslopes with relatively cohesive, low detachability soil with good vegetative cover may experience flows of high sediment transport capacity. The actual amount of sediment transported from this hillslope could be negligible because the soil characteristics and vegetation significantly reduce erosion. Conversely, a channel composed of fine sand could receive flow from the previously described hillslope. Because the sand does not require detachment prior to transport, the amount of sediment available for transport greatly exceeds that which the channel flow can transport. In this case, the channel flow will transport as much sediment as is physically possible based on the size gradation of the sand and energy of the flow. A watershed comprised of such hillslopes and channels could produce large quantities of sediment even though the hillslopes are not eroding.

Ponds are often used to limit the amount of sediment leaving mined land. The amount of sediment trapped by a pond is determined by the settling velocity of the sediment and the detention time of the runoff in the pond. The EASI program uses settling velocity (determined from the particle sizes) along with the pond storage and outflow characteristics to determine the trap efficiency of the pond. Because ponds are generally very efficient at trapping sediment, channel scour can occur downstream of a pond, depending on the outflow characteristics of the pond and the sediment characteristics of the downstream channels. In such a case, the pond may not significantly reduce the total amount of sediment produced by a watershed, but instead may change the sediment source from upstream of the pond to the channel downstream of the pond.

Table 2.1 shows the major input variables or parameters that must be estimated or computed for use in the EASI model.

Table 2.1. Major Input Data and Parameters for the EASI Model (after Simons et al. 1978).

Item	Typical Range
Geometry and Channel Data	
Watershed area	
Length of overland slopes	
Width of overland slopes	
Gradient of overland slopes	
Lengths of channel sections	
Gradient of channel sections	
Geometry of Channel Sections Pond Geometric and Outflow Characteristics	
Soil Data	
Particle size distribution	
Initial water content (saturation) of soil	0 - 100%
Final water content (saturation) of soil	0 - 100%
Saturated hydraulic conductivity	0.01 to 1.0 inches/hour
Capillary suction head	0.1 - 40 inches
Porosity	40 - 55%
Soil temperature	45 - 90 degrees F
Vegetation Data	
Density of ground cover	
Density of canopy cover	
Storage of ground and canopy covers	
Hydrologic Data	
Overland flow detachment coefficient	0.0 - 1.0
Channel flow detachment coefficient	0.0 - 1.0
Rainfall splash detachment coefficient	0.0001 - 0.013
Manning's n value	0.02 - 0.10

3. RECLAIMED PARCEL MODELING

3.1 Background

The N14 Coal Resource Area (CRA) that is the focus of this project was reclaimed between 1998 and 2002. The fundamental purpose of this study was to quantify the expected behavior and hydrologic response of the reclaimed areas relative to the conditions that existed prior to the occurrence of mining activities.

Runoff and sediment yield response from the reclaimed lands should be managed to not adversely impact the prevailing hydrologic balance and to limit additional contributions of suspended sediment to streamflow or runoff outside the mine permit areas. The natural watersheds on the mesa contribute significant quantities of sediment to the channel system. It is expected that the postmine condition will also produce comparable amounts of sediment without adverse impact on the hydrologic balance.

This section describes the data and procedures used to evaluate CRA N14. This area was modeled to determine the average annual hydrologic response following reclamation. Infiltration, runoff, and erosion processes from both hillslopes and channels within the CRA were modeled using EASI. Results were determined for concentration points at the outlets of the reclaimed watersheds. The locations of these points are shown in **Exhibit 1**. Modeling was also conducted to determine hydrologic response under premine conditions based on the topography, soils, cover, and other conditions that typified the undisturbed watersheds draining to each concentration point. **Exhibit 2** shows the modeling endpoints for the premine N14 watersheds.

3.2 Data

3.2.1 Soils

Soils data used for the current study (CRA N14) were based on data developed from the calibration of models used in the previous study (CRAs N1/N2 and J27) (RCE 1993). The composition of postmine soil in the current study is depicted along with the composition of postmine soils from the previous study in **Figure 3.1**. This figure shows that the soil composition of N14 is very similar to soils evaluated during model calibration. Therefore, the soil properties developed in the previous study are valid for this modeling project. These properties include calibrated parameters, such as infiltration and erodibility coefficients, and measured soil size distributions. **Table 3.1** lists the premine and postmine soils data used during EASI modeling of CRA N14.

3.2.2 Vegetation

Vegetative cover data representative of both pre- and postmine conditions in CRA N14 were supplied by PWCC. For the premine condition, land was characterized as being covered by sagebrush or pinon juniper. The spatial distribution of vegetative cover for the N14 premine condition appears in **Figure 3.2**. Average cover properties for CRAs N1/N2 and J27 of the previous study and N14 of the current study appear in **Table 3.2**. For the postmine condition, the entire area was assigned the same cover type. **Table 3.3** lists the pre- and postmine vegetative cover data used in the EASI model runs generated for the N14 CRA. Note that if a unit contained significant portions of both sagebrush and pinon juniper cover types, it was classified as half pinon juniper and half sagebrush.

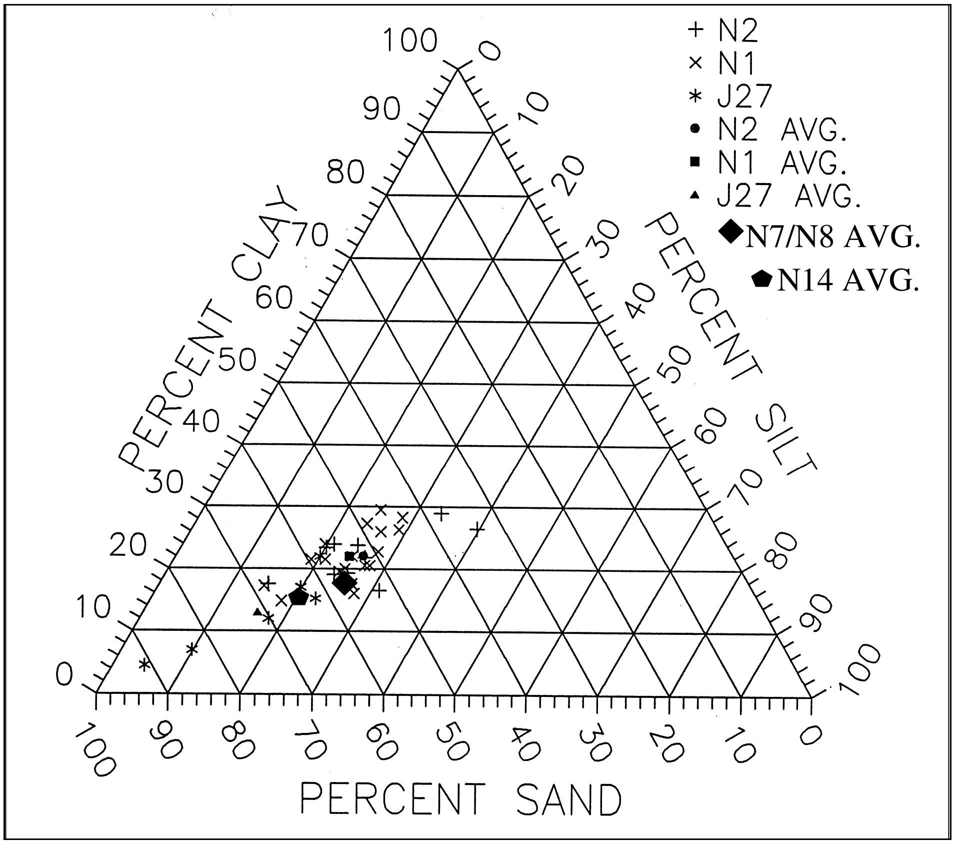


Figure 3.1. Reclaimed area soils trilinear graph.

Table 3.1. Soils Data.			
Condition	Premine	Postmine	Rock Chutes
Rainfall detachment	0.005	0.005	0
Overland flow detachment	0.44	0.44	0
Channel flow detachment	0.5	0.5	0
Initial soil moisture, %	70	70	70
Final soil moisture, %	90	90	90
Soil porosity, %	45	45	46
Temperature, *F	70	70	70
Hydraulic conductivity, in/hr	0.23	0.29	0.3
Capillary suction, in	3.7	2.6	2.6
	Particle Size Distribution (all conditions)		
	Size, mm	% Finer	
	0.001	0	
	0.004	18.0	
	0.016	27.4	
	0.062	36.6	
	0.125	56.2	
	0.250	64.3	
	0.500	72.4	
	1.000	80.5	
	2.000	88.6	
	4.000	92.4	
	16.000	100	

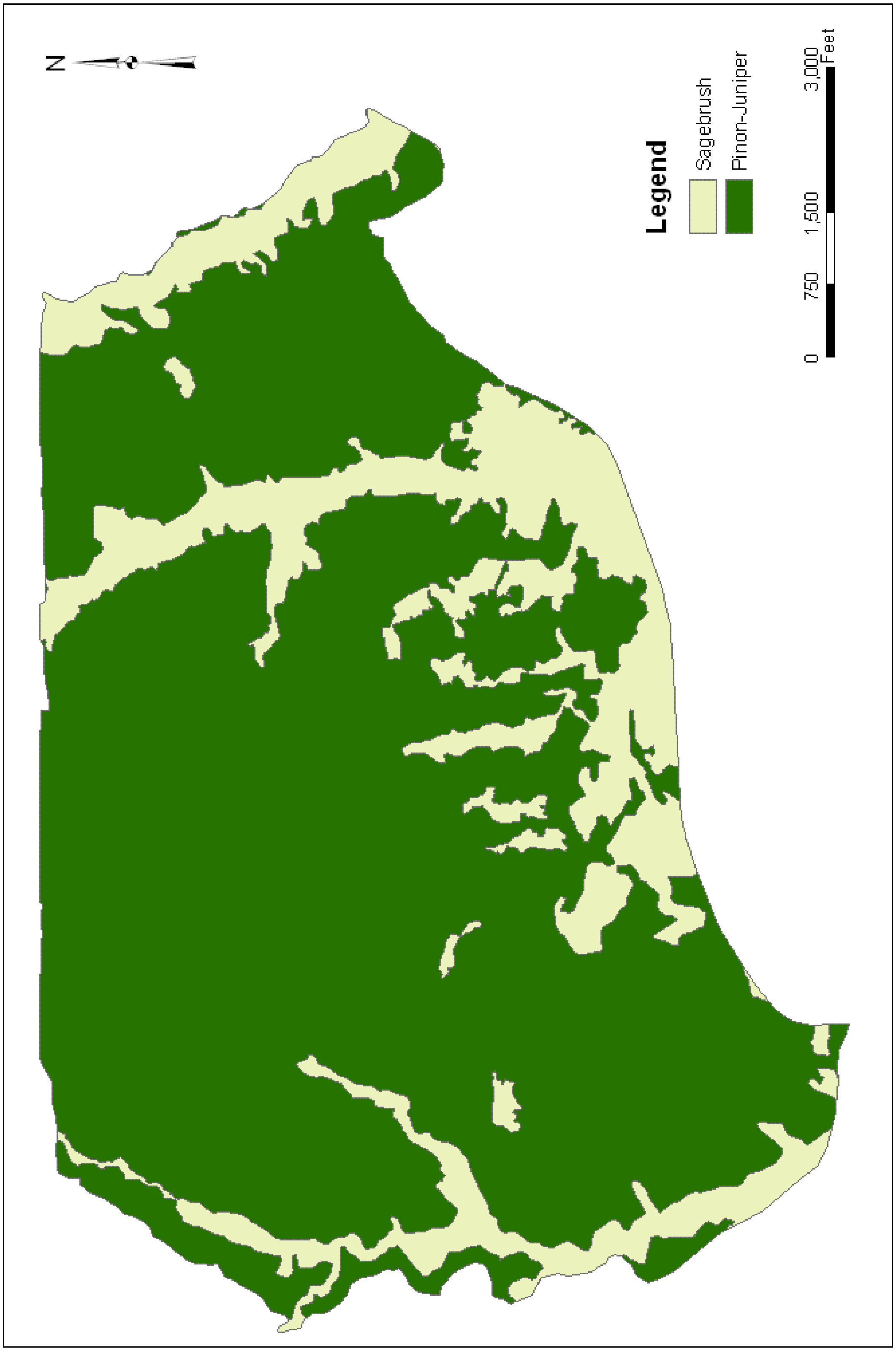


Figure 3.2. Spatial distribution of vegetative cover types for N14 premine condition.

Table 3.2. Cover Sampling Data.								
Area	Condition	Cover Type	Nonstratified Vegetation Cover (%)	Vegetation Canopy Cover (%)	Vegetation Ground Cover (%)	Litter* (%)	Rock (%)	Total Ground Cover (%)
N1/N2	Postmine	Postmine	25.6	1.4	24.2	13.6	4.2	41.9
N14	Postmine	Postmine		0.9	16.1	25.8	4.6	46.5
N1/N2/J27	Premine	Pinon Juniper	32.7	31.1	3.0	44.0	19.7	66.7
N14	Premine	Pinon Juniper		13.9	4.5	24.4	17.5	46.4
N1/N2	Premine	Sagebrush	25.1	16.0	10.3	25.3	18.1	53.7
J27	Premine	Sagebrush	30.6	9.7	22.0	24.0	1.6	47.6
N14	Premine	Sagebrush		3.4	11.7	27	4.1	42.8
*Including standing dead litter								

Table 3.3. Cover Data for N14.				
Condition	Pinon Juniper	Sagebrush	Half Pinon Juniper-Half Sagebrush	Postmine
Canopy cover, %	13.9	3.4	8.65	0.9
Ground cover, %	46.4	42.8	44.6	46.5
Canopy storage, in	0.05	0.05	0.05	0.05
Ground storage, in	0.05	0.05	0.05	0.05
Depression storage, in	0.03	0.03	0.03	0.03
Impervious area, %	0	0	0	0
Manning n	0.07	0.07	0.07	0.05

3.2.3 Topography

Pre- and postmine topography was supplied by PWCC in the form of ArcGIS geodatabase. Basin delineations, hillslope delineations, subwatershed delineations, as well as areas, slopes, and lengths of all units of the study area were defined and calculated using ArcGIS software. **Figures 3.3 and 3.4** show the watershed delineation and descriptions assigned to the basins used in the EASI model for the post- and premine conditions, respectively. Channel dimensions input to EASI were based on the topography supplied and limited field observations.

3.3 Methodology

Runoff and sediment yield in the semiarid western United States is largely governed by the occurrence of high-intensity, short-duration rainstorms of limited areal extent (Renard and Simaton 1975). Research has indicated that relatively few events may produce the greatest erosion (e.g., Hjelmfelt et al. 1986 reported that only 3 to 4% of rainfall events accounted for 50% of long-term sediment yields). Although there is perhaps a relatively limited physical basis for definition of an "average annual" runoff or sediment yield in a semiarid environment due to the extreme variability in response and importance of single infrequent events, such a term does provide a useful basis for long-term comparison between reclaimed and undisturbed conditions.

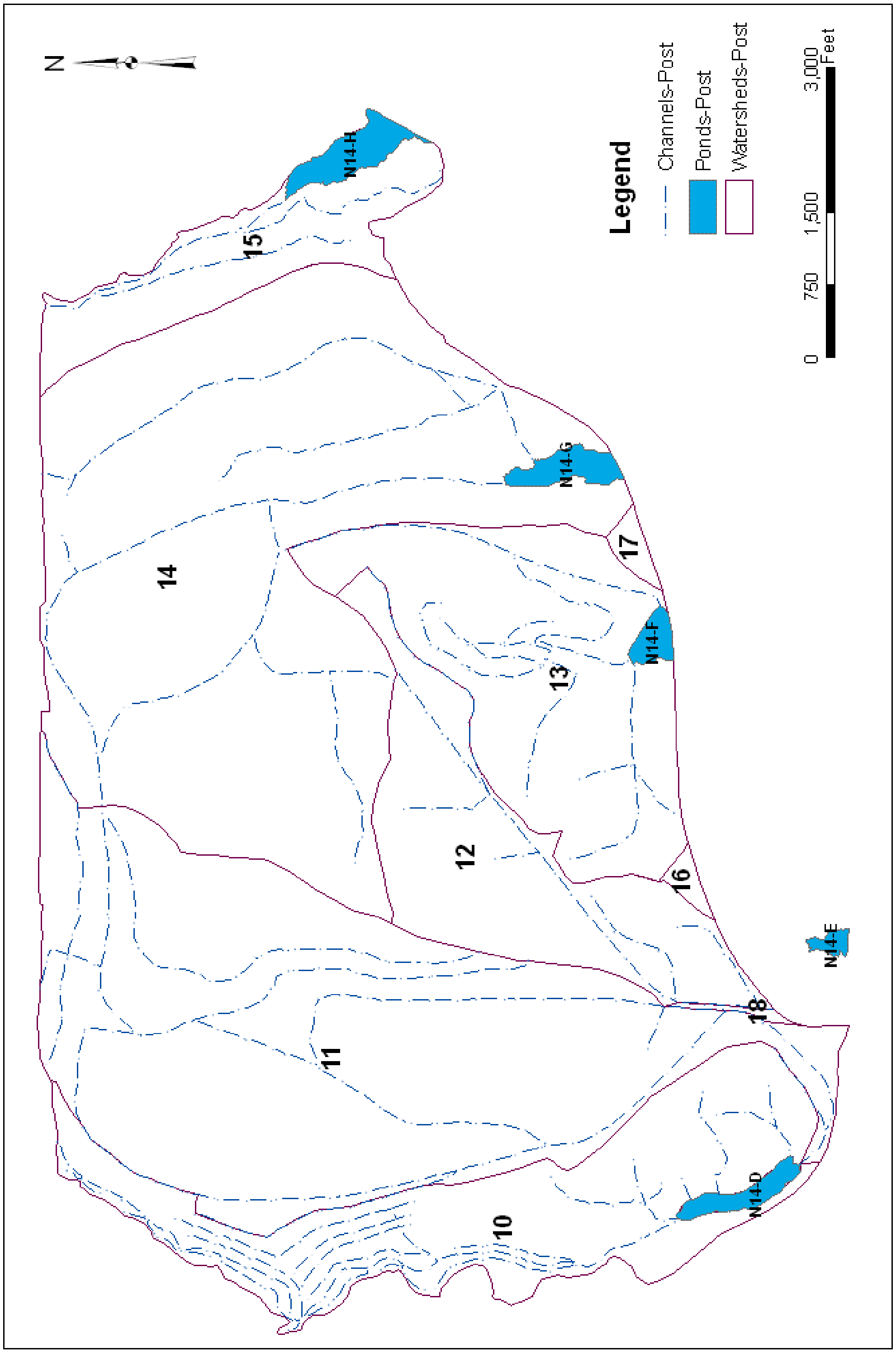


Figure 3.3. N14 postmine basins.

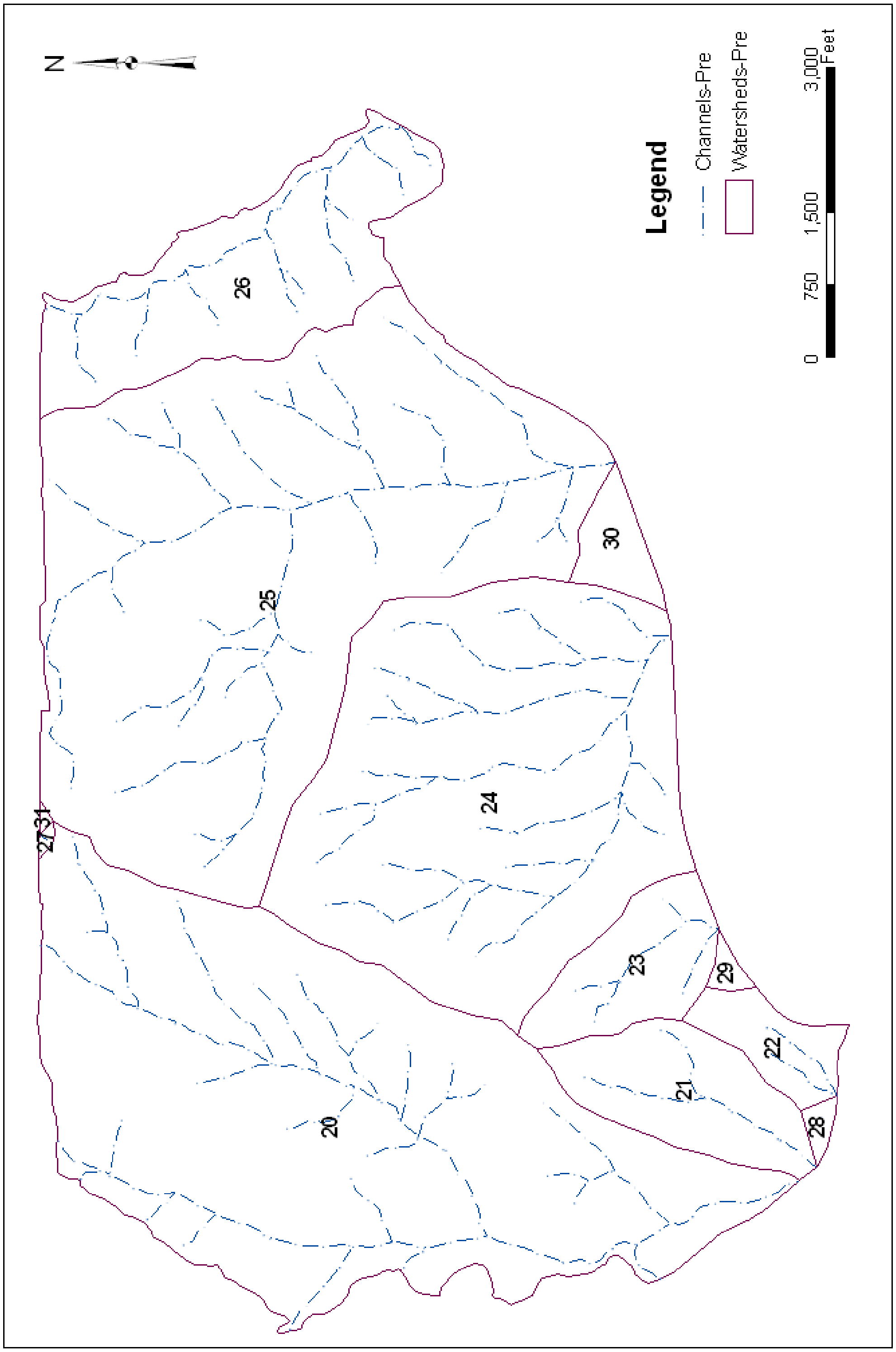


Figure 3.4. N14 premine basins.

To make comparisons between reclaimed lands and associated undisturbed lands at the Black Mesa Mining Complex on the basis of average annual sediment yield, a procedure was used that considers the importance of infrequent storm events in defining sediment yield in the semiarid west. First, however, the site-specific rainfall data available for the Black Mesa Mining Complex were used to evaluate the frequency and magnitude of the measured events relative to existing predictions for rainfall depth-duration (Miller et al. 1973). The analysis of the rainfall data was performed as part of a previous study of the N1/N2 and J27 CRAs (Resource Consultants and Engineers 1993).

Comparisons between runoff and sediment yield from undisturbed and reclaimed areas in CRA N14 were developed for specific modeling endpoints shown in Exhibits 1 and 2. Mining and reclamation activities did not exactly replicate the topography, drainage network, or drainage areas that existed prior to mining. Consequently, direct comparisons of total runoff and sediment yield cannot be made between undisturbed and reclaimed response at a given point in a watershed. Comparisons were made on the basis of unit rates of runoff (inches) and sediment yield (tons/acre) at the various modeling computation endpoints. Although the same disturbance boundary was used to model extents for both pre- and postmine conditions, the topographic differences that resulted after mining and reclamation occurred in the N14 CRA dictated that some small areas would be included or excluded from the modeling. The total area modeled for premine conditions is 1607.6 acres and for postmine conditions is 1580.6 acres. The difference in area results from the sediment ponds in postmine conditions. The area bounded by the disturbance limits identified by PWCC as shown in Exhibits 1 and 2 is 1607.6 acres.

3.3.1 Synthetic Rainfall

Synthetic storms of 2-, 5-, 10-, 25-, 50-, and 100-year return periods were used as input to the EASI model. Actual hyetographs were taken from the previous study (RCE 1993) and are based on both local data collection and the NOAA Atlas (Miller et al. 1973). **Table 3.4** lists the hyetographs used for each return period.

Table 3.4. Incremental Rainfall Intensities vs. Return Period.

Cumulative Time (min)	Incremental Intensity (in/hr)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
5	0.29	0.38	0.45	0.54	0.61	0.69
10	0.76	0.99	1.19	1.43	1.61	1.82
15	2.01	2.61	3.14	3.75	4.23	4.79
20	4.16	5.40	6.51	7.76	8.76	9.92
25	1.20	1.56	1.88	2.24	2.53	2.87
30	0.35	0.46	0.55	0.66	0.74	0.84
40	0.20	0.27	0.32	0.38	0.43	0.49
50	0.12	0.15	0.18	0.22	0.24	0.28
60	0.11	0.14	0.17	0.21	0.23	0.26
80	0.11	0.14	0.17	0.20	0.23	0.26
100	0.07	0.09	0.11	0.13	0.15	0.17
120	0.05	0.06	0.07	0.08	0.09	0.11
150	0.05	0.06	0.07	0.08	0.09	0.11
180	0.05	0.06	0.07	0.08	0.09	0.10
360	0.05	0.05	0.05	0.06	0.06	0.07
1440	0.02	0.03	0.03	0.03	0.03	0.04
Total rainfall, in.	1.42	1.82	2.10	2.50	2.71	3.03

3.3.2 Computation of Average Runoff and Sediment Yield

The EASI model was used to evaluate runoff and sediment yield from a series of storm events having recurrence intervals of 2, 5, 10, 25, 50, and 100 years. To define average annual conditions, the average annual sediment yield $(Y_s)_m$ generated from storm events was computed using the following equation (Lagasse et al. 1985):

$$(Y_s)_m = 0.01(Y_s)_{100} + 0.01\frac{(Y_s)_{100} + (Y_s)_{50}}{2} \quad (3.1)$$

$$+ 0.02\frac{(Y_s)_{50} + (Y_s)_{25}}{2} + 0.06\frac{(Y_s)_{25} + (Y_s)_{10}}{2}$$

$$+ 0.1\frac{(Y_s)_{10} + (Y_s)_{5}}{2} + 0.3\frac{(Y_s)_{5} + (Y_s)_{2}}{2}$$

$$+ 0.5\frac{(Y_s)_{2} + 0}{2}$$

In Equation 3.1, the subscripts denote return period of the storm in years. Equation 3.1 represents an integration of the sediment yield frequency curve based on the incremental probability of occurrence of relatively large storm events during any given year. Thus, Equation 3.1 considers the importance of high-intensity, short-duration rainfall on erosion processes in the study area. This procedure provides a consistent basis for comparison of sediment yield modeled for both undisturbed (premine) and reclaimed (postmine) conditions.

Average annual runoff was also computed using Equation 3.1, substituting storm event runoff volumes for sediment yields.

3.4 Results

Figures 3.3 and 3.4 show the post- and premine basin delineations. Since the individual subareas differ in number, acreage and outlet locations, a direct comparison is not possible on a subarea basis. Therefore, the best way to compare the results is on an average basis for the CRA. **Table 3.5** shows pre- and postmine drainage area, runoff, sediment yield, and erosion rates for the N14 CRA. Of course the pond greatly reduced sediment yield from the CRA. To consider the situation of pond removal for the postmine condition, the EASI model was run with sediment ponds replaced by channels. These channels are at the locations of the ponds and would discharge to a steep riprapped chute at the basin outlet. The channel is assumed to have a gentle slope of 1% and a length equal to the pond's length. Runoff is defined as the total volume of water leaving the CRA on an average annual basis and, therefore, does not include water stored in depression areas and ponds. For the premine condition, this is equal to the amount of water that drains off the hillslopes and subwatersheds because there are no ponds or significant depressions. For the postmine condition, this is equal to the amount of hillslope runoff less the amount stored in ponds. Similarly, the sediment yield is the amount of eroded material that leaves the CRA on an average annual basis computed using Equation 3.1. The sediment yield is the production from the hillslope areas and erosion from the channels. The amount of erosion tabulated in Table 3.5 is the sediment yield from the hillslopes and subwatersheds only and does not include channel erosion, channel deposition or sediment trapped in ponds. Sediment yield can be greater or less than erosion, depending on the amount of channel erosion and the capacity of the channel network to convey sediment off the leasehold.

Table 3.5. Average Runoff and Sediment Yield Results.					
CRA	Condition	Drainage Area (ac)	Runoff (in)	Sediment Yield (t/ac/yr)	Erosion (t/ac/yr)
N14	Premine	1,607.6	0.42	1.95	1.03
N14	Postmine	1,580.6	0.42	1.39	0.73

For the postmine condition, sediment yield is less than those in the premine condition. Sediment yield is approximately two-thirds of the premine amount, and runoff is the same as the premine amount. Hillslope and subwatershed erosion rates, which are significant from the perspective of postmine land use, are 30% lower for reclaimed (postmine) conditions. The reduction of sediment yield is due to the decrease of hillslope erosion and the channel erosion control measures for the postmine condition.

3.5 Discussion

Table 3.6 gives an overview of the geometric properties of the pre- and postmine disturbed areas. Premine hillslopes are generally longer than postmine hillslopes, postmine channels are not as steep as premine channels, and the drainage density of the postmine condition is greater than that of the premine condition. These properties agree with the postmine versus premine topography: the greater drainage density and shorter hillslopes of the postmine condition are due to the terracing of the land to allow less sediment erosion and transport. Generally, in a natural setting, a greater drainage density would be equated with higher sediment yields. However, the terraces are not "natural" channels as they are designed to segment long hillslopes into shorter lengths and the terrace channels are designed with low gradients to reduce erosion and sediment transport. A high drainage density in a natural setting would result in a short time of concentration and higher peak flows but a high drainage density due to terracing would increase time of concentration and decrease peak flows. Such differences in pre- and postmine topography make it difficult to generalize about sediment yield from pre- and postmine areas. This shows the value of modeling. One generalization that can be made, however, is that the significantly shorter hillslope lengths are the cause of lower erosion rates.

Table 3.6. Average Physical Properties of N14.		
	Premine	Postmine
Total Area (ac)	1607.6	1580.6
Total Channel Length (ft)	114,764	134,200
Mean Channel Slope	0.0684	0.0328
Drainage Density (mi/mi^2)	8.7	10.3
Mean Hillslope Length (ft)	304	274
Mean Hillslope Gradient	0.1324	0.1115

4. COMPARISONS WITH MEASURED SEDIMENT TRANSPORT

As discussed in Section 1, PWCC has monitored flow and sediment on the main channels, principal tributaries and small watersheds within the leasehold. These data, along with the runoff plots, were used to calibrate the EASI model soil erodibility and infiltration input variables. **Figures 4.1** and **4.2** show sediment transport and sediment concentration versus discharge for measured unmined (background), measured reclaimed, modeled unmined (premine) and modeled reclaimed (postmine) data. Although there is significant scatter shown in the data (as is expected with any sediment transport conditions), there are several conclusions that can be drawn from this data.

The open symbols in both figures depict measured data and whether the data were collected from reclaimed areas (the small watershed study) or from unmined or background surface water monitoring stations. The range of flows is generally greater for the background data but there is significant overlap between the two data sets between 0.1 and 100 cfs. This is because the reclaimed data are from small watersheds and the unmined data are from channels draining larger basins. These data show the same trend for sediment transport and sediment concentration over the entire range of flows and very close agreement in the area of discharge overlap. This, in itself, is strong evidence that (1) the sediment yields are channel transport capacity limited, (2) overlap of model predictions for both pre- and postmine conditions with measured data strongly indicate that EASI model predictions are representative and reasonable, and (3) sediment yields from reclaimed areas will not be additive to yields on the receiving streams.

The closed symbols depict data from the pre- and postmine EASI model runs. They represent data generated by EASI for both subwatersheds and channels for peak discharges resulting from 2-, 5-, 10-, 25-, 50-, and 100-year storms. Using the peak flows from extreme events results in discharges that generally exceed 10 cfs. The trend of the model-derived data is similar and the ranges of concentration and sediment transport are similar to the measured data and between pre- and postmine conditions.

The sediment discharge plot (Figure 4.1) shows a stronger trend because it is plotting discharge (sediment) against discharge (flow). This is expected because the sediment discharge does depend on flow discharge. The concentration plot (Figure 4.2) shows the two separate variables and, therefore, a less significant trend. PWCC believes that data measurement may have some influence on the scatter (outliers were removed), but the process variability is probably the major influence. The majority of the data, however, fall in a group centered on 100 cfs and 100,000 mg/l, both in the observed data and in the model results. These plots support the use of the EASI model, the results of the modeling, the conclusion that sediment yields from reclaimed areas are not additive to receiving stream sediment loads, and that sediment impacts to the prevailing hydrologic balance have been minimized.

From Figures 4.1 and 4.2 it is apparent that sediment loads and concentrations are dependent on the channel sediment transport capacity for both pre- and postmine conditions. Channel sources of sediment in this arid environment are virtually unlimited. Therefore, channel transport capacity and channel derived sediment limits and governs sediment yields from the small tributaries, large channels and the CRA as a whole. The similarity of sediment discharge (or concentration) between pre- and postmine conditions appears to be inconsistent with the lower rates of sediment yield shown in Table 3.5.

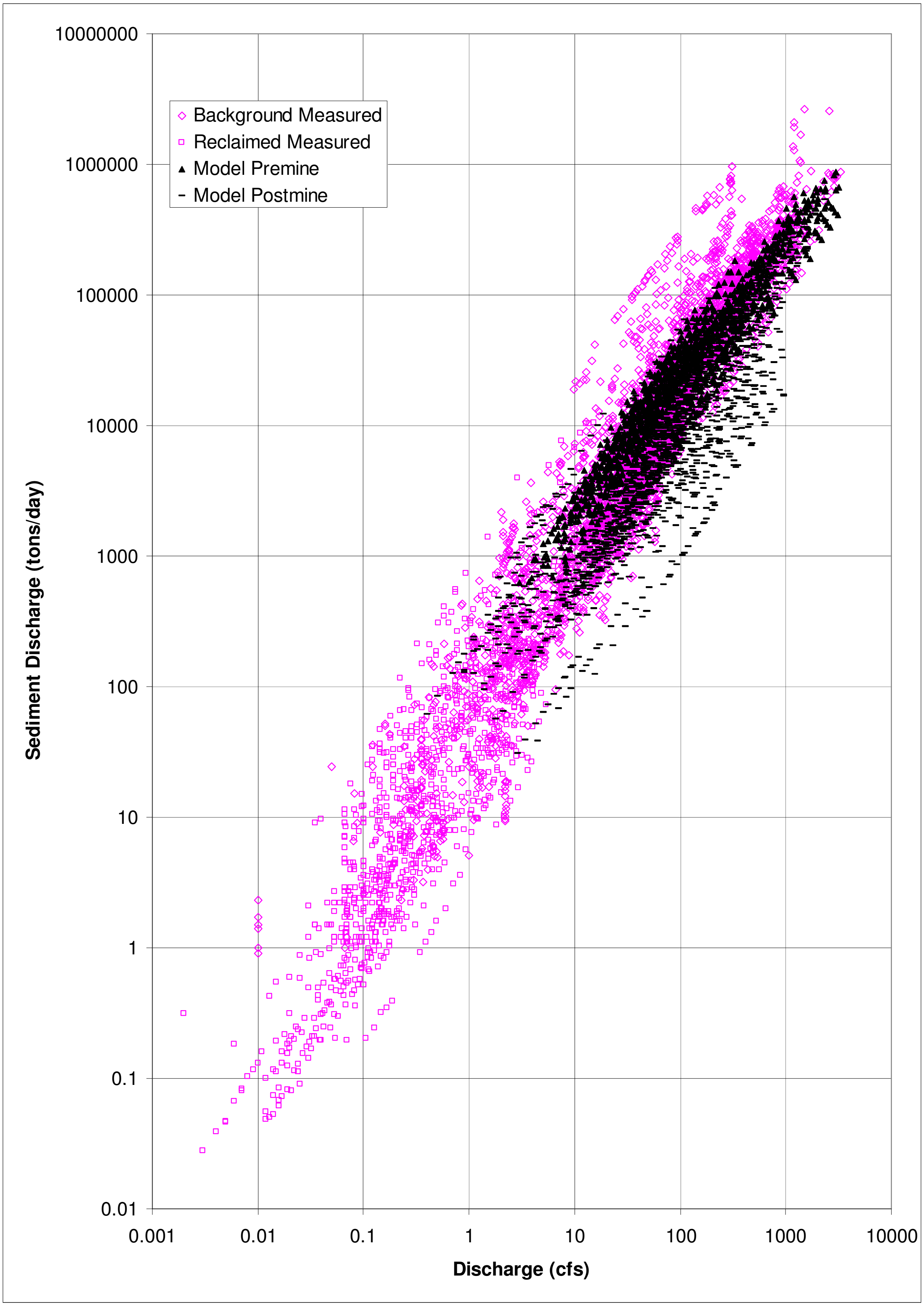


Figure 4.1. Observed and modeled sediment and water discharge.

Figure 4.2. Observed versus modeled sediment concentration and discharge.

However, the sediment yield shown in Table 3.5 is the amount of sediment leaving the CRA whereas the sediment discharge shown in Figure 4.1 is the peak rate of sediment in transport occurring in any channel on the CRA, whether the channel is located upstream or downstream of a pond. Therefore, it should be concluded that with or without the ponds trapping sediment or storing water, the mine reclamation is not contributing additional sediment to the receiving streams and sediment impacts to the prevailing hydrologic balance have been minimized.

Smith and Best (2000) analyzed the measured data (background and reclaimed) shown in Figure 4.1 to develop an approach that can be used to determine if channels in reclaimed areas have similar sediment transport characteristics as background channels. The method that they used was to develop Sen lines (Sen 1968) and confidence intervals around the data. The slope of the Sen line is a non-parametric statistic computed as the median slope of all possible slopes determined from pairing all the data points. The Sen line is drawn through the median coordinate of the data. Smith and Best first showed that the large channel flume data (background) and the small watershed background data could be combined. They concluded that since the data from one data set fall within the Sen line bounds of the other data set then the two data sets are merely extensions of each other and could be combined. Also, because the main channel and background small watershed site data could be combined, it indicated there is an unlimited supply of sediment and the channels are conveying sediment at (or near) capacity. The Sen line and bounds are shown with the background measured data in **Figure 4.3**.

They then plotted the reclaimed measured data (**Figure 4.4**) with the Sen line and bounds from the background data to show that the reclaimed data have the same characteristics even though the flow range of the measurements is lower. The data indicate that channel flows in this environment achieve the sediment transport capacity of the channel, whether in reclaimed or background conditions.

Using the same approach with the modeled data, **Figures 4.5 and 4.6** show the pre- and postmine computed sediment transport rates with the Sen lines and bounds. One difference between the plots is that the measured data occur throughout the flow hydrograph whereas the modeled data are tabulated at the peak of the simulation flow hydrograph. The premine data plot (Figure 4.5) shows the data tightly grouped around the Sen line and well within the bounds. The postmine data (Figure 4.6) plot most densely just below the Sen line and are more scattered. A few data points plot below the lower bound. On these graphs data plotting below the lines indicate that there is less sediment in transport for a given discharge. The lower sediment transport rates in the reclaimed data is probably the result of low gradient channels (in some cases terraces) while low gradient channels in the premine condition are rare.

Several conclusions can be drawn from these data plots: (1) EASI model well replicates erosion and sediment transport processes at the mine site for background and reclaimed conditions, (2) all data show similar trends and are within the same bounds, (3) data trends indicate that channels are transporting sediment at or near capacity, and (4) amounts of sediment leaving the CRA for postmine conditions are similar to premine conditions and within the range expected for the background conditions. Therefore, the overall conclusion is that the postmine reclaimed condition in N14 is not contributing additional suspended solids to receiving streams, and related impacts to the hydrologic balance have been minimized."

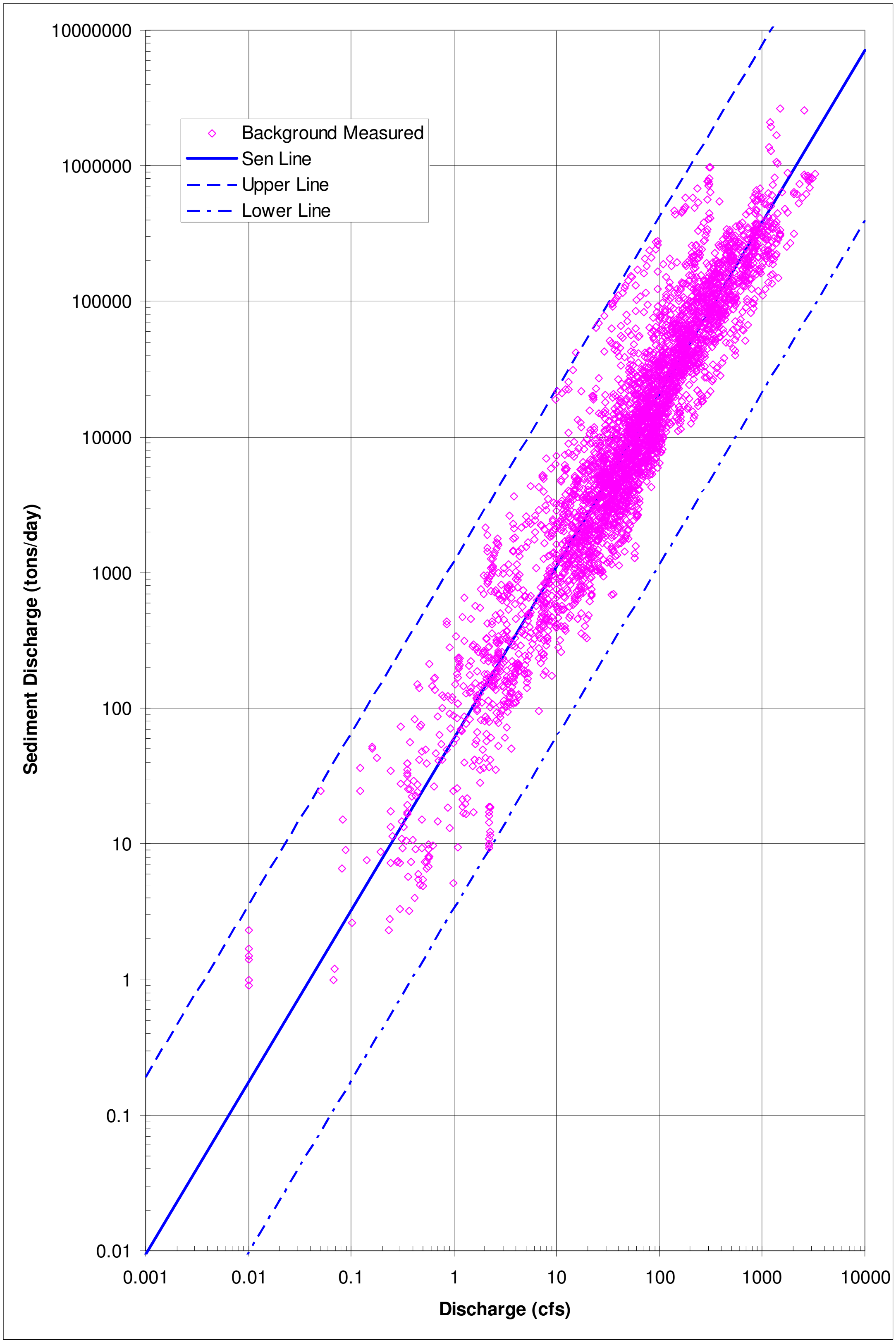


Figure 4.3. Background measured sediment and water discharge with Sen lines.

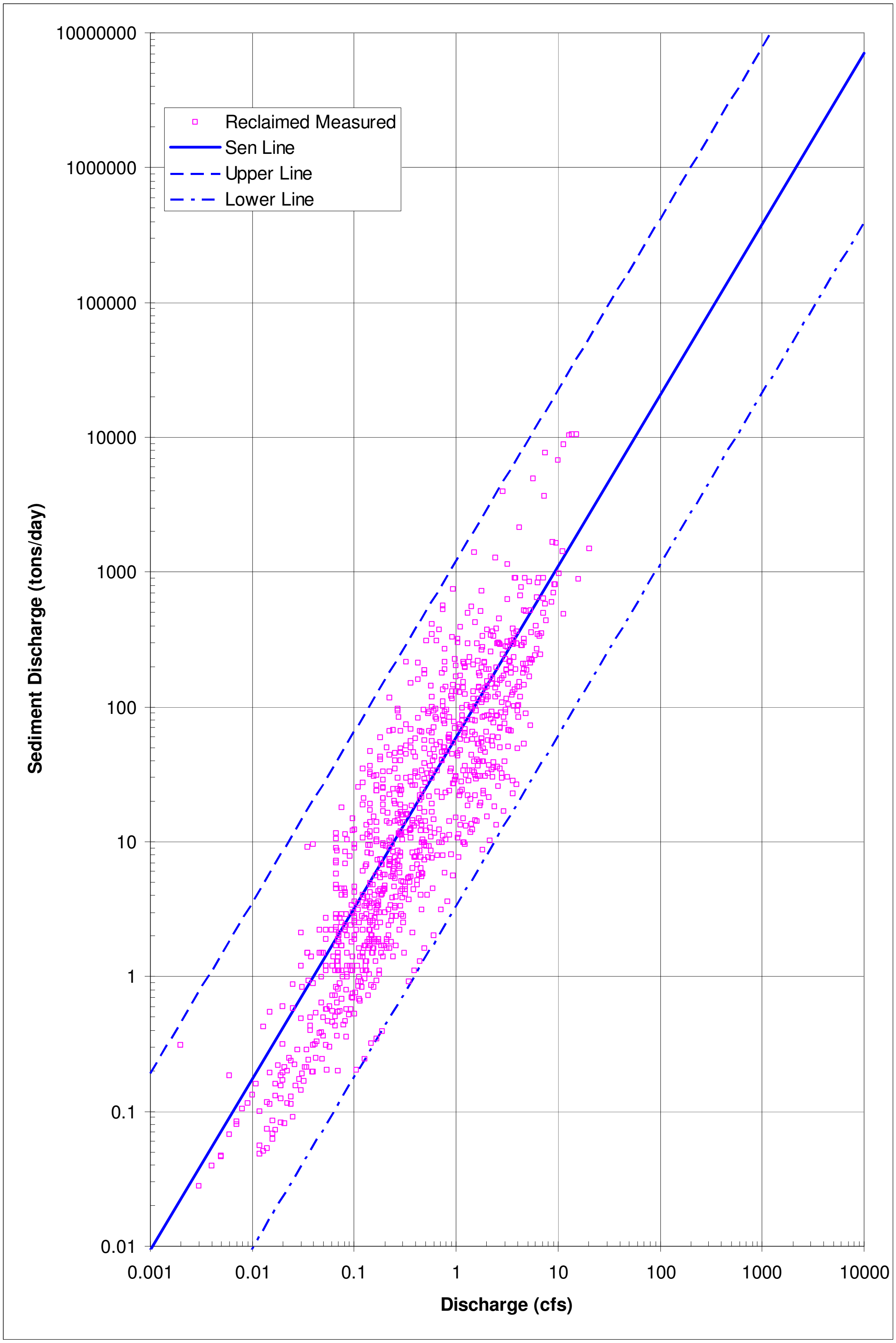


Figure 4.4. Reclaimed measured sediment and water discharge with Sen lines.

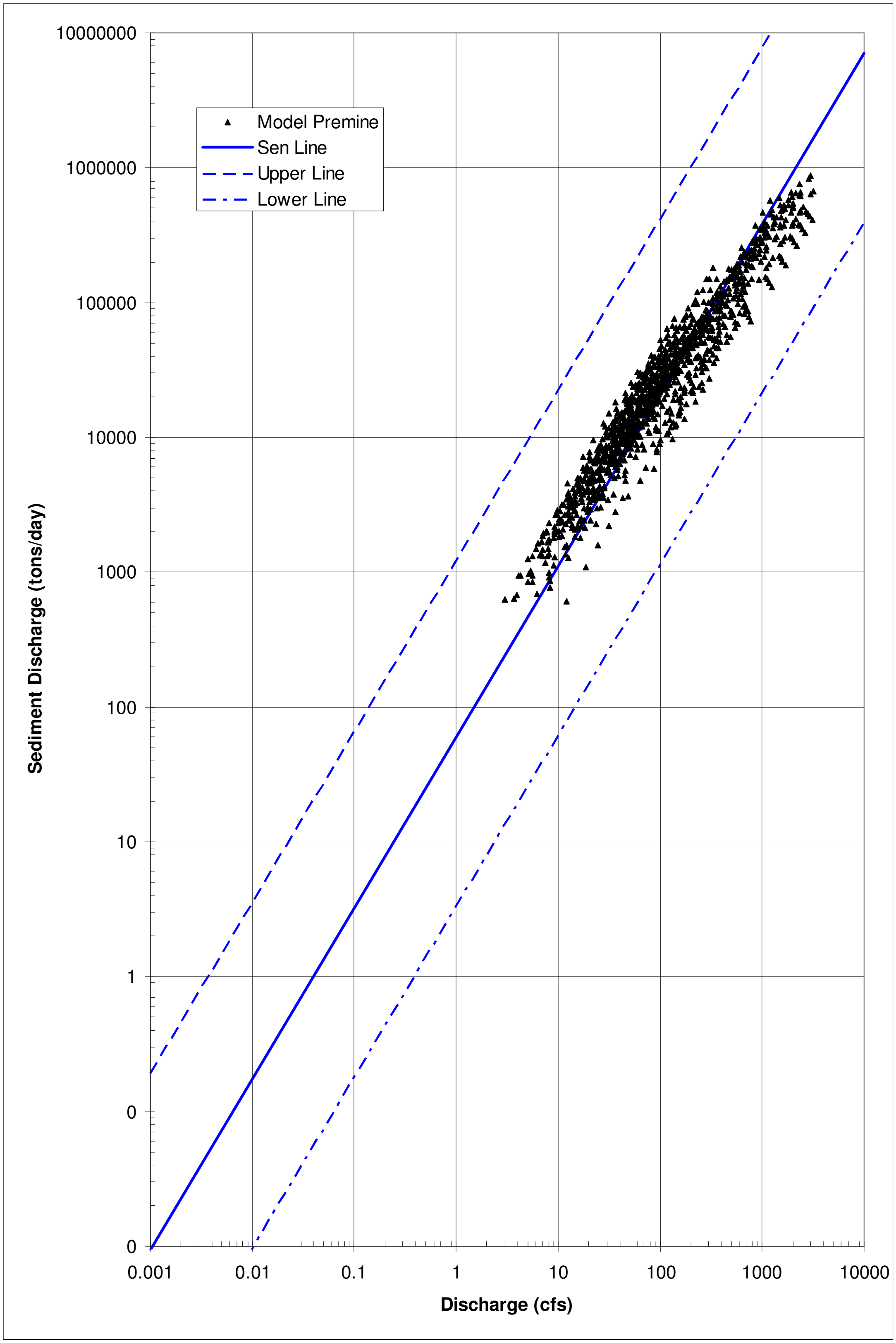


Figure 4.5. Modeled premine sediment and water discharge with Sen lines.

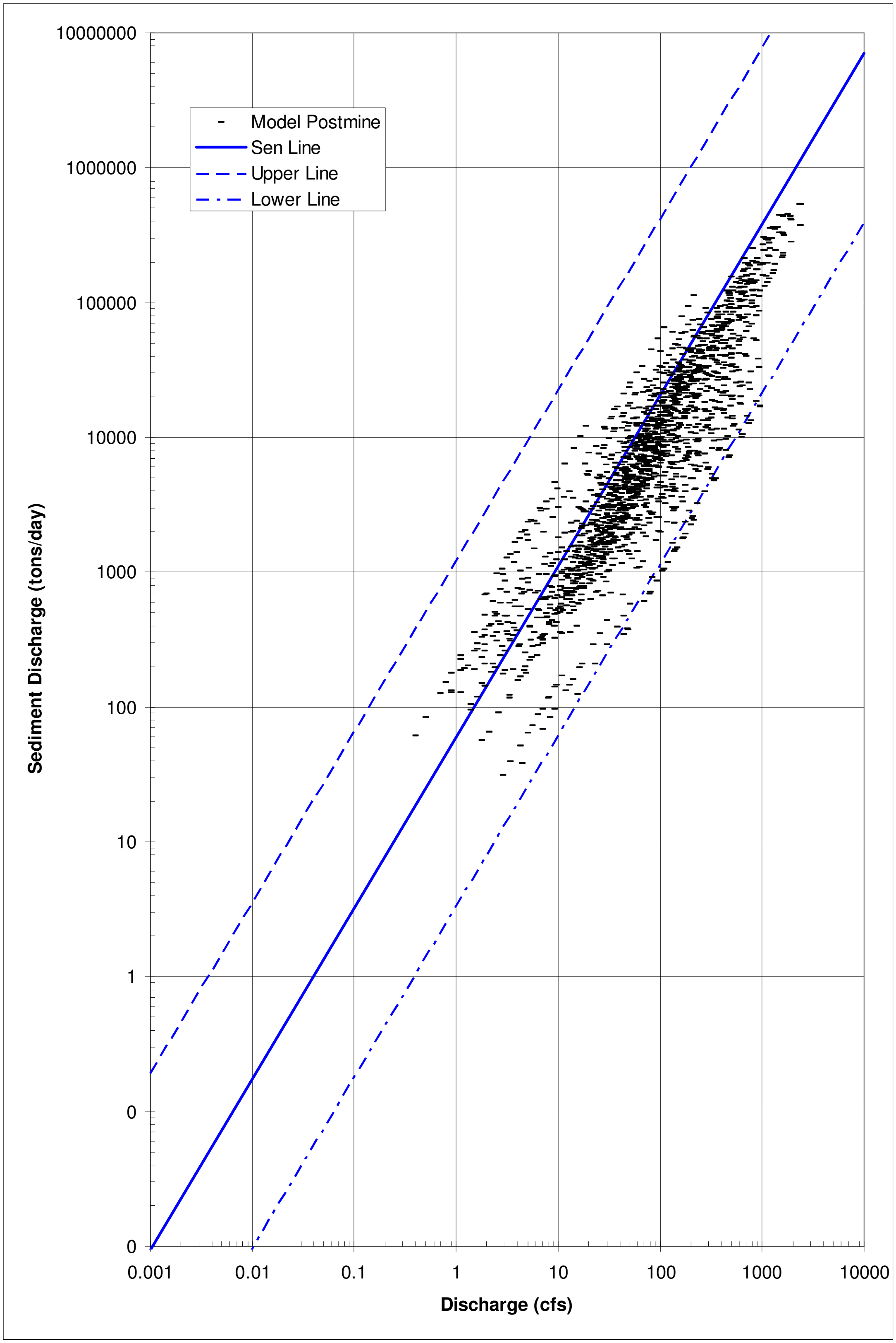


Figure 4.6. Modeled postmine sediment and water discharge with Sen lines.

5. REFERENCES

Chow, V.T., 1951. A practical procedure of flood routing, Civ. Engrs. and Public Works Rev. v. 46, no. 542, pp. 586-588.

Einstein, H.A., 1950. The Bed-load Function of Sediment Transportation in Open-Channel Flow, USDA Technical Bulletin No. 1026, Washington, D.C.

Fullerton, W.T., 1983. "Water and Sediment Routing from Complex Watersheds," MS Thesis, Colorado State University, Fort Collins, CO, 285 pp.

Green, W.H. and Ampt, G.A., 1911. Studies on soil physics,1, flow of air and water through soils, Jour. of Agric. Science, p. 1-24.

Hjelmfelt, A.T., Kramer, L.A., and Spomer, R.G., 1986. Role of large events in average soil loss in Proceedings of the Fourth Federal Interagency Sedimentation Conference, March 24-27, 1986, Las Vegas, NV, p. 3-1 to 3-9.

Lagasse, P.F., Schall, J.D., and Peterson, M.R., 1985. Erosion Risk Analysis for a Southwestern Arroyo, Journal of Urban Planning and Management, American Society of Civil Engineers, v. III, no. I, November, 1985, Paper No. 20165.

Miller, J.F., Frederick, R.H., and Tracey, R.J., 1973. "NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States," Volume VIII - Arizona, National Oceanic and Atmospheric Administration.

Renard, K.G. and Simaton, J.R., 1975. "Thunderstorm Precipitation Effects on the Rainfall-Erosion Index of the Universal Soil Loss Equation" in Volume 5 of Hydrology and Water Resources in Arizona and the Southwest, American Water Resources Assn., Arizona Section Arizona Academy of Science, Hydrology Section, Proceedings of April 11-12 meeting, Tempe AZ, v. 47-55.

Resource Consultants & Engineers, Inc. (RCE), 1993. "Surface Water Modeling of Reclaimed Parcels at the Black Mesa Complex," prepared for Peabody Western Coal Co.

Sen, P.K., 1968. "Estimates of Regression Coefficient Based on Kendall's tau: Journal of American Statistical Association, v. 63, p. 1379-1389.

Simons, D.B., Li, R.M., and Spronk, B.E., 1978. Storm Water and Sediment Runoff Simulation for a System of Multiple Watersheds, Vol. 1, Water Routing and Yield, Colorado State University.

Smith, T. and Best, A., 2000. "Assessing Sedimentation and Protection of the Hydrologic Balance in Disturbed and Reclaimed Areas at the Black Mesa and Kayenta Mines, Arizona, Using Baseline Sediment Data Collected in Receiving Streams," presentation given at the Billings Mined Land Reclamation Symposium in 2001, Billings, MT.

U.S. Bureau of Reclamation (USBR), 1960. Investigation of Meyer-Peter Muller Bed Load Formulas. Sedimentation Section, Hydrology Branch, Division of Project Investigations, U.S. Dept. of the Interior, June.

Water Engineering & Technology, Inc. (WET), 1990. "Determination of Background Sediment Yield and Development of a Methodology for Assessing Alternative Sediment Control Technology at Surface Mines in the Semiarid West," prepared for Office of Surface Mining and the National Coal Association, Fort Collins, CO.

Zevenbergen, L.W., Peterson, M.R., and Watson, C.C., 1990. Computer simulation of watershed runoff and sedimentation processes, Proceedings of the Billings Symposium; Planning, Rehabilitation and Treatment of Disturbed Lands.

EXHIBIT 1
Postmine Topography

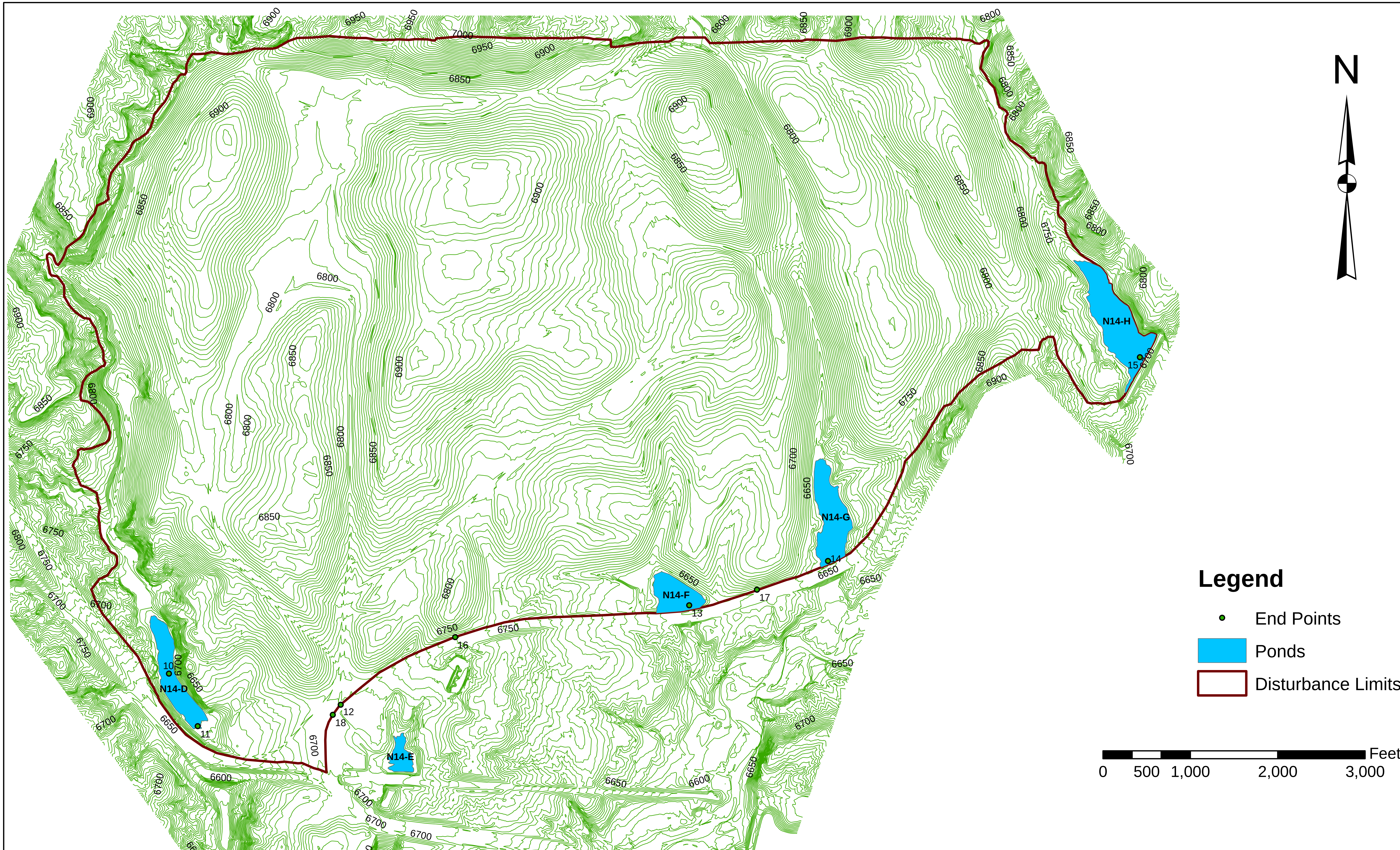


Exhibit 1. Postmine Topography

EXHIBIT 2
Premine Topography

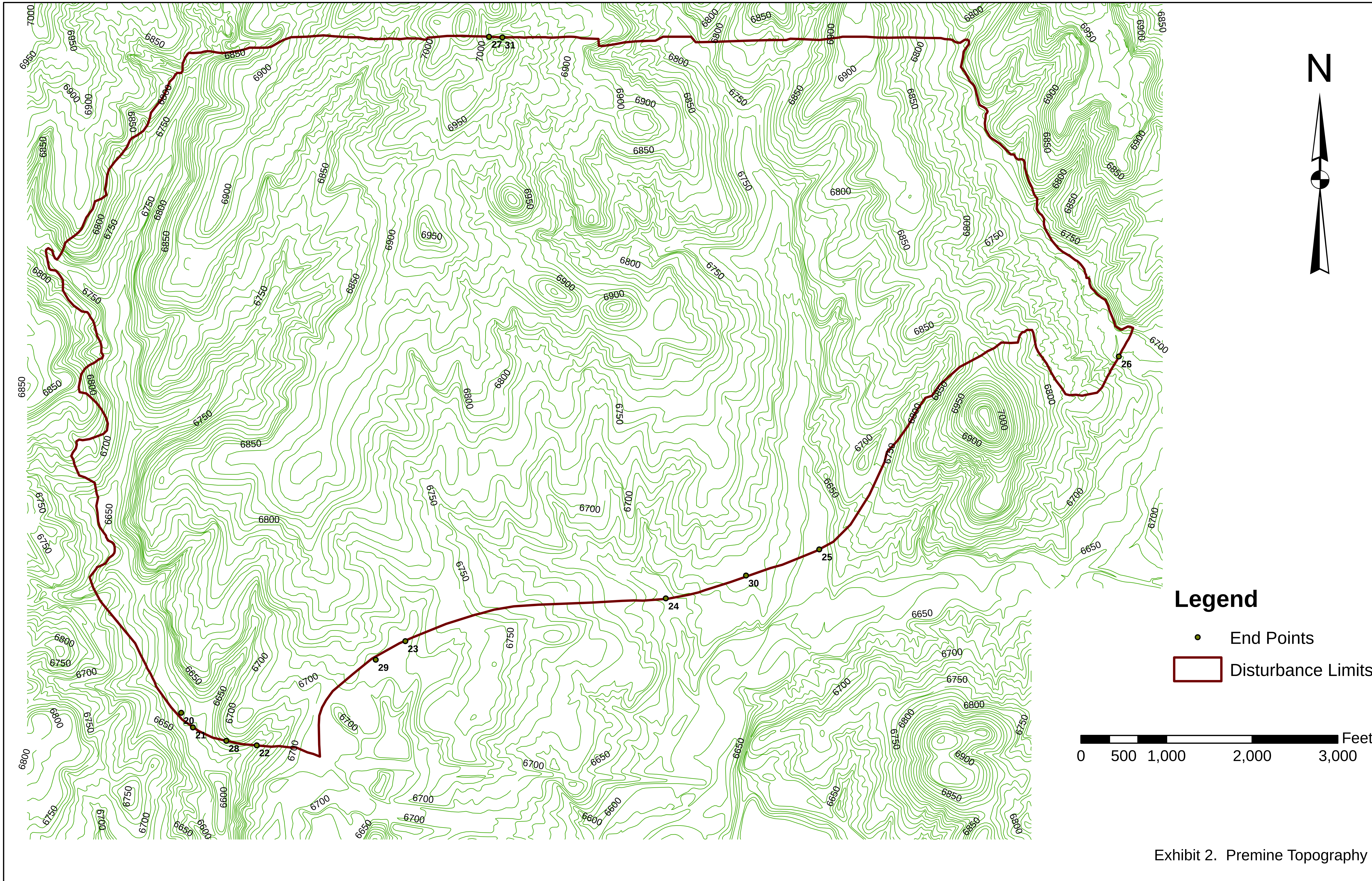


Exhibit 2. Premine Topography