0011

ANDALEX
RESOURCES, INC.

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PRICE, UTAH 84501
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APR 0 8 2004
DIV. OF OIL, GAS & MINING

File in:
❑ Confidential
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Refer to Record No 0011 Date 04082004
In C/0070019, 2004, Incoming
For additional information

Incoming
C/007/0019 OK
Task ID #1909

Utah Division of Oil, Gas & Mining
Coal Program
1594 West North Temple, Suite 1210
Box 145801
Salt Lake City, Utah 84114-5801

Attn: Pamela Grubaugh-Littig
Permit Supervisor

Re: Permit Area Expansion
Centennial Project
ACT/007/019
Carbon County, Utah

Dear Ms. Pam Littig:

Enclosed are 5 copies of amended pages and maps requesting approval of an Permit Area Expansion for the Centennial Project Permit Area.

The expansion area is for the remaining Mathis Tract area (approximately 400.00 acres), Federal Summit Creek Lease (approximately 702.53 acres) and the State L.B.A. (approximately 80.00 acres), for a total of approximately 1182.53 acres, as described on the amended pages and plates. This expansion will allow for proper development and continuation of mining in the Centennial Project Area.

The proposed change is for underground mining only. Due to the deep cover (from 2,600' to 3,000'), the change will have no effect on soils, vegetation, wildlife, land use, air quality, engineering, geology, surface hydrology or bonding. A PHC has also been prepared indicating no expected adverse affects to the hydrologic regime.

Required C_1/C_2 Forms are enclosed. If you have any questions, or need additional information, please let me know.

Sincerely,

Michael W Glasson

Michael Glasson
Senior Geologist

Form DOGM - C1 (Last Revised April 7, 2004)

File Folder # 3

APPLICATION FOR PERMIT PROCESSING

Permit Change X	New Permit ☐	Renewal ☐	Transfer ☐	Exploration ☐	Bond Release ☐	Permit Number: ACT/007/019

Title of Proposal:

PERMIT AREA EXPANSION

Mine: Centennial Project

Permittee: Andalex Resources, Inc.

Description, include reason for application and timing required to implement:

Instructions: *If you answer yes to any of the first 8 questions (gray), submit the application to the Salt Lake Office. Otherwise, you may submit it to your reclamation*

X Yes	☐ No	1. Change in the size of the Permit Area? 1182.53 acres Disturbed Area? 0 acres X increase ☐ decrease.
☐ Yes	X No	2. Is the application submitted as a result of a Division Order? DO #
☐ Yes	X No	3. Does application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes	X No	4. Does application include operations in hydrologic basins other than as currently approved?
☐ Yes	X No	5. Does application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes	X No	6. Does the application require or include public notice/publication?
X Yes	☐ No	7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes	X No	8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes	X No	9. Is the application submitted as a result of a Violation? NOV #
☐ Yes	X No	10. Is the application submitted as a result of other laws or regulations or policies? Explain:
☐ Yes	X No	11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes	X No	12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2?)
☐ Yes	X No	13. Does the application require or include collection and reporting of any baseline information?
☐ Yes	X No	14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes	X No	15. Does application require or include soil removal, storage or placement?
☐ Yes	X No	16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes	X No	17. Does the application require or include construction, modification, or removal of surface facilities?
X Yes	☐ No	18. Does the application require or include water monitoring, sediment or drainage control measures?
X Yes	☐ No	19. Does the application require or include certified designs, maps, or calculations?
X Yes	☐ No	20. Does the application require or include subsidence control or monitoring?
☐ Yes	X No	21. Have reclamation costs for bonding been provided for?
☐ Yes	X No	22. Does application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes	X No	23. Does the application affect permits issued by other agencies or permits issued to other entities?

X Attach 5 complete copies of the application.

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Michael W Stan Sr. Geologist 04/06/04

Signed - Name - Position - Date

Subscribed and sworn to before me this 7TH day of April, 2004

Linda Kerns

Notary Public

My Commission Expires: 05-08-05

Attest: STATE OF Utah

COUNTY OF Carbon

NOTARY PUBLIC
LINDA KERNS
345 NORTH 700 EAST
PRICE, UT 84501
MY COMMISSION EXPIRES
MAY 08, 2005
STATE OF UTAH

Received by Oil, Gas & Mining

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DIV. OF OIL, GAS & MINING

ASSIGNED TRACKING NUMBER

Form DOGM - C2 (Last Revised 6/93)

File Folder # 3

Application for Permit Processing
Detailed Schedule of Changes to the MRP

Title of Application:	Permit Number: ACT/007/019
PERMIT AREA EXPANSION	Mine: Centennial Project
	Permittee: Andalex Resources, Inc.

Provide a detailed listing of all changes to the mining and reclamation plan which will be required as a result of this proposed permit application. Individually list all maps and drawings which are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise the existing mining and reclamation plan. **Include page, section and drawing numbers as part of the description.**

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	X REPLACE	☐ REMOVE	Pages 1-18, 1-21
☐ ADD	X REPLACE	☐ REMOVE	Pages 2-1, 3-1
☐ ADD	X REPLACE	☐ REMOVE	Pages 4-1, 4-9
☐ ADD	X REPLACE	☐ REMOVE	Pages 6-1, 7-1, 8-1
X ADD	☐ REPLACE	☐ REMOVE	Appendix L, PHC for Mathis Tract, Federal Summit Creek and State L.B.A.
☐ ADD	X REPLACE	☐ REMOVE	Figures 4, 5 and 6 (Vaughn Hansen Report - Appendix L)
☐ ADD	X REPLACE	☐ REMOVE	Figure IV-II
☐ ADD	X REPLACE	☐ REMOVE	Plates 1 and 1-A
☐ ADD	X REPLACE	☐ REMOVE	Plates 2, 3 and 4
☐ ADD	X REPLACE	☐ REMOVE	Plate 19-A
☐ ADD	X REPLACE	☐ REMOVE	Plates 21, 22, 25
☐ ADD	X REPLACE	☐ REMOVE	Plate 29
☐ ADD	X REPLACE	☐ REMOVE	Plate 34
☐ ADD	☐ REPLACE	☐ REMOVE	
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Any other specific or special instructions required for insertion of this proposal into the Mining and Reclamation Plan?

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R645-301-100. GENERAL

The proposed Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change is simply an extension of our underground mine workings and will in no way involve any new surface facilities or otherwise have any affect on the surface. It does not involve any new hydrologic basins. Refer to R645-301-200 through R645-301-800 for additional information.

R645-301-110. LEGAL, FINANCIAL, AND COMPLIANCE INFORMATION

Legal, Financial, Compliance and Information

The objective of this chapter is to set forth all relevant information concerning ownership and control of Andalex Resources, Inc., the ownership and control of the property to be affected by mining activities and all other information and documentation required.

Please note that right-of-entry information for all new Leases is included in Appendix J, "Other Approvals". This includes the short form of the Mathis lease recorded at Carbon County.

Compliance Information

a) Suspension and Revocation

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex haven't had a mining permit suspended or revoked within the last five years.

b) Forfeiture of Bond

Andalex Resources, Inc., affiliates or persons controlled by or under common control with Andalex have not forfeited a mining bond or similar security in lieu of bond.

c) History of Violations

Appendix B contains a listing of all violations received within the last three years prior to the date of this application by Andalex and affiliated companies.

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R645-301-114. RIGHT-OF-ENTRY INFORMATION

Andalex Resources, Inc., in sublease agreement with AMCA Coal Leasing, Inc., currently holds approximately 5415.00 acres of private and federal coal leases in this permit area. The number will increase to 6597.53 acres with the addition of the remaining Mathis Tract, Federal Summit Creek Lease and State L.B.A. Andalex basis its legal right to enter and conduct mining activities in the permit area pursuant to the language contained in the Federal Coal Leases, Section 2, Rights of Lessee as follows:

> "The lessor, in consideration of any bonus paid (or to be paid if deferred), rents and royalties and other conditions hereinafter set forth, hereby grants and leases to the lessee the exclusive right and privilege to mine and dispose of all coal ... subject to the conditions, limitations and prohibitions provided in this lease and in applicable acts and regulations, the right to construct all works, buildings, structures, equipment, and appliances which may be necessary and convenient for the mining and preparation of the coal for market, and subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted..."

A similar right to enter and conduct underground mining activities is contained in the private lease agreement with the Zion Securities Corporation as follows:

> "During the life of the lease, so long as lessee is not in default hereunder, it may freely prospect, mine and develop the lease premises, extract and sell such coal therefrom as it may elect, and use the surface and underground thereof for all lawful purposes including the exploration and mining to be conducted therein and thereon. It may also use the leased lands in connection with the mining and development of other lands which it may own, lease, or acquire as a part of its general mining operations in the area."

Legal right-of-entry information for the Hoffman Creek federal and fee leases as well as the Graves Lease has been inserted into Appendix J, "Other Approvals". Also included in this appendix is our legal right-of-entry to the right-of-way which was added for the Aberdeen facilities (#UTU-62045) and the Right-of-Entry information for the Mathis Tract. None of the leases' rights-of-entry is a subject of pending litigation.

The Federal Coal Leases are described as follows (please see Plate 4):

UTU-66060 (Graves Lease)is subject to the terms and conditions set forth in the Federal Coal Lease issued by the Bureau of Land Management October 3, 1994. Specifically, Part I, section 2 of the lease "grants and leases to the Lessee the exclusive right and privilege to drill for, mine, extract, remove , or otherwise process and dispose of the coal deposits in, upon, or under the lands described below" as Tract 1 (Original Lease) and Tract 2 (Modification).

ANDALEX estimates that there are approximately 518,000 recoverable tons included within the 160 acre lease modification. This number of recoverable tons however is subject to the mineability of the coal. That is, The Aberdeen coal seam pinches out in a north-easterly direction. Also, the depth of cover increases dramatically to the north which could restrict recovery.

New Federal Summit Creek Lease

T. 12 S., R. 11 E. SLM, Utah
Sec. 29, SW¼SW¼, SW¼SE¼
Sec. 30, Lots 4, 12, 14, 15, 16
Sec. 31, Lots 1, 2, 7 through 11
Sec. 32, N½NW¼, W½NE¼, SE¼NW¼, NE¼SW¼, Containing 702.53 acres, more or less.

State L.B.A.

T. 12 S., R. 11 E., SLM, Utah
Sec. 29, NW¼SW¼
Sec. 30, Lot 11, Containing 80.00 acres, more or less.

The private fee leases are described as follows:

The Mathis Tract - Fee Lease

T.12S., R.10E., SLM, Utah
IBC: Section 36: S1/2S1/2, S1/2N1/2S1/2,containing 240 acres.
Section 36: N½N½S½, N½, containing 400 acres.
T.13S., R.11E., SLM, Carbon County, Utah
Sec. 7: S1/2 NW1/4
N1/2 SW1/4
SE1/4 SW1/4 containing 200 acres, more or less

The name and address of the lessor is Zion Securities Corporation, 10 East South Temple Street, Salt Lake City, Utah. This lease was originally made and entered into between Zion's and Centennial Coal Associates on August 1, 1972. AMCA Coal Leasing Inc. acquired the lease in February, 1977.

R645-301-200. SOILS

R645-301-210. INTRODUCTION

As the Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change is simply an extension of underground mine workings under roughly 2,600 to 3,000 feet of cover there will be absolutely no effect on soils.

R645-301-211. PREMINING SOIL RESOURCES

The soils map, shown as Plate 18 in Volume II, is a combination of the information provided by both EEC and SCS. EEC performed the work on the north and south one-thirds of the disturbed area and the SCS performed the work on the one-third in the middle. This was for the original Pinnacle Mine approval on the Zion's Fee area (please see second half of Appendix M).

The acreages given by EEC in the soils report does not include the entire disturbed area since we know that the SCS surveyed roughly one-third of the disturbed or "to be" disturbed area. The correct acreages as planimetered by Andalex staff is 34.2 acres. This of course includes the area where the Aberdeen Mine has been developed. The area of disturbed Brycan is approximately 8 acres and the Datino is 4 acres within the SCS survey. EarthFax Engineering has performed the Order 1 soil survey for the left fork fan installation. (See Appendix M.)

R645-301-212. STOCKPILING AND REDISTRIBUTION

Topsoil Handling During Operations

Removal

The area from which topsoil has been removed is 34.2 acres and includes poorly developed soils. Using dozers and front end loaders, the soil was scraped from the surface and dumped at a site near the facility location. The topsoil was removed as a separate operation from areas to be disturbed by surface installations such as roads and areas upon which support facilities are sited. The left fork topsoil will be salvaged according to EarthFax.

Storage

The topsoil storage areas are shown on Plate 6. The topsoil has been segregated, stockpiled, and protected from wind and water erosion and contaminants through revegetation and the use of berms.

Surveys conducted on the topsoil piles which were drawn into plans and profiles are now included in the plan in Volume II, Plates 37 and 36. This shows volumes stored currently.

R645-301-300. BIOLOGY

R645-301-310. INTRODUCTION

Vegetation Information

Introduction

Mountain-Brush, Desert Shrub, Pinion-Juniper Woodland, Sagebrush-Grass, Conifer-Aspen, and minor stream-side vegetative types cover the total mine plan area. Most of the area is covered by the Mountain-Brush type while the Pinion-Juniper Woodland type is predominant in the mine mouth area as well as the access routes and utility corridors; this area has been reseeded with a mixture as recommended by the U.S.D.A. S.C.S. (please see Soil Survey and Vegetation Inventory in Appendix M). Appendix M now also includes soils and vegetation information pertaining to the newly acquired AEP Lease. Because there will be no additional surface disturbance on the lease area, a First Order Survey is not deemed necessary.

As the Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change is simply an extension of underground mine workings under roughly 2,600 to 3,000 feet of cover there will be absolutely no effect on vegetation, fish or wildlife.

Andalex has selected and marked three reference areas in the field for vegetation. The Division has reviewed and approved these reference areas. Areas chosen include all types of vegetation conditions such as drainage areas, shallow slopes and steep slopes. Andalex contacted the SCS to help evaluate the condition of these sites. Please see SCS letter in Appendix M. It should be noted that Andalex does have the benefit of a revegetation test plot located on one of the topsoil piles. The drainage area reference area is the most adaptable to the left fork fan installation.

The revegetation map now shows the acreages for the three range types. Shrub clumps make up 2.15 acres, drainage areas make up 15.02 acres and steep slopes make up 17.03 acres. Total disturbed area, including the Aberdeen Mine left fork fan and road is 35.34 acres.

New vegetation mapping has been created for the entire permit area of the Centennial Mine including the Mathis Tract, New Federal Summit Creek Lease and State L.B.A. area. The mapping was done by Mt. Nebo Scientific, Inc. Springville, Utah. See Plate 19A.

The vegetation map will be created by using new and/or current available aerial photography with field work accomplished as a means for ground-truthing. Aerial photography used will be from appropriate periods of the growing season. Field verification work will be conducted during the growing season of 2002. The final vegetation map will be provided to the State of Utah, Division of Oil, Gas & Mining in December 2002.

R645-301-400. LAND USE AND AIR QUALITY

R645-301-410. LAND USE

As the Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change is simply an extension of underground mine workings under roughly 2,600 to 3,000 feet of cover there will be absolutely no effect on land use.

R645-301-411. ENVIRONMENTAL DESCRIPTION

Due to the rugged topography and sparse rainfall, the land area is presently used only for grazing, wildlife habitat, and outdoor recreation. Historically, the land has also been used for coal mining.

R645-301-411.100. PREMINING LAND USE INFORMATION

The initial development of the Book Cliffs Coal Field was started in the early 1890's. By the early 1900's practically the entire field had been prospected. Mines in the lease area were not active until the 1920's because the cliffs were less accessible and the coal beds were thinner.

The Knight-Ideal mines, now held by Andalex Resources are located adjacent to the Hoffman Creek lease area. Initial prospecting took place at this location in 1906 and extensive mining began in 1948 and ceased in 1958. During this period, 1,680,000 tons of coal were produced from the Gilson seam. The Knight-Ideal Mine is contiguous to our Sunedco leases (U-05067) in Hoffman Creek. By mining this lease, Andalex will recover all minable coal between Centennial and Knight-Ideal.

Three mines on or adjacent to the lease area in Deadman Canyon were the Zion, Olsen, and Sutton (Blue Flame) mines. The Zion was located on the Zion's fee lease and the Olsen and Sutton were on SL-027304. The first two produced from the Gilson seam and the last produced from the Aberdeen or Castlegate "A" seam. Production figures are not reliable but it is estimated that between 216,000 tons and 720,000 tons may have been produced from the Sutton mines. The Olsen mines produced about 18,000 tons and the Zion mine around 240,000 tons, between 1924 and 1944.

There was also a prospect entry driven in the Lower Sunnyside Seam (the Hileman) on lease U-010581 from which production was insignificant, approximately 1,400 tons. Mining ceased in the area in 1964.

R645-301-411.110. USES OF THE LAND AT THE TIME OF FILING APPLICATION

The Deadman Canyon area as well as the Straight and Hoffman Canyons would fall into two land use categories: 1) Fish and

R645-301-420. AIR QUALITY

As the Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change is simply an extension of underground mine workings under roughly 2,600 to 3,000 feet of cover there will be absolutely no effect on air quality.

Air Pollution Control Plan and Compliance with Air Quality Laws

Existing Environment

The permit area is located in a Class II air quality area.

Air Quality Impact Analysis

Please see the following section, section 3 re Emission Estimates.

Emission Estimates

Emission estimates are included as Appendix F in the form of an emission inventory. This inventory has been reviewed and approved by the Utah Bureau of Air Quality and the E.P.A. It has been re-approved to increase our production restriction on the basis the haul road has been paved by Carbon County. Air quality permit in appendix F.

Proposed Controls

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

There will be no additional fugitive emissions or air pollution associated with the newly acquired AEP Lease.

PSD Permit and Compliance with Air Quality Laws

The Environmental Protection Agency has determined that this project does not need a PSD air quality permit. This is based on our fugitive and non fugitive dust emissions inventory which assumes facilities necessary for 1.5 mm tons per year production. Further, the mine is not subject to the PSD regulations because of the new definition of a major source. (Refer to letter dated March 21, 1980 in Appendix J). All applicable air quality laws will be complied with and fugitive dust control practices, as required under 30 CFR 817.95, will be followed.

Andalex has been issued a new approval order for the mines and the Wildcat Loadout for 1.5 million tons per year. These were inspected and met compliance during the summers of 1989-1992.

R645-301-500. ENGINEERING

The Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change will not require any changes to engineering practices currently employed at the Aberdeen Mine. The change simply involves an extension of underground mine workings and does not involve the surface in any way. See 301-522 and 301-525 for additional comments on subsidence. See also IBC PHC, Appendix L.

R645-301-510. INTRODUCTION

Most of the maps previously submitted as part of the Mining and Reclamation Plan are applicable. Where necessary, original maps have been revised to indicate the newly acquired lease area and these revisions are included with this submittal as figures or as plates in Volume II. Plates which have been changed to show the location of the incidental boundary change are included.

It should be noted that no man made surface or subsurface features are located in or around the Mathis Tract I.B.C. or on adjacent proposed Federal and State Lease Applications shown on Plate I-A.

All categories within this section have been addressed, primarily in Volume II of the MRP which contains most of the plates.

a) Surface and subsurface ownership of lands contiguous to the permit area are shown on Plates 2 and 3.

b) The leases for which we have the legal right of entry are shown on Plate 4.

c) Andalex has submitted a permit modification to include the new AEP Lease recently acquired. Also, a permit will be sought in 1993 for a new fan installation immediately adjacent to Andalex's leases in the left hand fork in Deadman Canyon.

d) There are no buildings within 1,000 feet of the permit area except those used as part of the mining operation. They are shown on Plates 6 and 7.

e) There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plate 6 for their locations.

f) These reference areas are shown on Plate 9 as R-1, R-3 and R-4. They are each 200 feet square approximately.

g) The only user of surface water within this immediate hydrologic area is Andalex (Refer to Figure 5, Appendix L,

R645-301-600. GEOLOGY

As the Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change is simply an extension of underground mine workings under roughly 2,500 feet of cover there will be absolutely no effect on geology other than as we proceed further to the north, the depth of cover increases.
* SEE ALSO APPENDIX E

R645-301-610. INTRODUCTION

R645-301-611. GENERAL REQUIREMENTS

R645-301-611.100. GEOLOGY WITHIN AND ADJACENT TO THE PERMIT AREA

Introduction
The proposed permit area is in Book Cliffs which is the major physiographic feature in the region. The cliffs rise from a base at approximately 5,500 feet in elevation, to over 8,500 feet. Numerous canyons dissect the Book Cliffs. Soldier Creek and Coal Creek are the major area drainages. The permit area exhibits extreme topographic relief and is mountainous with steep cliffs and deeply incised drainages. With the exception of the Mancos Shale Formation, the Fiasco, Deadman, Straight Canyons, Hoffman Creek Canyon, Graves Lease and AEP Lease exhibit similar stratigraphic and topographic characteristics.

Tectonic Setting
The major coal seams of the Book Cliffs Coal Field lie within the Cretaceous Mesa Verde group which overlies the thick shales of the Cretaceous Mancos formation. The Mesa Verde group consists of the Star Point Sandstone, Blackhawk formation and Price River formation. The major coal seams lie within the Blackhawk formation.

The Tertiary Wasatch and Green River formations, along with the Price River formation, form the Roan Cliffs, the Tavaputs Plateau and the southern rim of the Uintah Basin. Lithologies present include fluvial, deltaic, and marine sandstones, mudstones, and shales.

Geologic History

During the Triassic and Jurassic periods, the area of the Book Cliffs was relatively stable, but gradually subsided and received sediments. The area, assumed to have been a relatively flat lowland, was occasionally covered by a shallow sea of short geologic duration. A thick red bed sequence suggests tropical conditions and the great thickness of sand accumulation suggests

R645-301-700. HYDROLOGY

The Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change will not encroach into any new hydrologic basins which are not addressed in the existing MRP (see plate 29). Seeps located within this boundary change have been addressed in the new Mathis Tract, Federal Summit Creek Lease and State L.B.A. PHC. (see PHC for the entire lease area).

SEE ALSO APPENDICES L, N, AND O

R645-301-710. INTRODUCTION

Water quality monitoring stations will be set up at the wells as shown on Figure IV-11, and also at the sedimentation pond discharge structures.

R645-301-711. GENERAL REQUIREMENTS

Hydrologic Protection Facilities

Sewage System

The nature of the overburden in the area offers excellent drainage. As a result, a septic system with drain fields conforming to the state codes has been established to handle the waste water disposal from the bathhouse and office facilities. The drain fields are located in native material (valley fill) cast of the bath houses in the parking area. Enclosed as Appendix G are the two septic system plans as designed by a Utah Registered Professional Engineer and approved by the State of Utah Department of Health.

Water Treatment

Based on the State of Utah, Department of Health review of the septic systems, water treatment is not needed. (Personal communication, Mr. Gerald Story, Utah Department of Health, Price, Utah).

Drainage Control - Diversions, etc.

See R645-301-512.240.

Sediment Control

See R645-301-512.240.

R645-301-711.100. EXISTING HYDROLOGIC RESOURCES

Appendix L

R645-301-711.200. POTENTIAL IMPACTS TO THE HYDROLOGIC BALANCE

Appendix L - Potential Hydrologic Consequences

R645-301-711.300. COMPLIANCE WITH HYDROLOGIC DESIGN CRITERIA

Protection of Hydrologic Balance and Compliance with Water Quality Laws

Andalex will follow its approved "Sedimentation and Drainage Control Plan" and comply with the N.P.D.E.S. Permit No. UTG-040007 issued July, 1989 (see Appendix J). Please note this permit authorizes three discharge points; two from sedimentation ponds (001, 003) and one from the underground mine (002). See IV-11

Andalex has approval from the State Engineer, Division of Water Rights, to collect runoff water from the disturbed area for use as a dust suppressant in the underground mining operation. This runoff is a result of direct precipitation with the runoff area.

Andalex will comply with the Clean Water Act (33 U.S.C. Sec. 1251 et seq.) and all other applicable water quality laws and health and safety standards.

Surface and Groundwater Monitoring

Location of Monitoring Points

Groundwater

Monitoring Plan for Proposed Permit Expansion

This monitoring plan is based on the PHC determination presented in Appendix L. As discussed previously, the potential for detrimental impacts resulting from mining activities in the North Mathis Tract, Summit Creek Federal Lease and State L.B.A. expansion area is considered remote. However, to document that no impacts to the hydrologic balance occur, and to provide verification that temporal variations in groundwater and surface water discharge rates are the result of climatic and seasonal variability, we recommend the monitoring of two springs within and north of the expansion area, B362 and B261. The locations of these springs are shown on Figure IV-11 of the MRP (Groundwater and surface water monitoring locations).

Details on each of the proposed new sites are discussed in Appendix L, "Probable Hydro logic Consequences of Coal and Mining in the Summit Creek and North Mathis Tracts, Andalex Resources, Inc., Tower Mine.

The monitoring plan for the proposed expansion area is summarized in Tables a, b, and c below.

Table a	North Mathis Tract, Summit Creek Federal Lease and State L.B.A. Groundwater Monitoring Plan	
Spring	Protocol	Comments
B362	A, 1	Flagstaff Limestone Spring in Antone Creek drainage.
B261	A, 1	Flagstaff Limestone spring in Dep Canyon (Pace Spring)

Table b	Monitoring protocols for springs in the expansion area
Water level and flow measurements: A Spring: quarterly discharge measurements when accessible.	
Water Quality: 1 Spring: quarterly operational water quality measurements (Table 6 List) when accessible.	

Table c	Groundwater operational water quality parameters
Field Measurements	Reported as
pH	pH units
Specific Conductivity	pS/cm@25°C
Temperature	°C
Flow	gpm
Laboratory Measurements	
Total Dissolved Solids	mg/L
Carbonate	mg/L
Bicarbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L

Groundwater monitoring sites are depicted on Figure IV-11, and include Well #1, S18-1 and S25-1. (The latter two are springs in the vicinity of the permit area, stratigraphically below any coal to be mined.) S25-1 is located in Hoffman Creek and has been monitored since the issuance of the emergency lease permit. This drainage also exclusively serves the new Sunedco Lease. Well #1 penetrates the first aquifer below the lowermost coal to be mined. The Aberdeen Sandstone is discussed in Appendix L.

The new AEP does not expose any new groundwater.

As stated earlier, the mines in this area are relatively dry. Like most any underground mine, minor "drippers" and some seepage is encountered. Such areas can accumulate moderate amounts of water underground, particularly in the areas of old workings. Such was the case when, in 1981, the new mine cut into some old works, releasing a surge of water that had to be discharged from the mine. Currently the mine "makes" enough water to discharge approximately 50% of the time via our approved UPDES point 002.

No flows presently exist underground that warrant monitoring; however, if significant flows are encountered underground, Andalex Resources will initiate monitoring according to the Division guidelines for groundwater baseline (and later, operational) monitoring. For the purpose of this section, "significant flows" shall be defined as: "Underground mining flows from a single source of 3 gpm or greater and sustained at a rate of 3 gpm or greater for a period of 30 days". If such flows are encountered, monitoring will be initiated. If the flow is being monitored and decreases below the above described "significant flow" amount, monitoring will be discontinued after a period of 60 days.

Surface Water

It should be noted that there are three new surface water monitoring sites associated with the North Mathis Tract, Summit Creek Federal Lease and state L.B.A. addition.

Surface water monitoring sites are depicted on Figure IV-11 and include 7-1, 8-1, 18-3, 18-4, 18-2, 25-2 and 12-1 and new sites AC-1, SC-1 and B263. Proposed new sites are discussed further in Appendix L. 25-2 is located in Hoffman Creek and has been monitored since the issuance of the emergency lease permit (no flow to date). This drainage also exclusively serves the new Sunedco leases. A new surface water monitoring location (12-1) will be situated at the month of Alrad Canyon in T.13S., R.10E., section 12 . The left fork of Deadman Canyon is already monitored at 18-3. These locations assure that all major drainages beneath the permit area are monitored. Also included in the surface monitoring are points 1, 2, and 3, part of UPDES Permit #UTG-040007 also shown on Figure IV-11. New surface water monitoring stations will be set up as needed for all new lease additions.

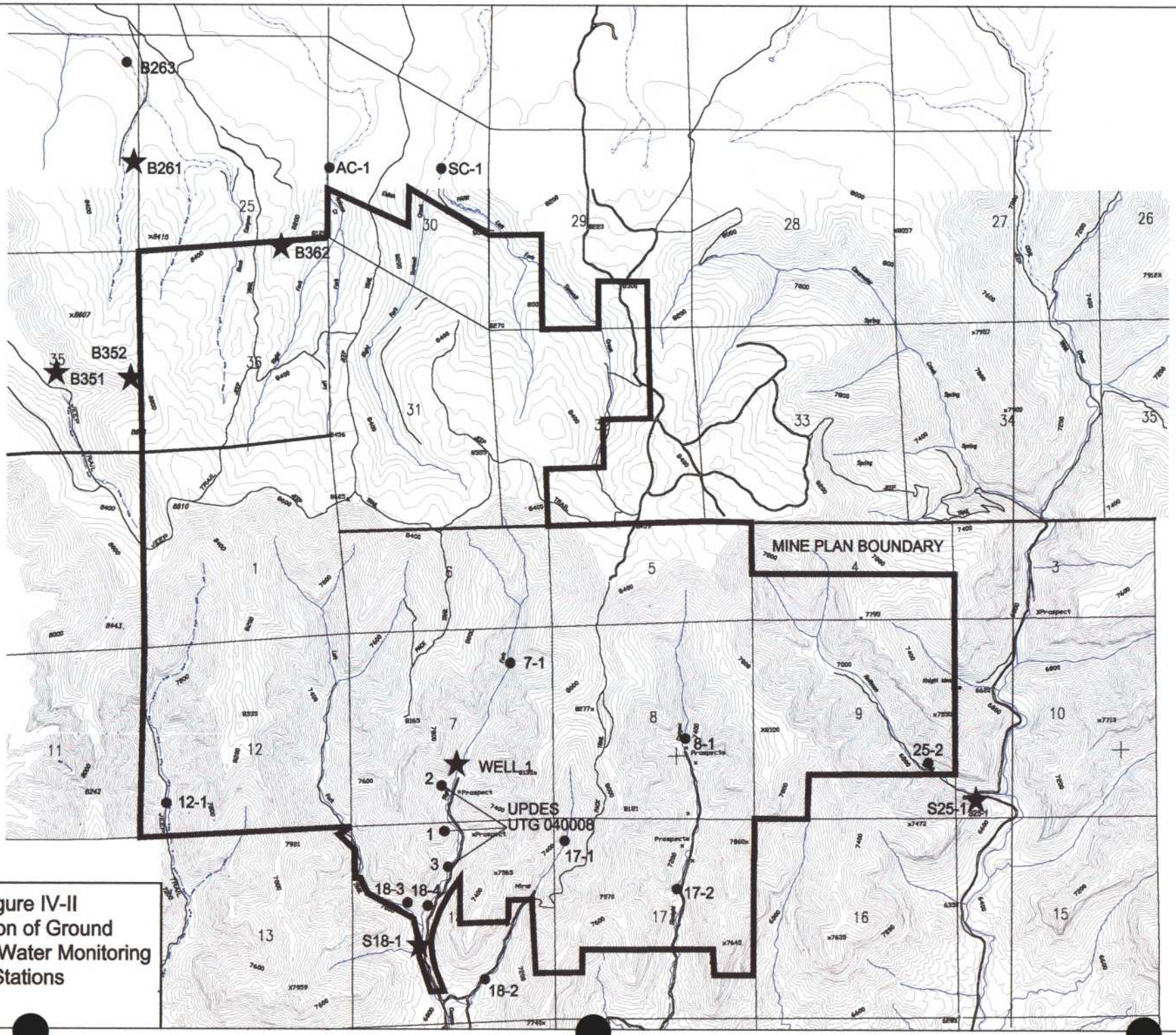

Figure IV-II
Location of Ground
& Surface Water Monitoring
Stations

Scale: None

R645-301-800. BONDING AND INSURANCE

As the Mathis Tract, New Federal Summit Creek Lease and State L.B.A. boundary change is simply an extension of underground mine workings under roughly 2,600 - 3,000 feet of cover there will be absolutely no effect to the surface and therefore has no influence on the reclamation bond already in place. ANDALEX is equipped with the required liability insurance.

R645-301-810. BONDING DEFINITIONS AND DIVISION RESPONSIBILITIES

N/A -- DIVISION

R645-301-811. TERMS USED

N/A -- DIVISION

R645-301-812. DIVISION RESPONSIBILITIES - BONDING

N/A -- DIVISION

R645-301-812.100. FORMS

N/A -- DIVISION

R645-301-812.200. REGULATION TERMS AND CONDITIONS FOR PERFORMANCE BONDS AND INSURANCE

N/A -- DIVISION

R645-301-812.300. BOND AMOUNT

N/A -- DIVISION

R645-301-812.400. SELF-BOND

N/A -- DIVISION

R645-301-812.500. BOND RELEASE

N/A -- DIVISION

R645-301-812.600. BOND FORFEITURE

N/A -- DIVISION

Probable Hydrologic Consequences of Coal Mining In the Summit Creek and North Mathis Tracts, ANDALEX Resources, Inc., Tower Mine

6 April 2004

ANDALEX Resources, Inc.
Price, Utah

Add to Appendix L

PETERSEN HYDROLOGIC
CONSULTANTS IN HYDROGEOLOGY

Probable Hydrologic Consequences of Coal Mining In the Summit Creek and North Mathis Tracts, ANDALEX Resources, Inc., Tower Mine

6 April 2004

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Price, Utah

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Introduction

The ANDALEX Resources Tower Mine is located in the Book Cliffs coal field, approximately 10 miles east of Price, Utah (Figure 1). ANDALEX is applying for a permit to mine coal in the Summit Creek and North Mathis coal tracts, which are contiguous with the northern boundary of the existing Tower permit area (Figure 2). The coal resources in the Summit Creek and North Mathis tracts, which lie under more than ½ mile of overburden, will be accessed from the existing Tower Mine underground workings. No new surface facilities or mine portals will be constructed as a result of coal mining in the Summit Creek and North Mathis tracts. The Summit Creek tract encompasses approximately 1.2 square miles and includes portions of Sections 29, 30, 31, and 32, T12S R11E, SLBM (Figure 2). The North Mathis tract encompasses approximately 0.6 square miles and is contained entirely in Section 36, T12S R11E, SLBM (Figure 2).

The land surface in the Summit Creek and North Mathis tracts and adjacent area is located in Emma Park, an upland plateau with rolling hills above Book Cliffs escarpment (Figure 1). The Emma Park region is currently experiencing a period of moderate to severe drought that began in late 1999 and continues to the present. No springs, seeps, or perennial stream reaches were identified in the Summit Creek or North Mathis tracts during surveys conducted by ANDALEX in 1980, 2001, and 2003. A single groundwater seep has been identified previously in the North Mathis tract. This seep, which has been monitored for several years by other entities, has historically usually been dry.

This report describes the probable hydrologic consequences (PHC) of coal mining in the Summit Creek and North Mathis tracts as required by Utah Coal Mining rule R645-301-728. This report is written in direct support of Chapter 7 of the Mining and Reclamation Plan (MRP) for the Tower Mine.

Including this introduction, this report contains the following sections:

- Introduction
- Methods of Study
- Mining Operations and Subsidence
- Physiography and Geology
- Presentation of Data
- Climate
- Description of Groundwater and Surface-Water Systems
- Determination of Probable Hydrologic Consequences of Coal Mining
- Recommended Monitoring Plan
- References Cited

Methods of Study

Data Compilation and Analysis

Existing hydrogeologic maps and reports were obtained and reviewed. Solute, discharge, and isotopic data were obtained from ANDALEX and from the Utah Division of Oil, Gas and Mining on-line hydrologic database (2004). Hydrologic data were analyzed using graphical and statistical methods. Solute chemical compositions were analyzed using Stiff (1951) diagrams. Groundwater mineral saturation indices were calculated using WATEQF (Plummer and others, 1976).

Spring, Seep, and Flowing Stream Surveys

The Summit Creek and North Mathis tracts and adjacent areas were surveyed by ANDALEX for seeps, springs, and flowing stream reaches in 1980, 2001, and 2003. No springs, seeps, or flowing stream reaches were identified in the Summit Creek or North Mathis tracts or adjacent areas. A single groundwater seep has previously been identified in the North Mathis tract. This seep, which has been monitored for several years by other entities, is usually dry. Several surface-water-fed stock-watering ponds have been identified in the stream drainages of the Summit Creek and North Mathis tract areas.

It should be noted that while the 1980 survey was conducted during a period of normal to mild wetness, the 2001 and 2003 spring and seep surveys were conducted during the current period of moderate to severe drought.

Mining Operations and Subsidence

The Aberdeen Mine has been in operation since 1990. Coal mining operations at the mine are carried out in the Aberdeen Seam (also known as the Castlegate A Seam) using longwall mining methods. Continuous mining methods are used primarily for development of longwall mining panels. Historically, the Tower Mine has experienced difficulties in roof control because of the geologic conditions at the mine. The existence of strong, massive sandstone units a few tens of feet above the mined coal seam results in the establishment of rock stresses that are not favorable to longwall-mining operations. Consequently, mining at the Tower Mine is carried out using a barrier–panel longwall design. Using this technique, substantial barriers of undisturbed coal are left between adjacent longwall panels. Because of the support of the unmined coal barriers and

the structural strength of the overlying massive sandstone units, subsidence at the land surface is minimal or non-existent. It has been the experience at the Tower Mine that in areas where the overburden exceeds approximately 1,000 feet, no measurable subsidence at the land surface occurs (Tower Mine subsidence data, 2003). Mining in the Summit Creek and North Mathis tracts will occur under more than 2,600 feet of cover. Thus, no subsidence of the overlying land surface is anticipated.

Historically, the Tower Mine has been a relatively dry mine. As mining at the Tower Mine currently progresses northward under increasing depths of cover, perched groundwater systems continue to be encountered. Most groundwater encountered in the mine discharges from sandstone channels in the mine roof. As is typical with other coal mines in the region, these roof drips commonly dry-up rapidly after first being encountered and the total groundwater discharged from individual sandstone channels is not of significant consequence. Seasonal variations in mine-water in-flow rates are not apparent (Personal communication, Mike Glasson, 2004). The groundwater encountered to date in the mine is best classified as nuisance water. Large inflows of groundwater into the mine workings have not occurred.

Physiography and Geology

The Summit Creek and North Mathis tracts are situated in the high plateau of Emma Park. Surface relief in the area is approximately 800 feet and ranges from approximately 7,900 feet in Summit Creek Canyon to 8,600 feet near the escarpment rim (Figure 2). The land surface in the

area slopes moderately to the north and consists of rolling hills and gullies that are vegetated primarily with sagebrush with interspersed stands of quaking aspens.

Within the Summit Creek and North Mathis tracts, only the Flagstaff Limestone is exposed at the surface. In the existing Tower Mine permit area, six Cretaceous- to Tertiary-age bedrock formations crop out. These include, in descending order, the Flagstaff Limestone, North Horn Formation, Price River Formation, Castlegate Sandstone, Blackhawk Formation, and the Mancos Shale. These bedrock formations were deposited during transgressions and regressions of the shoreline of the Western Cretaceous Interior Seaway during the Late Cretaceous and Early Tertiary. This ancient shoreline was located along the eastern edge of the tectonically uplifted mountains of the Sevier Orogenic Belt. Sediments eroded from the uplifted mountains were carried toward the seaway by fluvial systems and deposited as terrestrial, shoreline, marine, and interfingered non-marine and marine sedimentary sequences. A geologic map of the Summit Creek and North Mathis tract areas is shown in Figure 3.

The bedrock formations in the Tower Mine and the Summit Creek and North Mathis tract areas are briefly described briefly below.

Flagstaff Limestone

The Flagstaff Limestone is a Tertiary-age fresh-water limestone deposit. The formation consists of gray, thick- to thin-bedded limestone with some marls and thin sandstone stringers. It was deposited in lacustrine, marginal lacustrine, and alluvial plain depositional environments. The Flagstaff Limestone is exposed at the land surface throughout the Summit Creek and North

Mathis tracts and forms the cap rock over most of Emma Park (Figure 3). In most locations in the Wasatch Plateau and Book Cliffs coal fields, the Flagstaff Limestone is fractured. Because the primary porosity of the formation is low, groundwater flow in the Flagstaff Limestone occurs primarily in fractures.

North Horn Formation

The North Horn Formation consists predominantly of shale with lesser amounts of sandstone, limestone, and conglomerate. Sandstone paleochannels exist throughout the formation. The sandstone channels are isolated vertically and horizontally by mudstone deposits and lacustrian clays that are common throughout the formation. The North Horn Formation contains hydrophyllic clays that swell when wetted. Where exposed at the surface, it commonly forms slopes. The North Horn Formation is exposed at the surface immediately below the rim of the Book Cliffs escarpment adjacent to the Summit Creek and North Mathis tracts. The North Horn Formation is approximately 600 feet thick in the area.

Price River Formation

The Price River Formation consists of two or more thick sandstone layers interbedded with subordinate shale and sandy shale. The formation commonly forms a moderately steep ledge and slope hillside above the precipitous cliffs of the underlying Castlegate Sandstone.

Castlegate Sandstone

The Castlegate Sandstone consists of predominantly coarse-grained sandstone with occasional siltstone and claystone interbeds. The sandstone was deposited in a braided-stream fluvial

system and the lenticular sandstone channels are varied in size and interpenetrate. Although the primary porosity is high, the existence of mudstone drapes and pervasive carbonate and silica cement greatly reduces the ability of the formation to transmit water. The Castlegate Sandstone forms a prominent cliff above the underlying Blackhawk Formation.

Blackhawk Formation

The Blackhawk Formation consists of interbedded sandstone, mudstone, claystone, shale, and coal. In the vicinity of the Tower Mine, the massive, Aberdeen Sandstone is present at the base of the formation. The Aberdeen Seam (Castlegate A Seam), in which the Tower Mine workings exist, is present immediately above this sandstone. The massive Kenilworth Sandstone is present approximately 75 feet above the Aberdeen Seam. Sandstone Paleochannels, sinusoidal fluvial sandstones interpenetrating with the surrounding fine-grained rocks, are present in the Blackhawk Formation. The Blackhawk Formation is approximately 1,000 feet thick in the vicinity of the Tower Mine.

Mancos Shale

The Mancos Shale is over 4,000 feet thick and underlies vast portions of the Colorado Plateau. The low-permeability marine shale is carbonaceous, gypsiferous, and slightly calcareous.

Structure

Rock strata in the Tower Mine and adjacent Summit Creek and North Mathis tract areas dip to the northeast at approximately 6°. The strike of the rocks in the mine area roughly parallels the

trend of the Book Cliffs escarpment. No faulting has been identified in the Tower Mine permit area.

Presentation of Data

The locations of springs and seeps in the Summit Creek and North Mathis tract areas are shown on Figure 2. Details of hydrologic monitoring sites in the Summit Creek and North Mathis tract areas are listed in Table 1. Springs and streams in the area have been routinely monitored by ANDALEX Resources and other entities. The results of recent and historical discharge and water-quality data from these springs and streams are listed in Table 2. The solute compositions of groundwaters and surface waters in the study area are represented graphically as Stiff (1951) diagrams in Figure 4. Stiff diagrams are a useful way to compare the solute compositions of groundwaters. The shape of the Stiff diagram is a representation of chemical type, while the size of the Stiff diagram is a function of the total dissolved solids concentration.

Tritium and radiocarbon contents and radiocarbon mean residence times ("ages") of groundwaters in the Tower Mine are presented in Table 3.

Climate

Average precipitation at the Tower Mine portal area averages approximately 11 inches. Precipitation in the highest portions of the permit area, including the Summit Creek and North Mathis tract areas, may be up to approximately 15 inches per year. Average monthly

temperatures at the mine range from about 20 °F in January to 70 °F in July and August (ANDALEX Resources, 1995).

Climatic conditions in the vicinity of the Tower Mine have varied significantly during the period of the Tower Mine operation. This is illustrated in a plot of the Palmer Hydrologic Drought Index (PHDI) for Utah Region 6 (Figure 5). The PHDI is a monthly value generated by the National Climatic Data Center using a variety of hydrologic parameters that indicates wet and dry spells. The PHDI is calculated from several hydrologic parameters including precipitation, temperature, evapotranspiration, soil water recharge, soil water loss, and runoff. Consequently, it is a useful tool for evaluating the relationship between climate and groundwater and surface water discharge data. Beginning in 1997 and continuing through late 1999, the region experienced a period of moderate to extreme wetness. Beginning in late 1999, the region rapidly entered a period of moderate to severe drought that has continued to the present (Figure 5).

Description of Surface-Water and Groundwater Systems

It should be noted that while the 1980 spring and seep survey of the Summit Creek and North Mathis tract areas were conducted during a period of normal to mild wetness, the 2001 and 2003 surveys were conducted during the current period of moderate to severe drought (Figure 5). Thus, it is possible that some springs or seeps may have been flowing during wetter times in the past that may not have been flowing when the spring and seep surveys were conducted.

Discharge hydrographs for groundwater and surface water in the vicinity of the Summit Creek and North Mathis tract areas are presented in Figure 6. Most surface water in the Summit Creek

tract area drains into the Willow Creek drainage through either the Left or Right Forks of Summit Creek or Antone Creek. A small area of approximately 28 acres in the eastern portion of the Summit Creek tract drains into the Clearwater Creek drainage (Figure 7). Surface water in the North Mathis tract area flows into either the Antone Creek or Deep Creek drainages (Figure 7). No perennial stream reaches have been identified in either the Summit Creek or North Mathis tract areas. During the spring snowmelt event, short-lived surface flows likely occur in the ephemeral stream drainages. During the summer and fall months, short-lived surface flows occur in the ephemeral drainages in direct response to torrential rainfall events.

During wet climatic conditions, groundwater naturally discharges from the Flagstaff Limestone and North Horn Formation in the area, albeit in meager quantities and for short durations (Figure 6, Table 2). Seeps and springs in the region show rapid response to both season and climate, suggesting short flowpaths and shallow circulation depths. Seeps and springs in the region showed a rapid response to the very wet period in the late 1990's (Figure 6). Likewise, many springs in the region have ceased flowing entirely during the current period of prolonged drought. The groundwater systems that support the seeps and springs in the area operate primarily in shallow alluvial and colluvial deposits and in the uppermost fractured bedrock underlying these deposits. The abundant shale and mudstone horizons in the North Horn Formation and underlying Price River Formation effectively prohibit the downward migration of groundwater into deeper horizons. The fact that seeps in the area commonly dry-out during the summer months indicates that the groundwater travel time from recharge area to discharge area is less than one year. This also suggests that groundwater recharge locations are situated near the groundwater recharge areas (i.e., there is no regional-type aquifer supporting these seeps and

springs). Because shallow alluvial and colluvial groundwater systems are constrained by local surface topography, recharge and discharge areas generally must occur within the local surface-water sub-drainage in which the seep or spring is located.

Both groundwaters and surface waters in the Summit Creek and North Mathis tract and adjacent areas are of the calcium-bicarbonate or calcium-magnesium-bicarbonate type, with average TDS concentrations of 305 and 319 mg/l, respectively (Table 2). This solute composition is consistent with the dissolution of carbonate minerals in the presence of soil-zone CO_2 gas. Elevated concentrations of chloride, sulfate, and sodium, which commonly occur in groundwaters that circulate deeply through rocks of marine origin in the western United States, are not observed in groundwaters or surface waters in the study area (Table 2). This information supports that conclusion that groundwater circulation depths are shallow.

In contrast to the shallow groundwater systems that support seeps at the land surface in the region, the Blackhawk Formation groundwater systems encountered in the Tower Mine workings do not have good hydraulic communication with shallow, active recharge sources. This is evidenced by the lack of seasonal discharge variations and the short durations of in-mine groundwater inflows. Groundwaters sampled in the Tower Mine have mean residence times from 13,000 to 15,000 years. Tritium contents, which indicate whether groundwater has received recharge in the past 50 years, are near the lower laboratory detection limits (Table 3). The lack of hydraulic communication between the inactive groundwater systems encountered in the mine and shallow, near-surface recharge sources is primarily the result of heterogeneity of the rock sequence in the mine area. As illustrated in Figure 8, although lenticular rock bodies

that have the potential to transmit water exist in the Blackhawk and overlying formations, these lenticular rock bodies are of limited extent and are encased both vertically and horizontally in low-permeability fine-grained rocks. Thus, the potential for groundwater migration through these rocks, both vertically and horizontally, is limited. Groundwater in the mine environment commonly occurs in vertically and horizontally isolated, perched groundwater systems.

Determination of Probable Hydrologic Consequences of Coal Mining in the Summit Creek and North Mathis tract areas

728.100, 728.200 Quality and quantity of surface water and groundwater under seasonal flow conditions and baseline hydrologic information

No springs, seeps, or flowing stream reaches were identified in the Summit Creek or North Mathis tracts during the 2001 and 2003 spring and seep surveys. A single seep (B362) has been previously identified and monitored. On most occasions this seep has been dry (Table 2). It is possible that during significantly wetter periods, increased discharge from shallow groundwater systems in the Summit Creek and North Mathis tract areas could occur.

Water quality and discharge data for seeps, springs, and streams located in the vicinity of the Summit Creek and North Mathis tract areas are presented in Table 2. Groundwater discharges and surface-water flows in the region respond rapidly to climate and season. Both groundwaters and surface waters monitored in the Summit Creek and North Mathis tract areas are of the calcium-bicarbonate or calcium-magnesium-bicarbonate type (Figure 4, Table 2). TDS concentrations in the seeps and surface water drainages average 305 and 319 mg/l, respectively. Most groundwater and surface water in the region is near neutral to slightly alkaline in character, with pH values generally ranging from about 7.3 to 8.6.

728.310 Whether adverse impacts may occur to the hydrologic balance

The likelihood of any adverse impacts to the hydrologic balance as a result of coal mining in the Summit Creek and North Mathis tracts is considered extremely unlikely. As discussed previously, groundwater encountered in the mine workings occurs under isolated, perched conditions. The deep groundwater systems are not in hydraulic communication with shallow recharge sources or shallow groundwater systems. Thus, the interception of the ancient, perched groundwater in the mine will not impact the overlying shallow groundwater systems in the Summit Creek and North Mathis tracts or surrounding areas.

Generally, the deformation of strata overlying coal mines as a result of mining-induced subsidence has the potential to interrupt or re-route pre-mining groundwater flow paths. However, as discussed previously, because of the unique barrier-pillar longwall design utilized at the Tower Mine, the thickness of the overburden (>2,600 feet), and the presence of strong, massive sandstone units overlying the coal seam, no subsidence above the Summit Creek or North Mathis tracts will occur. Thus, any shallow groundwater or surface-water systems in the Summit Creek and North Mathis tracts and surrounding area will be isolated from the mine workings by a more than ½ mile-thick sequence of low-permeability, relatively undamaged bedrock. No mining-related interruption of shallow groundwater flow paths is anticipated.

728.320 Whether acid-forming or toxic-forming materials are present that could result in the contamination of surface-water or groundwater supplies

It is anticipated that the rocks in the Summit Creek and North Mathis tracts will have acid- and toxic-forming potential similar to that in the rocks in the existing Tower Mine permit area. No

new topsoil or waste rock piles are planned as a consequence of mining in the Summit Creek or North Mathis tracts. Historically, no contamination of surface-water or groundwater supplies has occurred at the Tower Mine as a result of the presence of acid-forming or toxic-forming materials. Consequently, no adverse impacts are anticipated as a result of mining in the Summit Creek and North Mathis tracts.

Although iron-sulfide minerals such as iron pyrite are known to exist in small quantities in the Book Cliffs and Wasatch Plateau coal fields, these materials do not cause contamination of surface-water or groundwater supplies. The oxidation of sulfide minerals, when exposed to water and air, releases H^+ ions (acid), temporarily decreasing the pH of the water. However, acid produced from this reaction is rapidly consumed through reactions with carbonate minerals that are pervasive in the rocks of the Utah coal district. Thus, acid mine discharge does not occur. The dissolved iron in the water is rapidly precipitated as iron-hydroxide as the water encounters oxygen.

Thus, the potential for contamination of surface-water or groundwater supplies as a result of interaction with acid-forming or toxic-forming materials in the Summit Creek and North Mathis tracts is considered negligible.

728.331 What impact the proposed coal mining and reclamation operation will have on sediment yield from the disturbed areas

No subsidence in the Summit Creek and North Mathis tract area will occur as a result of mining in the tracts. No new surface disturbances are planned in conjunction with the mining of the

Summit Creek and North Mathis tracts. Thus the potential for sediment yield from disturbed areas is negligible.

728.332 What impact the proposed coal mining and reclamation operation will have on acidity, total suspended and dissolved solids and other important water quality parameters of local impact

No new mine discharges or surface facilities are planned as a result of mining in the Summit Creek and North Mathis tracts. The chemical character of water encountered in the Summit Creek and North Mathis tracts will likely be similar to that encountered previously in the Tower Mine permit area. Thus, the potential for increases in acidity, total suspended and dissolved solids, or other important water quality parameters above current levels as a result of mining in the Summit Creek and North Mathis tracts is considered negligible.

728.333 What impact the proposed coal mining and reclamation operation will have on flooding or streamflow alteration

No new mine discharges or surface facilities are planned as a result of mining in the Summit Creek and North Mathis tracts. It is anticipated that the nature of future groundwater inflows in the Summit Creek and North Mathis tracts will be similar to those encountered previously in the Tower Mine permit area. Historically, no flooding or streamflow alteration has occurred as a result of discharge from the Tower Mine. Because no subsidence is anticipated in the Summit Creek and North Mathis tracts and adjacent area, no subsidence-related changes to stream morphology should occur. The potential for flooding or streamflow alteration as a result of mining in the Summit Creek and North Mathis tracts is considered low.

728.334 What impact the proposed coal mining and reclamation operation will have on groundwater and surface-water availability

As discussed previously, shallow alluvial and colluvial groundwater systems are hydraulically isolated from the deep, inactive groundwater systems encountered during mining operations. The shallow systems are isolated from the mine environment by more than ½ mile of undamaged, low-permeability bedrock. Because of the barrier-pillar design and the geologic conditions in the Summit Creek and North Mathis tracts, no subsidence is anticipated. As is common on lands used for livestock grazing, impoundments have been created in the surface drainages in the Summit Creek and North Mathis tracts and adjacent areas to capture snowmelt and rainwater for livestock watering. Because the land surface in the Summit Creek and North Mathis tract areas will not experience subsidence, these stock-watering ponds should not be impacted.

Thus, the potential for adverse impacts to groundwater and surface-water availability in the Summit Creek and North Mathis tracts and adjacent area is negligible. Mining in the Summit Creek and North Mathis tracts may make available groundwater from perched, inactive groundwater systems that would otherwise have been unavailable.

728.350 Whether the underground coal mining and reclamation activities may result in contamination, diminution or interruption of State-appropriated water

As discussed previously, mining in the Summit Creek and North Mathis tracts will occur under greater than 2,600 feet of overburden. Shallow alluvial and colluvial groundwater systems in the Summit Creek and North Mathis tract areas are hydraulically isolated from the deep groundwater

systems that will be encountered during mining operations. No subsidence of the land surface above the Summit Creek and North Mathis tracts and adjacent area is anticipated. Thus the potential for contamination, diminution or interruption of State-appropriated water is considered negligible.

However, if in the very unlikely event that that contamination, diminution, or interruption of State-appropriated water did occur, ANDALEX Resources would be required under Utah Coal Mining Rule R731.530 to replace any State-appropriated water supply that is contaminated, diminished, or interrupted by underground coal mining and reclamation activities.

Recommended Monitoring Plan

This recommended monitoring plan is based on the PHC determination presented above. As discussed previously, no springs, seeps, or flowing stream reaches were identified in the Summit Creek tract area and only a single groundwater seep (B362) is known to exist on the North Mathis tract. Additionally, the potential for mining-related impacts to shallow groundwater systems that could support seeps or springs or provide baseflow to streams is considered remote. However, to document that no impacts to the hydrologic balance occur and to document the response of shallow groundwater and surface-water systems to climatic variability, we recommend the monitoring of two Flagstaff Formation springs. These include B362, located on the North Mathis tract, and B261, located north of the North Mathis and Summit Creek tract areas. We also recommend the monitoring of three creeks. These include B263 (Deep Creek below tract area), AC-1 (Antone Creek below tract area), and SC-1 (Summit Creek below tract area below the confluence of the Left and Right Forks).

The locations of these monitoring points are shown on Figure 6 of the MRP (Ground and surface water monitoring locations). The recommended monitoring plan is summarized in Tables 4, 5, 6, and 7 below.

It should be noted that ANDALEX Resources is committed to adequately monitoring the hydrologic resources in the Summit Creek and North Mathis tract areas. Accordingly, should seeps, springs, or perennial streams be identified in the Summit Creek and North Mathis tract areas when wetter climatic conditions return to the area, ANDALEX commits to carrying out a

monitoring program that will adequately monitor the potential for mining-related impacts to the hydrologic resources in the Summit Creek and North Mathis tract areas.

Table 4 Recommended Monitoring Plan for springs and streams.

Spring	*Protocol*	*Comments*
B362	A, 1	Flagstaff Limestone spring in Antone Creek drainage
B261	A, 1	Flagstaff Limestone spring in Deep Canyon (Pace Spring)

Stream	*Protocol*	*Comments*
AC-1	B, 2	Antone Creek located downstream of tract boundary
SC-1	B, 2	Summit Creek located below confluence of Left and Right Forks below tract boundary
B263	B, 2	Deep Creek downstream of tract boundary

Table 5 Monitoring protocols for springs and streams in the Summit Creek and North Mathis tract areas.

Water level and flow measurements

A Spring: quarterly discharge measurements when accessible

B Stream: quarterly discharge measurements when accessible

Water Quality

1 Spring: quarterly operational water quality measurements (Table 6 list) when accessible

2 Stream: quarterly operational water quality measurements (Table 7 list) when accessible

Table 6 Recommended groundwater operational water quality parameters.

Field Measurements	Reported as
pH	pH units
Specific Conductivity	μS/cm @ 25°C
Temperature	°C
Discharge	gpm
Laboratory Measurements	
Total Dissolved Solids	mg/L
Carbonate	mg/L
Bicarbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L

Table 7 Recommended surface-water operational water quality parameters.

Field Measurements	Reported as
pH	pH units
Specific Conductivity	μS/cm @ 25°C
Temperature	°C
Discharge	gpm
Dissolved oxygen	mg/L
Laboratory Measurements	
Total Dissolved Solids	mg/L
Total Suspended Solids	mg/L
Carbonate	mg/L
Bicarbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L

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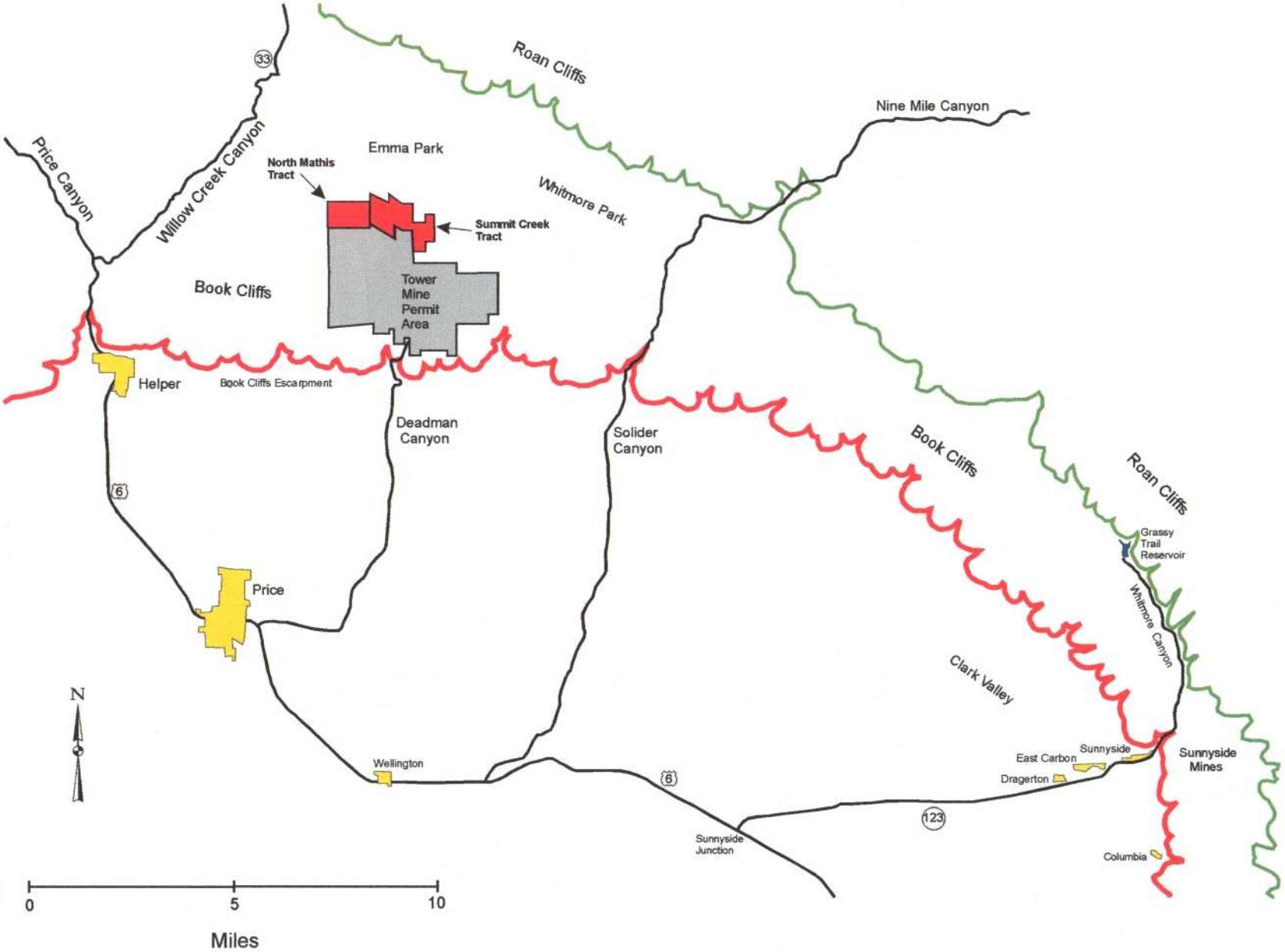


Figure 1 Location map for the Tower Mine and the Summit Creek and North Mathis tract areas.

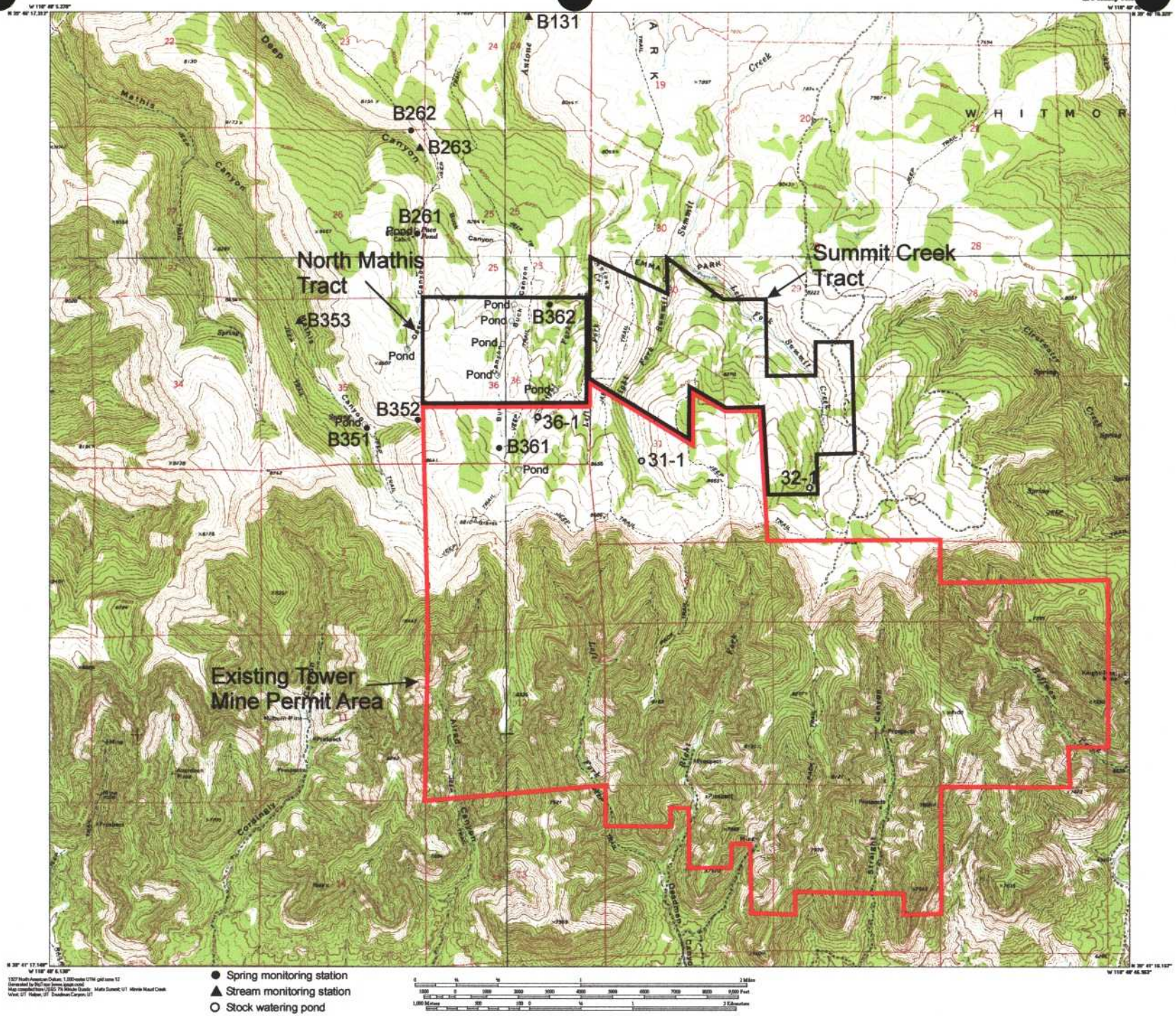


Figure 2 Location of the Summit Creek and North Mathis Tracts and historic water monitoring locations.

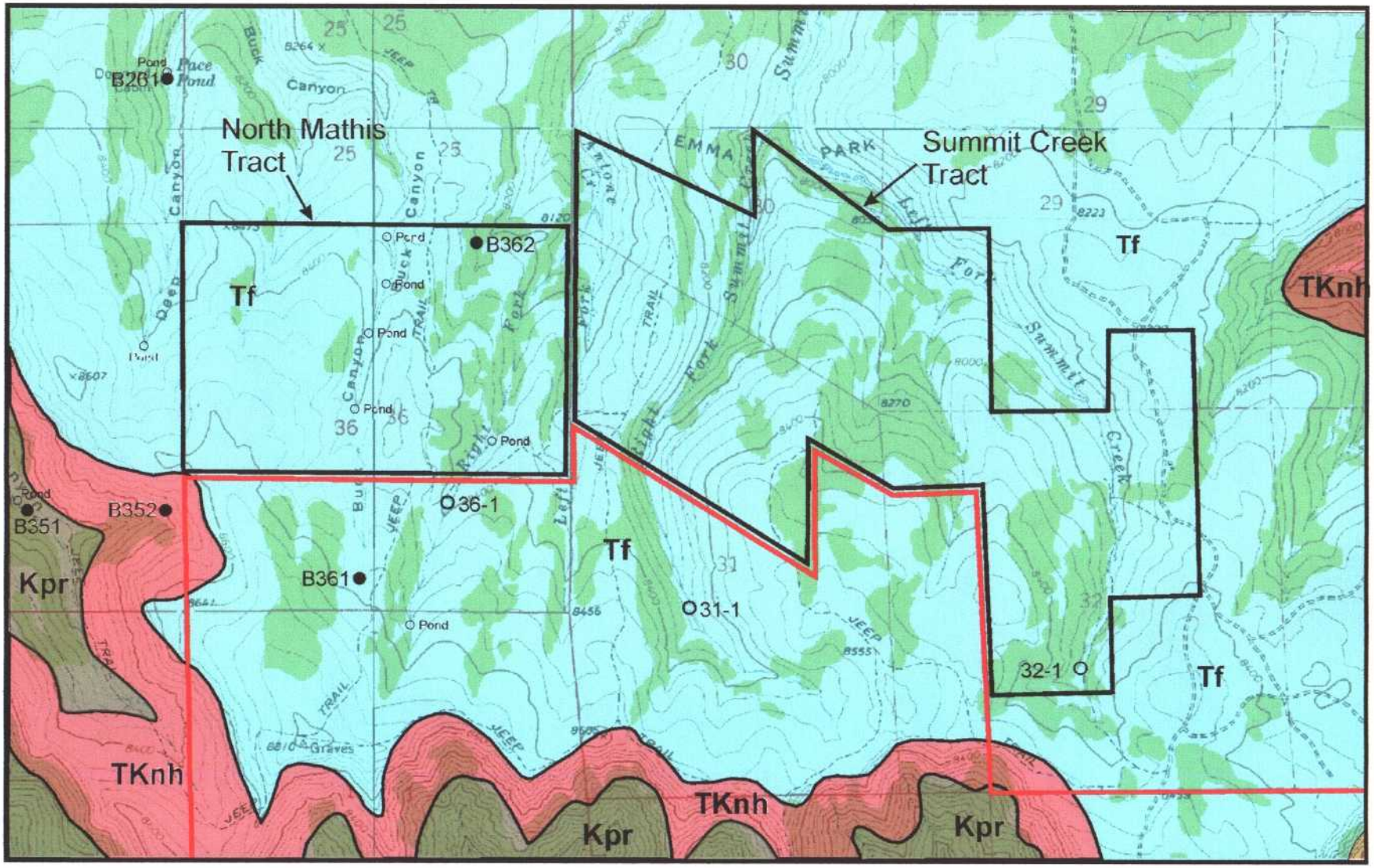


Figure 3 Geologic map of the Summit Creek and North Mathis tract areas.

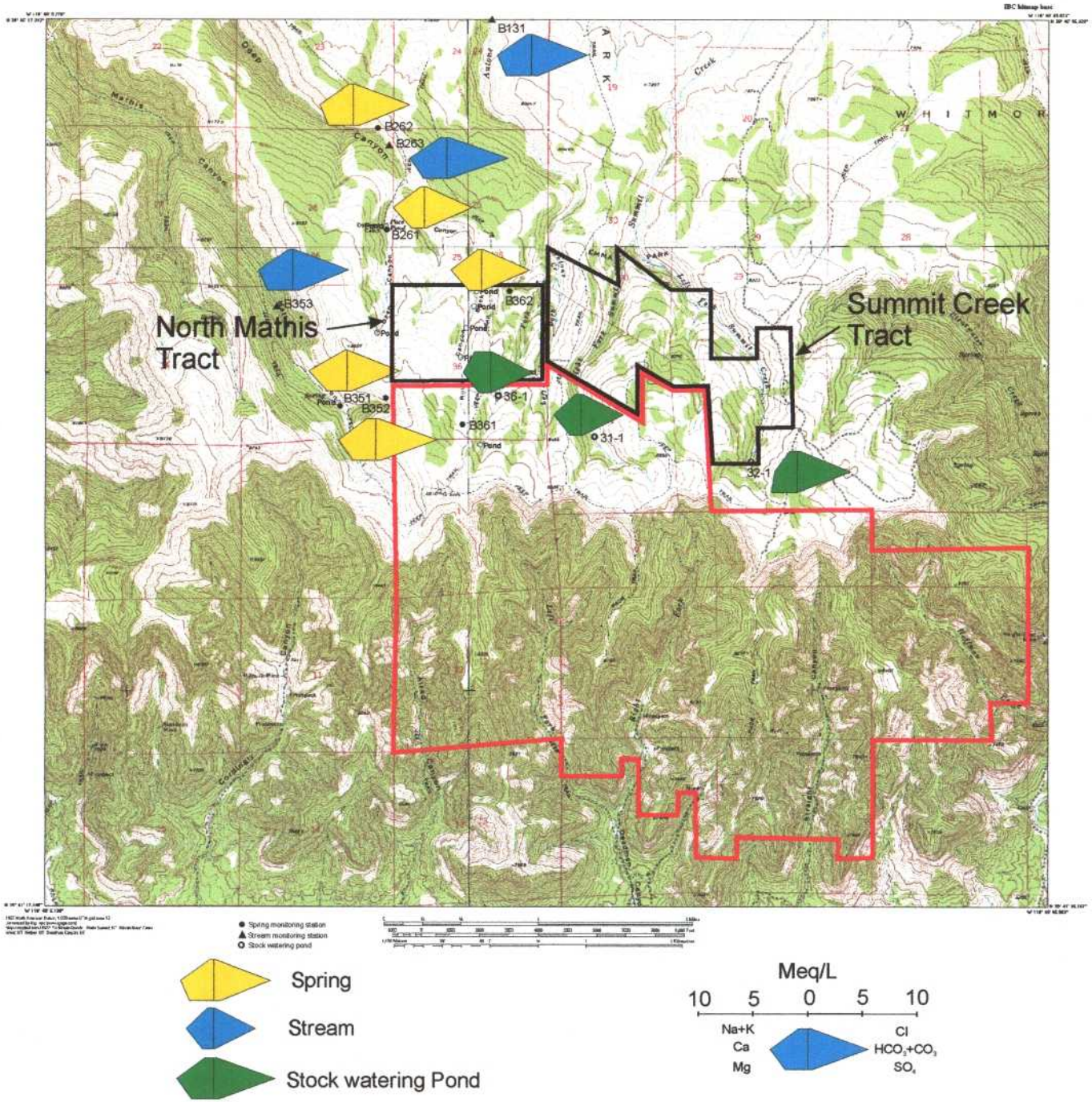
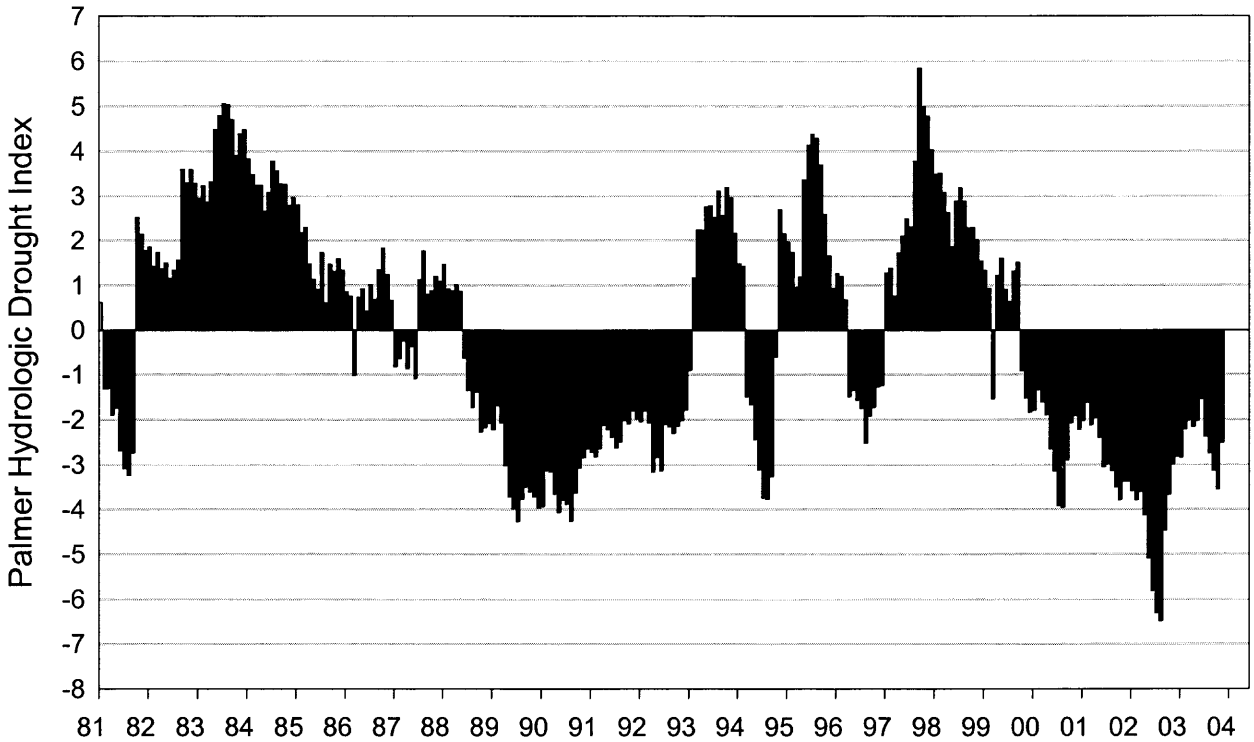


Figure 4 Stiff diagrams for springs, streams, and stock watering ponds in the vicinity of the Summit Creek and North Mathis tracts.



-1 to -2	Mild Drought	1 to 2	Mild Wet Spell
-2 to -3	Moderate Drought	2 to 3	Moderate Wet Spell
-3 to -4	Severe Drought	3 to 4	Severe Wet Spell
-4 to -5	Extreme Drought	4 to 5	Extreme Wet Spell

Figure 5 Plot of the Palmer Hydrologic Drought Index for Utah Region 6.

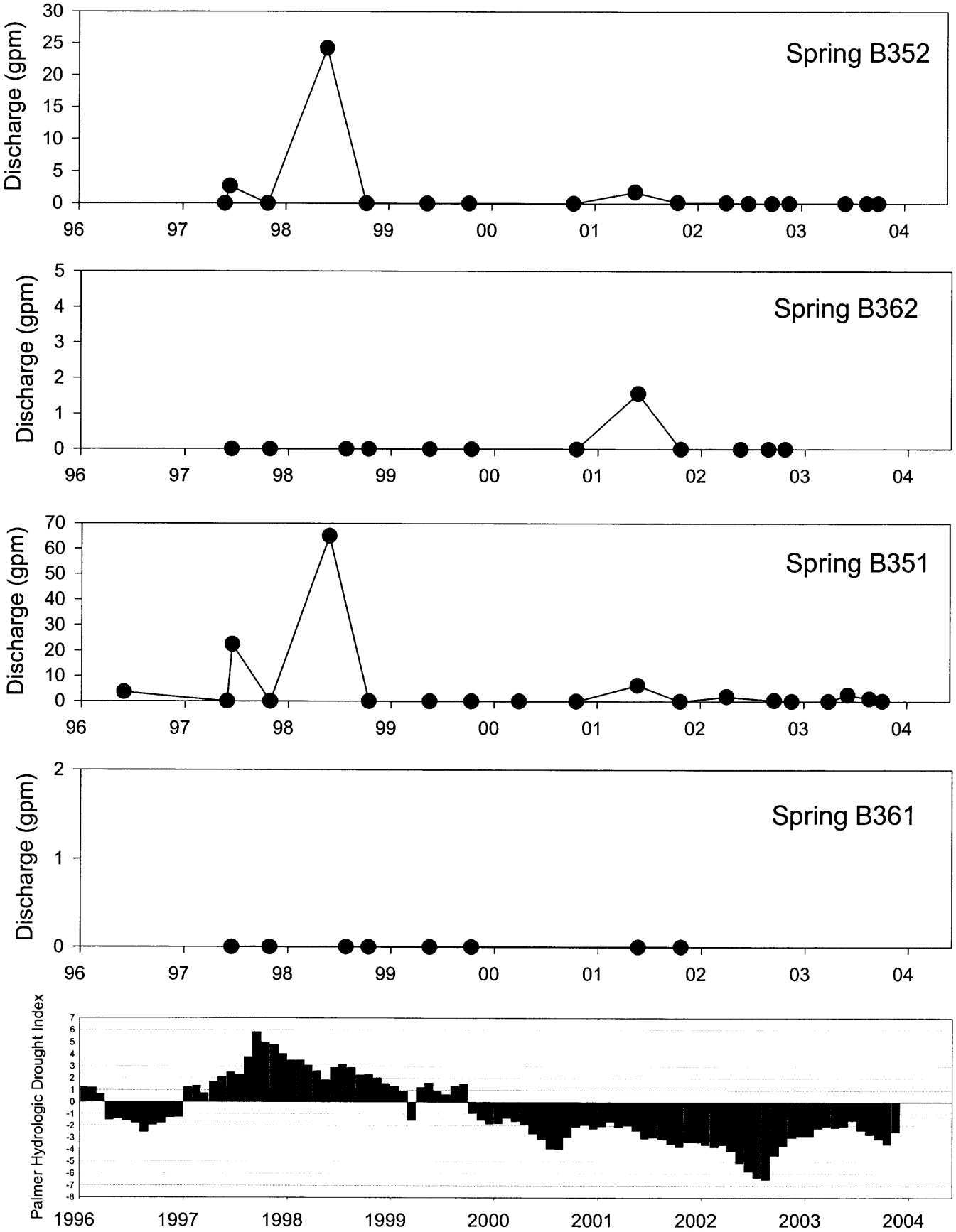


Figure 6 Discharge hydrographs for springs and streams in the Summit Creek and North Mathis tract areas. Also plotted is the PHDI for Utah Region 6, 1996-2003.

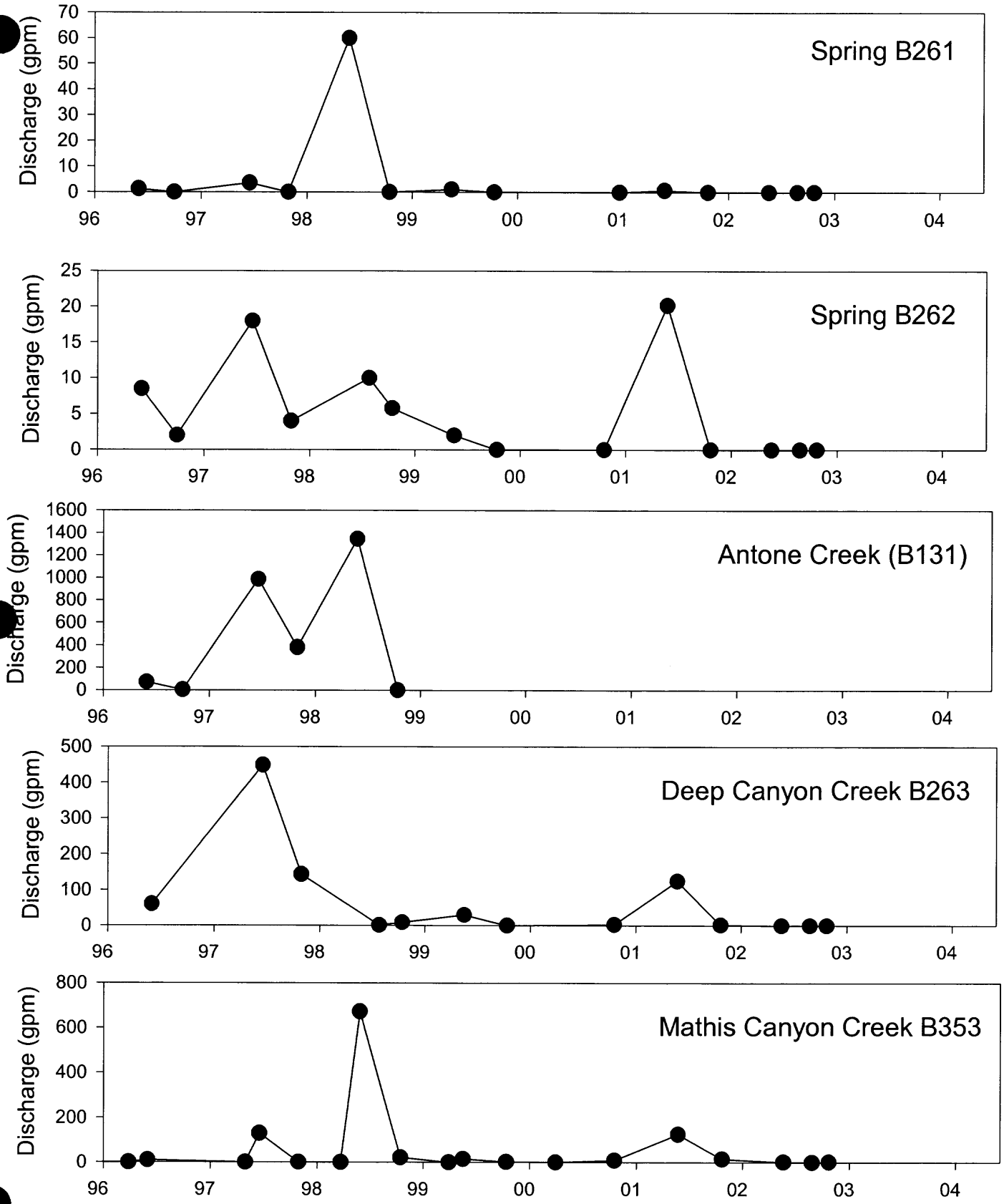


Figure 6 (continued).

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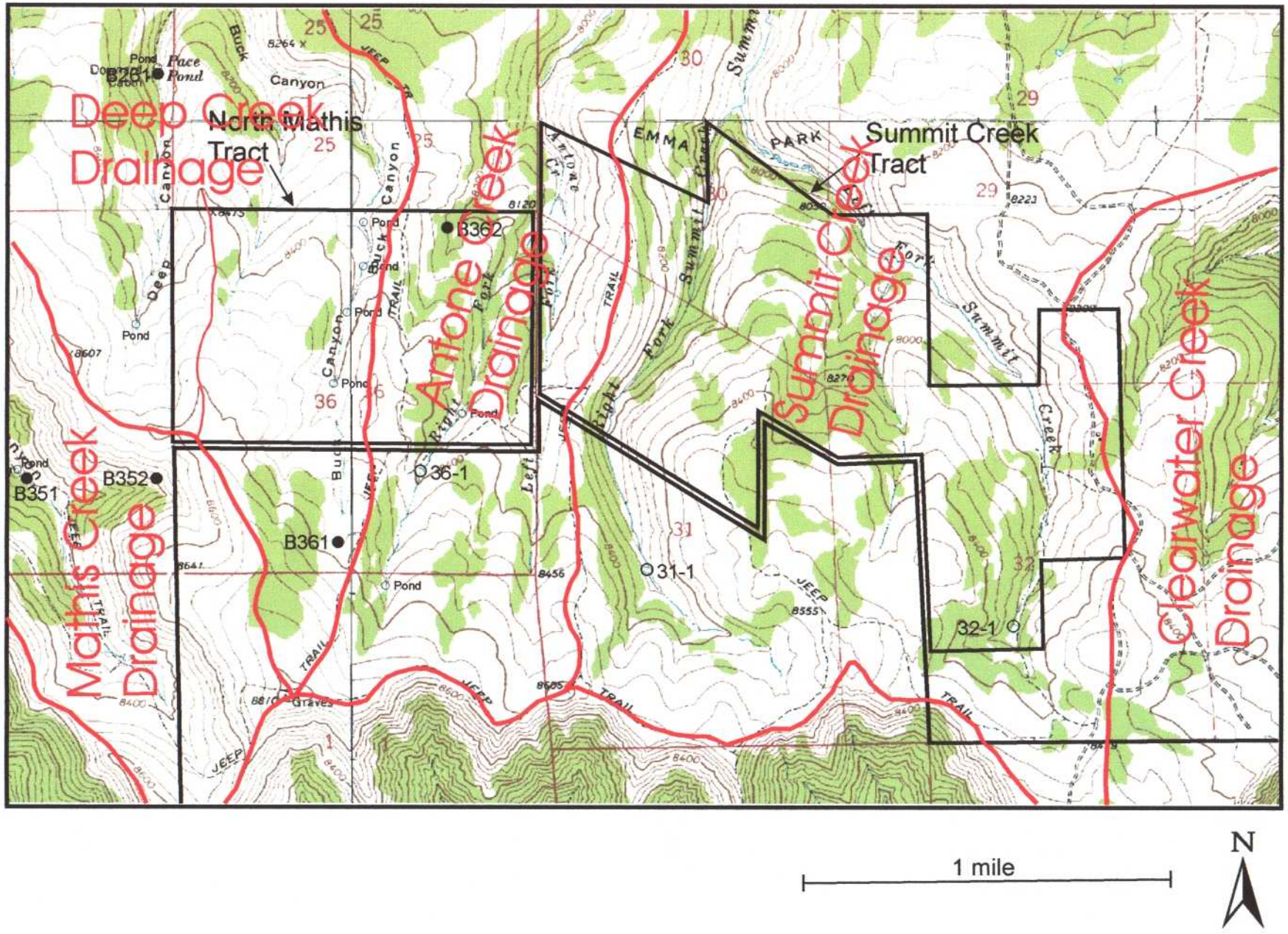

Figure 7 Surface-water drainages in the Summit Creek and North Mathis tract areas.

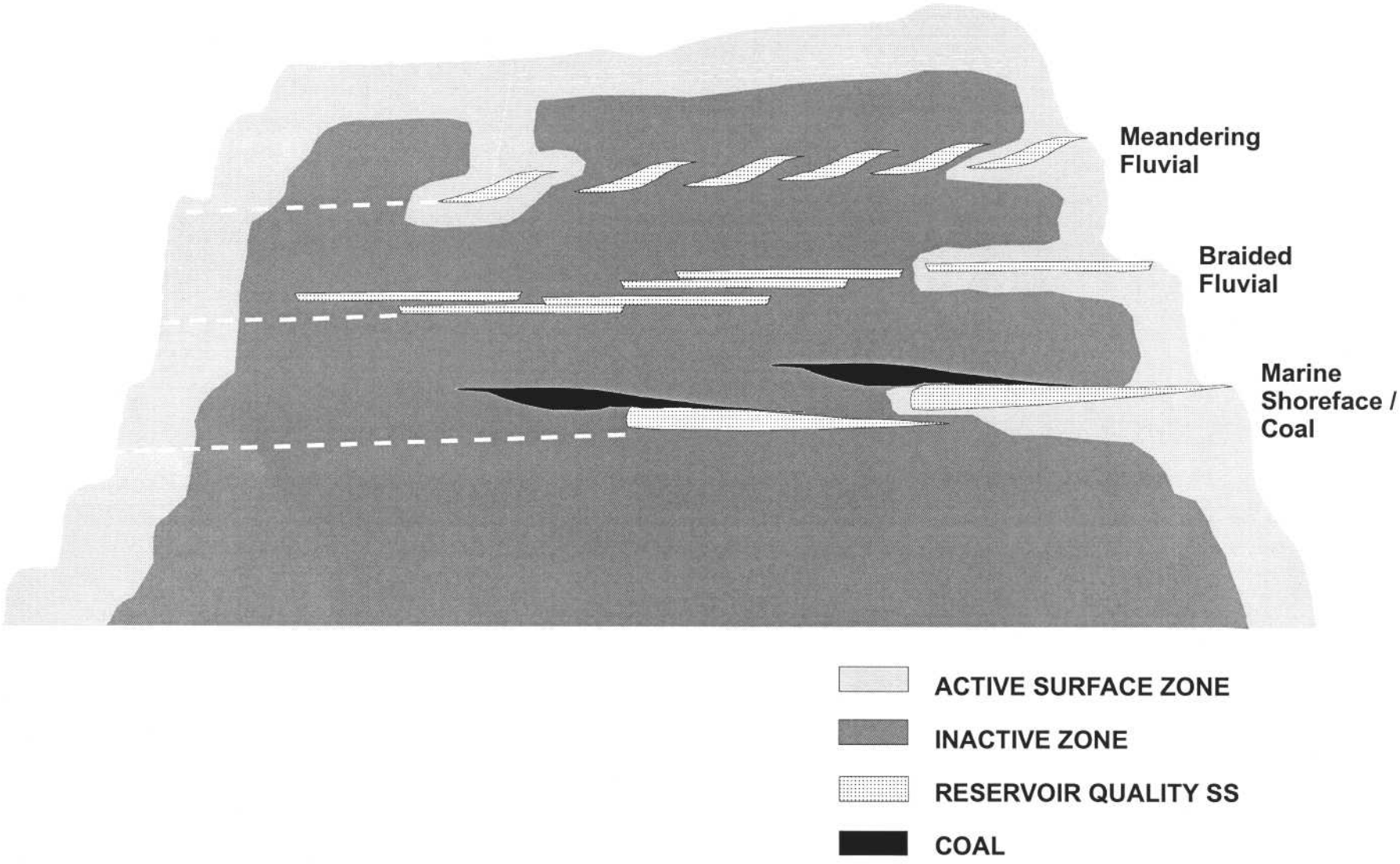

Figure 8 Conceptual model of active and inactive groundwater flow regimes in the Summit Creek and North Mathis tract areas..

Table 1 Monitoring site details for springs, streams, and stock-watering ponds in the vicinity of the Summit Creek and North Mathis tracts.

Site	Description	Data Source	Location	Geology
Springs				
B261	Spring in Deep Canyon, also known as Pace Pond spring	Willow Creek Mine	SE 1/4 Sec 26 T12S R10E	Flagstaff Limestone
B262	Spring in Deep Canyon	Willow Creek Mine	NE 1/4 Sec 26 T12S R10E	Flagstaff Limestone
B351	Spring adjacent to Mathis Creek	ANDALEX, Willow Creek Mine	SE 1/4 Sec 35 T12S R10E	Price River Formation
B352	Seep above Mathis Creek drainage	ANDALEX, Willow Creek Mine	SE 1/4 Sec 35 T12S R10E	North Horn Formation
B361	Seep in headwaters of Buck Creek drainage	ANDALEX, Willow Creek Mine	SW 1/4 Sec 36 T12S R10E	Flagstaff Limestone
B362	Seep in Right Fork Antone Creek drainage	Willow Creek Mine	NE 1/4 Sec 36 T12S R10E	Flagstaff Limestone
Streams				
B131	Antone Creek below tract area	Willow Creek Mine	SW 1/4 Sec 13 T12S R10E	---
B263	Deep Creek below tract area	Willow Creek Mine	NE 1/4 Sec 26 T12S R10E	---
B353	Mathis Creek below tract area	Willow Creek Mine	NW 1/4 Sec 35 T12S R10E	---
Stock Watering Ponds				
36-1	Stock watering pond in Buck Creek drainage	ANDALEX	SE 1/4 Sec 36 T12S R10E	Flagstaff Limestone
31-1	Stock watering pond in Right Fork Summit Creek drainage	ANDALEX	SW 1/4 Sec 31 T12S R11E	Flagstaff Limestone
32-1	Stock watering pond in Left Fork Summit Creek drainage	ANDALEX	SW 1/4 Sec 32 T12S R11E	Flagstaff Limestone

Table 2 Discharge and water quality data for springs, streams, and stockwatering ponds in the Summit Creek and North Mathis tract areas.

Site	Date	Flow gpm	Temp. °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl mg/L	Trace Inorganic Constituents: Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se mg/L	Zn (D) mg/l	Nutrients: NO_3+NO_2 mg/L (N)	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	Other Properties: T Alk. mg/L	Hard. mg/L	Set Solids ml/l	TSS mg/L	O&G mg/L	Acidity mg/l	Hydroxide mg/l
Springs																																								
B261	5/31/1996	1.3	17		255	190		43	10.7	3.4	2	169	<2	<10	4							1.42	0.16																	
B261	10/1/1996	0																																						
B261	6/17/1997	3.6	15	8.22	597	310		90.7	27.2	7	2	332	<2.	20	4							0.03	<0.01		0.029	0.009								332	339					<2.
B261	10/29/1997	0																																						
B261	5/27/1998	60	9	8.29	665	343		75	20	6	2	354	<5.	12	4							0.1	<0.1		<0.1	<0.1								290	270					
B261	10/15/1998	0																																						
B261	5/18/1999	1.1	15	7.48	573	296		70	23	7	2	350	<5.	8	4							0.4	<0.1		0.5	<0.1								286	270					
B261	10/13/1999	0																																						
B261	12/20/2000	0																																						
B261	5/24/2001	0.76	8	8.14	496	325		77	23	6	2	348	<5.	11	4							<0.1	<0.1		<0.1	<0.1								285	287					
B261	10/22/2001	0																																						
B261	5/20/2002	0																																						
B261	8/26/2002	0																																						
B261	10/23/2002	0																																						
Average		**5.5**	**11.75**	**8.03**	**583**	**318.5**		**78.2**	**23.3**	**6.5**	**2**	**346**		**12.8**	**4**																									
B262	5/31/1996	8.5	8	7.8	491	360		79.7	34.2	18.5	1.3	350	<2	20	10							1.21	<0.01																	
B262	10/1/1996	2	9	6.45	789	350		85.7	32.8	15.8	1.3	341	<2	20	9							<0.01	<0.01																	
B262	6/17/1997	18.0	9	8.48	746	360		82.6	36.6	19.4	1.3	342	<2.	20	10							0.01	<0.01		<0.005	<0.005								342	357					<2.
B262	10/29/1997	4.0	7	8.03	832																																			
B262	7/27/1998	10	8	7.46	754	399		80	36	17	<1.	437	<5.	20	12							<0.1	<0.1		<0.1	<0.1								358	348					
B262	10/15/1998	5.8	9	7.02	702	431		82	35	18	1	443	<5.	53	11							<0.1	<0.1		<0.1	<0.1								364	349			<2.		
B262	5/18/1999	2	13	7.65	670	418		75	40	21	1	444	<5.	39	13							0.3	<0.1		<0.1	<0.1								364	352					
B262	10/13/1999	0																																						
B262	10/18/2000	0																																						
B262	5/24/2001	20.2	9	7.77	669	396		70	36	19	<1.	427	<5.	30	8							<0.1	<0.1		<0.1	<0.1								350	323					
B262	10/22/2001	0																																						
B262	5/20/2002	0																																						
B262	8/26/2002	0																																						
B262	10/23/2002	0																																						
Average		**5.0**	**9.2**	**7.7**	**729**	**401**		**77.9**	**36.7**	**18.9**	**1.1**	**419**		**32.4**	**10.8**																									
B352	5/30/1997	0.00																																						
B352	6/17/1997	2.69	10	8.26	537	340		82.9	30.6	21	1.3	310	<2	30	12							0.07	<0.01		0.006	0.009								310	333		<5			<2
B352	10/29/1997	0.00																																						
B352	5/27/1998	24.2	8	7.85	688	305		68	23	14	2	366	<5	19	10							1	<0.1		<0.1	<0.1								300	265					
B352	10/15/1998	0.00																																						
B352	5/18/1999	0.00																																						
B352	10/13/1999	0.00																																						
B352	10/18/2000	0.00																																						
B352	5/24/2001	1.80	7	7.46	508	330		62	24	19	<1	363	<5	17	8							<0.1	<0.1		<0.1	<0.1								298	254					
B352	10/22/2001	0.13	10	7.35	451	401		78	30	25	1	404	<5	25.6	13.5							0.1	<0.1		<0.05	<0.05								331	318					
B352	4/11/2003	0.10	6.6	7.56	657																																			
B352	8/28/2002	0.00																																						
B352	9/19/2002	0.00																																						
B352	11/19/2002	0.00																																						
B352	6/5/2003	0.00																																						
B352	8/21/2003	0.00																																						
B352	10/1/2003	0.00																																						
Average		**1.70**	**8.32**	**7.70**	**568**	**344**		**72.7**	**26.9**	**19.75**	**1.43**	**361**	**<5**	**22.9**	**10.88**																									
B351	5/31/1996	3.59	10		393	320		76.1	31.2	9.6	0.7	299	<2	40	3		0.117					0.49	<0.01			0.012								299	318					<2
B351	5/30/1997	0.00																																						
B351	6/17/1997	22.4	7.1	8.12	549	270		80.1	24.8	5.2	0.7	280	<2	20	3							0.07	<0.01		<0.005	<0.005								280	302					<2
B351	10/29/1997	0.00																																						
B351	5/27/1998	65	12	8.28	596	318		71	17	4	<1	333	<5	13	4							0.1	<0.1		<0.1	<0.1								273	247					
B351	10/15/1998	0.00																																						
B351	5/18/1999	0.00																																						
B351	10/13/1999	0.00																																						
B351	3/29/2000	0.00																																						
B351	10/18/2000	0.00																																						
B351	5/24/2001	6.28	11	7.84	474	303		73	22	4	<1	330	<5	12	2							0.1	<0.1		<0.1	<0.1								270	273					
B351	10/22/2001	0.00																																						
B351	4/11/2002	1.85	3.4	8.05	319																																			
B351	6/28/2002		9	7.4	510	387		82	33	11	<1	372	<5	66	5							<0.1	<0.1		<0.05	<0.05								305	341					
B351	9/19/2002	0.30	8	7.3	730	418		89	36	14	<1	360	<5	95	5							<0.1	<0.1		<0.05	<0.05								295	370					
B351	11/19/2002	0.00																																						
B351	3/29/2003	0.00																																						
B351	6/5/2003	2.50		8.7	490	354		77.7	31.6	10	1.25	339	<5	51	5							0.256	<0.005		0.018	0.008														
B351	8/21/2003	1.00	14	8.1	650	418		84.2	36.2	12.5	0.99	359	<5	77	6							0.31	<0.005		0.035	0.025														
B351	10/6/2003	0.01	13	7	700																																			
Average		**5.42**	**10.0**	**8.08**	**503**	**303**		**75.1**	**23.8**	**5.70**	**0.70**	**311**	**<5**	**21.3**	**3.00**																									
B361	6/17/1997	0																																						
B361	10/29/1997	0																																						
B361	7/27/1998	0																																						
B361	10/15/1998	0																																						
B361	5/18/1999	0																																						
B361	5/18/1999	0																																						
B361	10/13/1999	0																																						
B361	5/24/2001	0																																						
B361	10/22/2001	0																																						
Avearge		**0**																																						
B362	6/17/1997	0																																						
B362	10/29/1997	0																																						
B362	7/27/1998	0																																						

B362	10/15/1998	0																																					
B362	5/18/1999	0																																					
B362	10/13/1999	0																																					
B362	10/18/2000	0																																					
B362	5/24/2001	1.57	9	8.55	442	269		60	15	7	2	284	<5	9	6						0.5	<0.1		<0.1	<0.1								238	212					
B362	10/22/2001	0																																					
B362	5/20/2002	0																																					
B362	8/26/2002	0																																					
B362	10/23/2002	0																																					
Avearge		**0.07**	**9**	**8.55**	**442**	**269**		**60**	**15**	**7**	**2**	**284**	**<5**	**9**	**6**																		**238**	**212**					
Streams																																							
B263	5/31/1996	60.1	11.1	8.47	401	290	8.1	71.9	26.5	12.3	1.8	290	<2	10	7			0.285			1.97	<0.01		0.085	0.006								290	289	<0.1	72			<2
B263	6/17/1997	448.8	12	8.42	469	290	10.2	71.3	27.1	12.7	2.5	314	<2	20	9						0.22	0.01		0.028	0.016								314	290		<5	<2		<2
B263	10/29/1997	143.6	3.5	8.31	916	270		75	27	14	1.6	320	<10	13	9.9						0.13	<0.01		0.18	0.008								320	300		15	<5		
B263	7/27/1998	1.0	13	8.03	705	362		74	29	12	1	392	<5	13	10						0.1	<0.1		<0.1	<0.1								321	304					
B263	10/15/1998	8.5	8.9	7.95	538	400		78	32	15	2	393	<5	12	10						0.1	<0.1		<0.1	<0.1								322	327		8	<2		
B263	5/18/1999	30	14.5	8.23	553	295		63	23	11	2	318	6	12	8						<0.1	<0.1		<0.1	<0.1								271	252		7	<2		
B263	10/13/1999	0.3	7	8.37	405	311		67	30	16	3	352	7	13	9						0.3	<0.1		<0.1	<0.1								300	291		25	<2		
B263	10/18/2000	2.69	4	8.15	616	367	8.6	74	28	14	2	384	<5	12	9	<1.	<0.01	<1.	0.1	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<0.01	0.08	<0.03	<0.5	<0.05	315	300		<5	<2	11	
B263	5/24/2001	125	15	8.5	531	310	7.2	71	23	10	1	335	<5	10	6						0.6	<0.1		<0.1	<0.1								275	272		37	<2		
B263	10/22/2001	1.80	8	7.91	440	357		80	30	14	2	411	<5	10.6	11						<0.1	<0.1		<0.05	<0.05								337	323		<5	<2		
B263	5/20/2002	0.00																																					
B263	8/26/2002	0.00																																					
B263	10/23/2002	0.00																																					
Average		**63.2**	**9.70**	**8.23**	**557**	**325**	**8.53**	**72.5**	**27.6**	**13.1**	**1.89**	**351**	**<5**	**12.6**	**8.89**																							
B353	8/28/1994	4.5			508																																		
B353	3/27/1996	0																																					
B353	5/31/1996	9.87	10.1	9.41	354	270	8.2	60.1	30	9	1	253	<2	30	3			0.103			0.09	0.01		<0.005	0.005								253	274	<0.1	<5			<2
B353	4/30/1997	0																																					
B353	6/17/1997	130	6.1	7.6	523	290	12	72.1	31.5	8.8	0.9	308	<2	30	5						0.21	<0.01		0.011	<0.005								308	310		8	<2		<2
B353	10/29/1997	0.45	4	8.26	666	310		70	29	9	1	360	<10	32	3.6						0.06	<0.01		<0.005	<0.005								360	290		<1	<5		
B353	3/23/1998	0																																					
B353	5/27/1998	673	10.5	8.47	641	330		71	24	8	<1	373	<5	22	5						0.4	<0.1		<0.1	<0.1								306	276		28	<2		
B353	10/15/1998	21.5	6	8.01	490	363		69	32	9	1	344	<5	33	5						0.3	<0.1		<0.1	<0.1								82	304		15	<2		
B353	3/30/1999	0																																					
B353	5/18/1999	15	11	8.07	491	293		61	25	7	1	309	<5	29	3						0.1	<0.1		<0.1	<0.1								253	255		7	<2		
B353	10/13/1999	2	6	8.12	371	314		70	30	12	<1	356	<5	30	4						<0.1	<0.1		<0.1	<0.1								291	298		13	<2		
B353	3/29/2000	0																																					
B353	10/18/2000	8.98	7	8.31	597	318	8.6	62	32	11	1	339	<5	30	5		<0.01	<1.	0.1	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<0.01	<0.03	<0.03	<0.5	<0.05	278	287		9	<2		
B353	2/22/2001																																						
B353	5/24/2001	125.7	12	8.31	540	296	7.4	58	29	8	<1	333	<5	25	4						0.2	<0.1		<0.1	<0.1								273	264		15	<2		
B353	10/22/2001	14.8	7	8.33	385	348		64	34	10	1	350	<5	32.2	4.9						<0.1	<0.1		<0.05	<0.05								287	300		5	<2		
B353	5/20/2002	1.4	14	7.94	517	347		62	32	11	<1	336	<5	39	5						<0.1	<0.1			<0.05														
B353	8/26/2002	0.0																																					
B353	10/23/2002	1.4	7	8.1	745	357		69	36	11	<1	365	<5	49	5						<0.1	<0.1			<0.05														
Average		**53.1**	**8.0**	**8.3**	**506**	**313**	**9.1**	**65.7**	**29.7**	**9.2**	**1.0**	**333**	**<5**	**29.3**	**4.3**																								
B131	5/29/1996	71.8	15.2	8.6	429	300	8.9	66.9	25.7	12.7	1.2	273	<2	10.0	7.0						0.5	0.01			0.012														
B131	10/1/1996	2.7	14.5	8.5	671	300		59.2	33.0	23.6	1.4	287	<2	30.0	11.0						0.1	0.01			0.021														
B131	6/18/1997	987.0	14.0	8.5	711	310	9.1	77.2	26.7	11.7	1.0	284	<2	10	8.0						0.3	<0.01			0.0											16.0	8.0		
B131	10/31/1997	381.0	5.5	8.3	628	290	8.6	66.0	27.0	14	1.2	300	<10	16	8.7						0.1	<0.01			0.0											10.0	<5		
B131	5/27/1998	1346.0	13.5	8.6	612	308		65.0	21.0	10	1.0	319	13.0	15	8.0						0.5	<0.1			<0.1											42.0	<2		
B131	10/15/1998	0.0																																					
Average		**464.8**	**12.5**	**8.5**	**609.8**	**301.6**	**8.9**	**66.9**	**26.7**	**14.4**	**1.2**	**292.6**		**16.2**	**8.5**																								
Stock Watering Ponds																																							
36-1	22-Dec-80	---	2	8.0	205	220		54	13.2	29	11.4	185	31	<3.0	4		0.002	0.022	0.016	<0.001	0.01	0.49	0.06	<0.0002	0.475	0.195	<0.001	<0.001	0.007			<0.01	0.13	214				24.2	<0.1	
31-1	22-Dec-80	---	2	8.3	198	200		54	13.2	5.9	11.85	185	31.2	7	4		0.002	0.018	0.005	<0.001	0.01	1.6	0.06	<0.0002	1.05	0.005	<0.001	<0.001	0.007			<0.01	0.08	204				26.2	<0.1	
32-1	22-Dec-80	---	2	7.3	262	265		44	30	9	15	317	<0.01	<3.0	10		<0.001	0.040	0.015	<0.001	0.02	0.36	0.06	<0.0001	0.135	0.12	<0.001	<0.001	0.015			0.2	0.08	260				15	6	

TOWER DIVISION
ABERDEEN SEAM
LONGWALL PLAN

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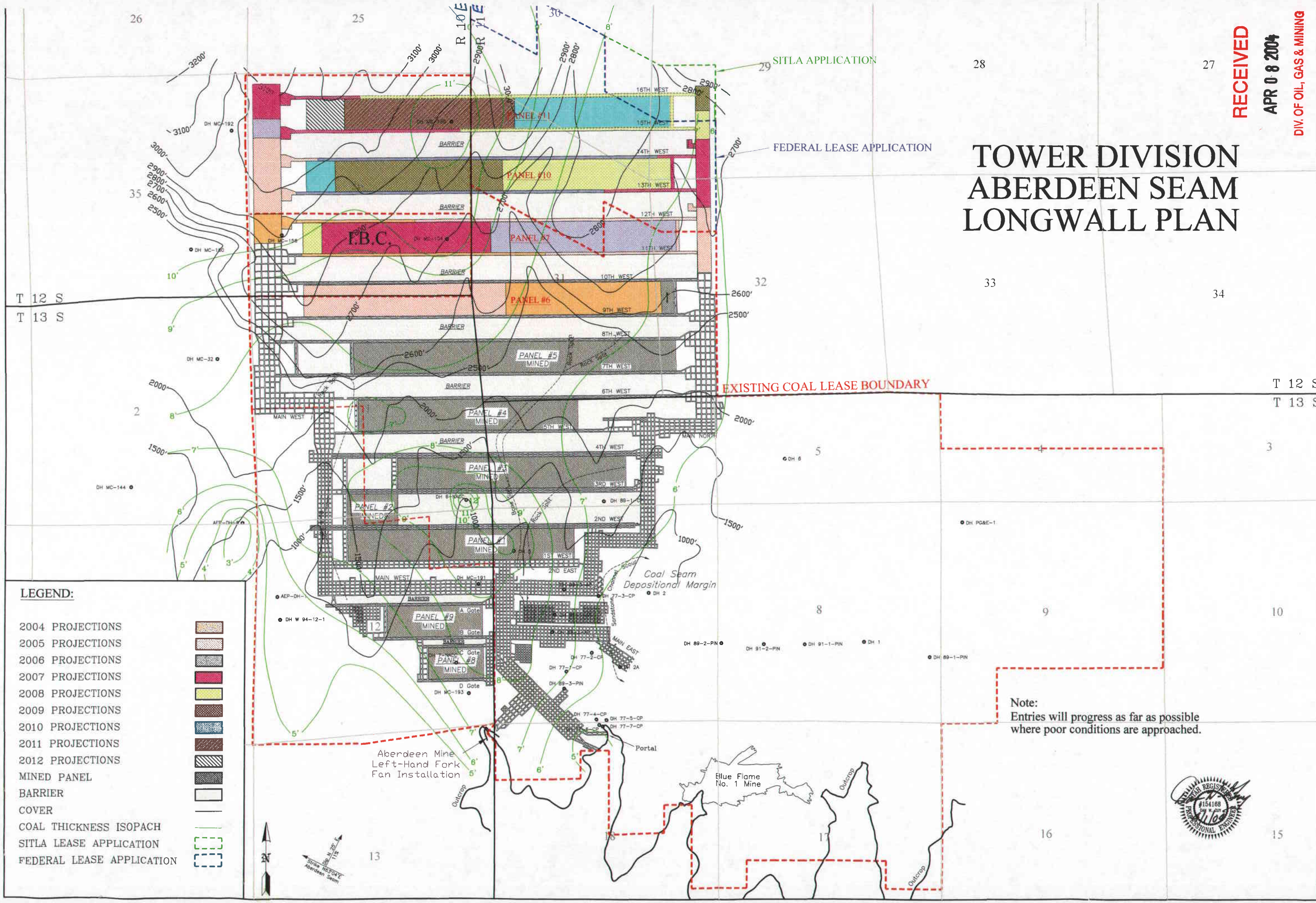
Tower Division



SCALE: 500' 0' 1000' 2000'

ACAD REF: 2004PL729

March 25, 2004

Aberdeen Mine
P.O. Box 902
Price, Utah 84501

PLATE 29

Isopachs
Current Mining
Mining Projections
Cover
Drillhole Location