COAL EXPLORATION PERMIT APPLICATION FOR COAL LEASES ADL324600 and ADL229336 JONESVILLE COAL MINE PROJECT

Submitted To:

Alaska Department of Natural Resources
Division of Mining, Land & Water
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Permit Required Information and Preparatory Statement

This permit application provides information as required by the Alaska Surface Coal Mining Control and Reclamation Act of 1977 (ASCMCRA). Each separate section of the application will state the exact regulation from 11 AAC 90.163 and 167. The regulation will be in italics, and the required information will be in normal type-font below each regulation.

It is important for the public reading this permit application to clearly understand that it is for exploration only. This is not a mine permit application. In accordance with Article 8 of AS 27.21 and 11 AAC 90.163 and 167, the applicant is proposing exploration that, according to the regulations, will disturb the natural land surface. This disturbance involves low impact exploration drilling and some off-road travel by large, rubber-tired or tracked vehicles.

State of Alaska coal exploration permits call for baseline data gathering of an area's natural and environmental resources to determine if a prospective resource site will support a mining venture. This data includes information on the geology, as it pertains to coal resource potential, and environmental baseline data such as surface and ground water hydrology, vegetation, soils, fish and wildlife, and cultural or historic resources. Ranger Alaska, LLC is fortunate that the area around the Jonesville Coal Project has been subject to previous mining and exploration programs and the relevant data from previous activities is available. Ranger Alaska, LLC has been collecting baseline water data since it acquired the leases in 2009 as part of an active Underground Mining Permit U-201 held by Ranger Alaska covering some of the same area subject to this Coal Exploration Permit Application.

The applicant, by law and regulation, can only incorporate data that is known to exist at the time of the permit application. Ranger Alaska is aware of the presence of Coal at Jonesville and has a good idea of the quality, quantity and, to a lesser extent, the mineability of the deposit. One purpose of the proposed exploration program is to gather additional geotechnical information to allow for the determination of an appropriate mining plan. Consequently, prior to evaluating the results from the exploration program, it is premature to project if a surface mine, underground mine or a combination of the two will be developed. Any future mine development decisions will be made after a thorough evaluation of the area is complete and the required environmental baseline data has been collected and reviewed.

PART A - GENERAL INFORMATION

1.0 APPLICANT INFORMATION

11 AAC 90.163 (a) (1) A person that intends to conduct coal exploration that will substantially disturb the natural land surface or that will take place in an area designated unsuitable for surface mining under AS 27.21.260 shall file an application in the format required by 11 AAC 90.021. The application must include: 11 AAC 90.161 (a) (1) the information required under 11 AAC 90.161 (a) (1), (a) (2), and (a) (5); 11 AAC 90.161 (a) (1) the name, address and telephone number of the person seeking to explore and the person who will be present at and responsible for conducting the exploration activities;

1.1	Name of Applicant	Ranger Alaska, LLC
	Officers	Tony Simpson – President Ben Vallerine – VP, Secretary & Treasurer Alan Scott – Director
1.2	Address of Applicant	110 N. Rubey Dr., Suite 201 Golden, Colorado 80403
1.3	Telephone Number	(303) 279-4946
1.4	Representative of the applicant who will be present during and be responsible for conducting the exploration	Ben Vallerine
1.5	Address of Representative	110 N. Rubey Dr., Suite 201 Golden, Colorado 80403
1.6	Telephone Number	(303) 279-4946

2.0 LOCATION OF THE EXPLORATION

11 AAC 90.161 (a) (3) the boundaries of the exploration activities;

2.1 Legal Description – Coal Exploration Area

ADL324600

Township 19 North, Range 3 East, Seward Meridian

	Acres
Section 16: SW1/4 NW1/4, W1/2 SE1/4 NW1/4, NE1/4 SE1/4 NW1/4, W1/2 NE1/4 SW1/4, NW1/4 SW1/4, S1/2 SW1/4	210
Section 17: S1/2, S1/2 N1/2,	480
Section 18: SE1/4, E1/2 SW1/4, SE1/4 NE1/4	280
Section 19: NE1/4, E1/2 NW1/4	240
Section 20: N1/2 N1/2, SW1/4 NW1/4	200
Lease Acre Total:	1,410

ADL229336

Township 19 North, Range 3 East, Seward Meridian

Section 21: NW1/4 NW1/4	40
Lease Acre Total:	40

2.2	Number of Acres in Exploration Area	1,450
2.3	Number of Acres of Federal Land	N/A
2.4	USGS 1:250,000 or 1:63,360 Quadrangle Name:	Anchorage C-6 Quad
2.5	Distance and Direction to Nearest Community:	Sutton, 2 miles SE

3.0 PERIOD OF EXPLORATION

11 AAC 90.161 (a) (2) a statement of the period of intended exploration

	Month	Day	Year
3.1	March	1	2013
3.2	March	1	2015

4.0 OWNERSHIP OF SURFACE/SUBSURFACE MINERAL ESTATE

11 AAC 90.163 (a) (3) the names and address of all owners and leaseholders of record of the surface land and the mineral estate in the area to be explored;

4.1 Surface Owner

State of Alaska
Division of Mining, Land & Water
550 West 7th Avenue, Suite 900
Anchorage, Alaska 99501
(907) 269-8634

4.2 Mineral Estate Owner

Alaska Mental Health Trust Authority
c/o AK Mental Health Trust
Land Office
718 L Street, Suite 202
Anchorage, Alaska 99501
(907) 269-8657

State of Alaska
Division of Mining, Land & Water
550 West 7Avenue, Suite 900
Anchorage, Alaska 99501
(907) 269-8634

4.3 Surface Land Leaseholder

Ranger Alaska, LLC
110 N. Rubey Dr., Suite 201
Golden, Colorado 80403
(303) 279-4946

4.4 Mineral Estate Lease Holder

Ranger Alaska, LLC
110 N. Rubey Dr., Suite 201
Golden, Colorado 80403
(303) 279-4946

4.5 Adjacent Surface & Mineral Estate

Usibelli Coal Mine Leaseholder
P.O. Box 1000
Healy, Alaska 99743
(907) 683-2226

4.6 Right to Enter

11 AAC 90.161(a)(5) an explanation of the right of the person seeking to explore to enter and conduct exploration activities;

The applicant, Ranger Alaska, LLC, and its representatives base their right to enter the Jonesville Coal Mine property for the purposes of conducting exploration and reclamation through its January 2009 acquisition and assignment of the Jonesville Coal Leases ADL324600 and ADL229336.

PART B - EXPLORATION AREA DESCRIPTION

11AAC 90.163 (a) (2) an exploration and reclamation plan of operations, that includes:

11AAC 90.163 (a) (2) (A) a brief description of the proposed area, cross-referenced to the map required under (4) of this subsection, including available information on the following:

1.0 LOCATION, ACCESS AND PHYSIOGRAPHY

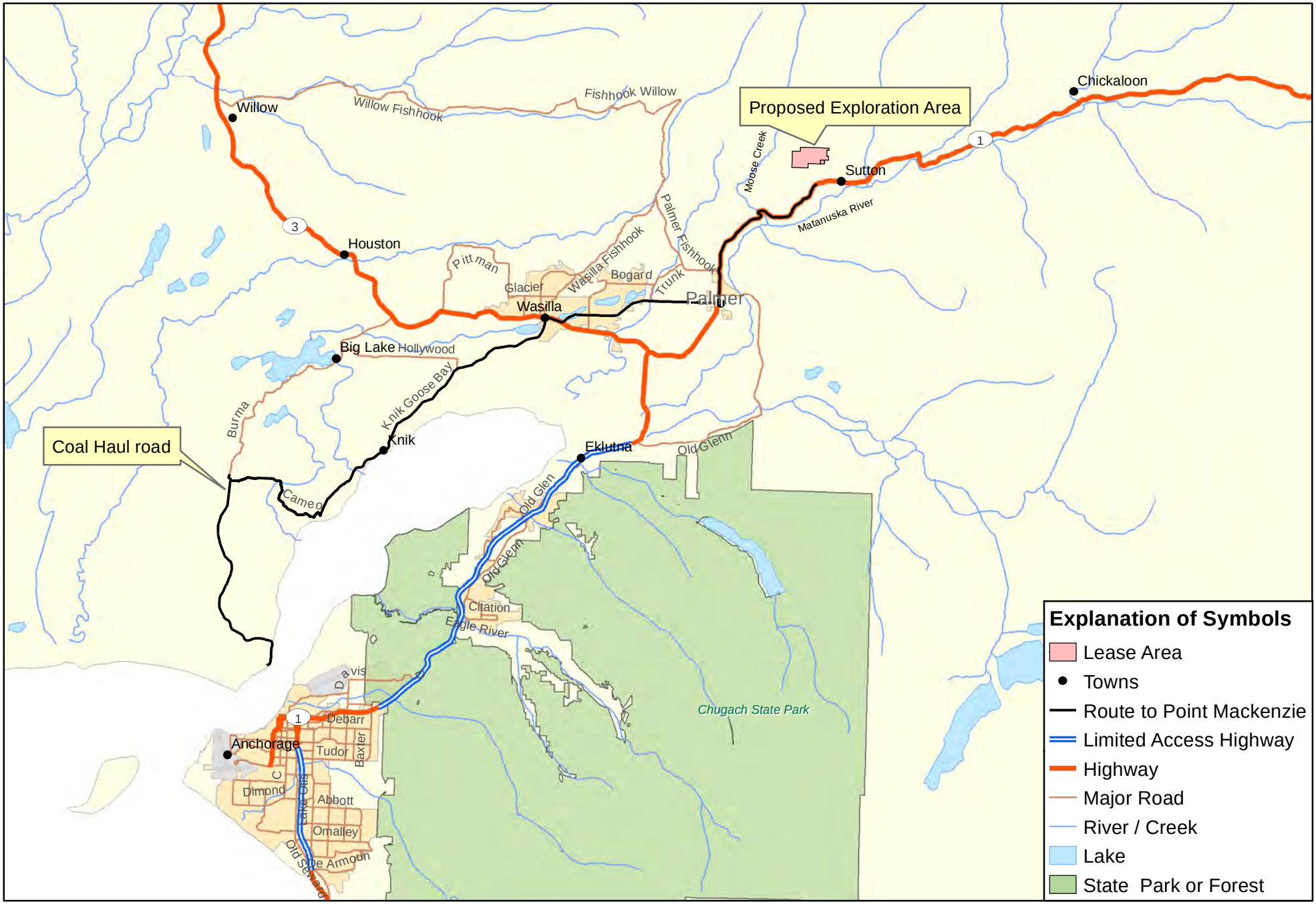
11AAC 90.163 (a) (2) (A) Surface topography and other physical features

11AAC 90.167 (f) Existing roads, trails, runways and marine facilities may be used under the following conditions: 11 AAC 90.167 (f) (1) all applicable federal, state, and local requirements must be met.

The Jonesville Coal Project, specifically the deep exploration drilling and shallow tailings exploration that is the focus of this permit application, is located on and adjacent to the eastern portion of Wishbone Hill, an historic coal mining district, and the site of a past-producing surface and underground coal mine. The existing Jonesville Coal Leases include the 1,410 acre ADL324600 and the 40 acre ADL229336. The exploration will take place approximately 55 air miles northeast of Anchorage or 2 miles northwest of Sutton in south-central Alaska (Figure 1). The eastern Wishbone Hill area is one of several coal-bearing districts on Wishbone Hill and within the Matanuska Valley where mining or exploration, including borehole drilling occurred for the past century.

The Wishbone Hill area lies on the north side of the Matanuska Valley near its lower end (Figure 2). Wishbone Hill takes its name from the prominent conglomerate-capped hill that rises to 2,300 feet and is rimmed on its northern, eastern, and southern sides by steep near vertical escarpments, making it resemble a plateau. The proposed exploration project will take place on top of this plateau and on the lower bench areas east of this escarpment, as well as the lower historic tailings disposal areas that exist a few hundred feet southeast from the historic mine workings. The canoe-shaped Wishbone Hill, which slopes gently to the southwest, is approximately 7 miles long and one and one-half miles wide and extends from Moose Creek on the west to Eska Creek on the east.

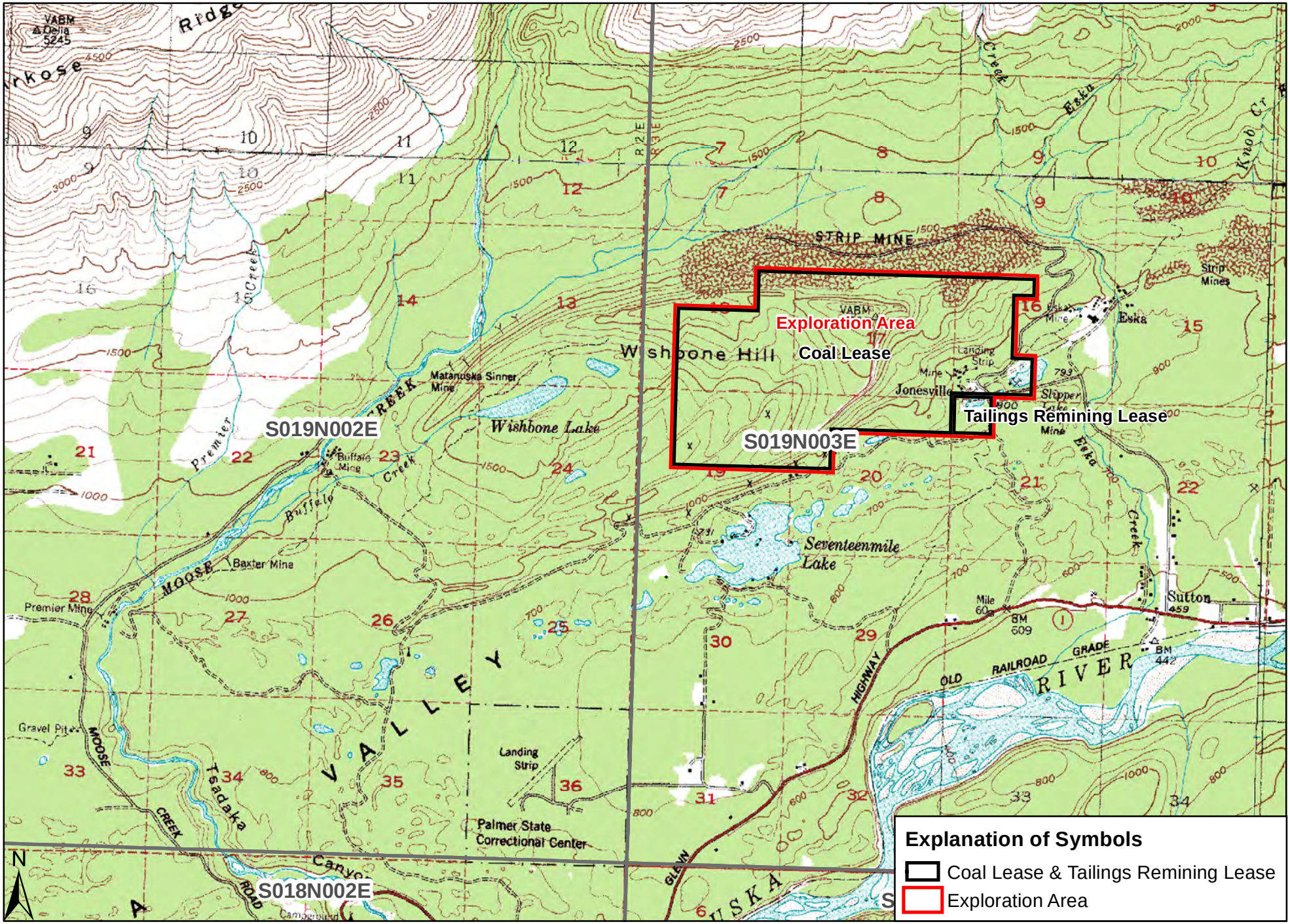
Access from Anchorage is via the Glenn Highway, exiting at Mile 61 onto the Jonesville Road, a paved secondary road. After traveling north along this paved road approximately 1.7 miles, the Jonesville Road turns to gravel. Near this point, another gravel spur road branches off to the west approximately 0.7 miles, arriving at the mine gate. Another gravel access road to the old mine site exits to the west off the unpaved portion of Jonesville Road about 1/8 mile past the initial gravel spur road. This unimproved gravel road is also the primary access to Slipper Lake and the abandoned northern strip pit areas of the old mining operation.



Jonesville Coal Lease Location Map

Alaska Earth Sciences
Revised by RY
Oct 2012

Figure 1



Wishbone Hill Area

Alaska Earth Sciences
Revised by RY
Oct 2012

Figure 2

The Jonesville Coal Project encompasses most of the eastern 3 miles of Wishbone Hill and this is where the proposed exploration will take place. Two separate coal leases and permit areas comprise the project (Figure 3). They include the main 1,410 acre coal lease, and a 40 acre lease in Section 21.

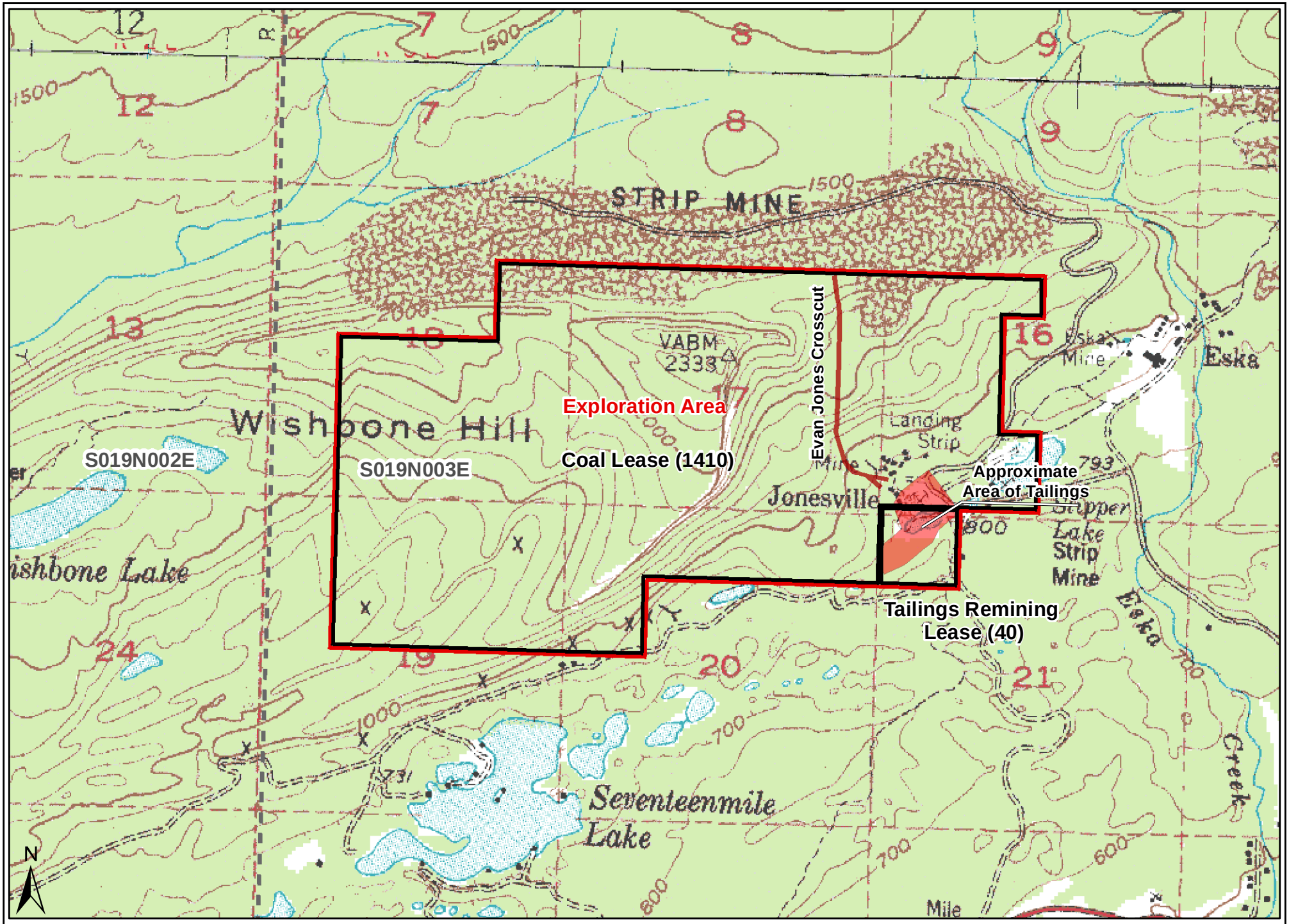
The proposed deep drill holes will be located in Sections 16, 17, 19, 20, and 21. The shallow tailings area drill holes will be located in Sections 16 and 21. The staging area for the exploration is proposed to be in Section 16 at the abandoned mine facility area of the old Evan Jones Coal Mine. This area is relatively flat and contains acres of historic recontoured spoil banks, a large tailings pond, two sediment ponds, and an equipment storage area at its western end. Slipper Lake was formed in the early days of mining from the damming of a small drainage and marsh area in the far eastern extremity of this flat area. No exploration activities are planned for the area near Slipper Lake.

2.0 REGIONAL GEOLOGY

11 AAC 90.163 (a) (2) (A) Geology

The geology of the Matanuska River basin, which contains the Jonesville coal lease area, includes four principle lithologic groups that are, from oldest to youngest, A Precambrian basement of low-grade metamorphic rocks, late Mesozoic and early Tertiary marine and terrestrial sedimentary rocks, mid Tertiary hypabyssal igneous complexes, and Quaternary glacial and fluvial-related deposits. Wishbone Hill area geology, modified from Wilson et.al. (1998) is illustrated in Figure 4. The Matanuska Valley is a northeast-trending structural trough underlain predominantly by Mesozoic and Tertiary sediments and bounded on the north and south by major deformational systems. The sedimentary section is underlain by low-grade metasedimentry rocks, which are exposed south of the valley in the Chugach Mountains. Metamorphosed volcanic basement rocks of the lower Jurassic Talkeetna Formation and the plutonic rocks of the Talkeetna Mountains batholith are exposed north and east of the valley. Generally, the bedrock formations are well exposed higher on the valley walls, while within the valley itself, there are limited exposures. These exposures, where found, lie mainly along fluvial cutbanks and road cuts. Most of the valley floor is overlain by poorly consolidated Pleistocene and Holocene units of glacial and glacialfluvial origin (Clardy, 1984).

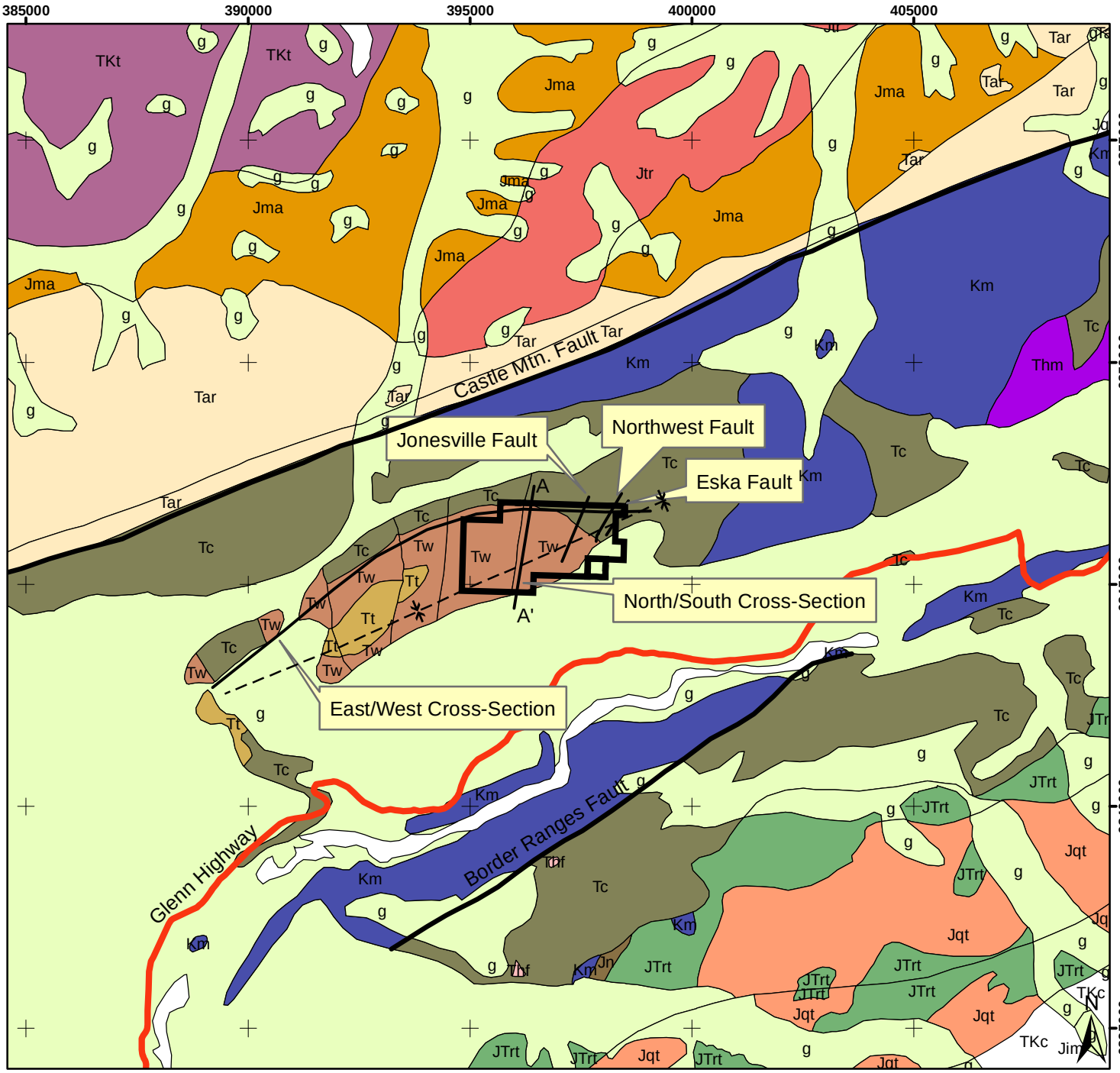
In the lower Matanuska Valley, including the Wishbone Hill area, Mesozoic and Tertiary-aged sedimentary lithologies are incorporated in five major formations (Figure 5). The lowermost formation (Arkose Ridge Formation) is primarily located northwest of Wishbone Hill in the Hatcher Pass area and is separated from general Matanuska Valley geology by a major fault. This formation exhibits arkosic sandstones and conglomerates eroded off granitic rocks to the north in the Talkeetna Mountains. It also contains volcanically derived sediments such as breccias and tuffs. There still remains a question to the age of this formation, which is referenced by a query in Figure 5.



Jonesville Coal Leases

Alaska Earth Sciences
Revised by RY
Aug 2012

Figure 3



Modified from USGS OF 98-133.

Lithology

Layered Rocks

- g - Holocene - Glaciers and superglacial moraine
- Tt - Oligocene - Tsadaka Formation
- Tw - Eocene - Wishbone Formation
- Tc - Eocene and Paleocene - Chickaloon Formation
- Tar - Eocene and Paleocene - Arkose Ridge Fomation
- Km - Late and Early Cretaceous - Matanuska Formation
- Jn - Late Jurassic - Naknek Formation
- JTrt - Early Jurassic to Late Triassic - Talkeetna Formation

Intrusives

- Tim - Eocene - Hypayssal mafic Intrusions
- Ti - Eocene - Hypayssal felsic and intermediate intrusions
- TKt - Early Paleocene and Late Cretaceous - Tonalite
- Jtr - Late Jurassic - Trondhjemite
- Jqt - Middle Jurassic - Quartz diorite and tonalite
- Jma - Middle to Early Jurassic - Amphibolite and quartz diorite

Highway

Coal Lease

0 0.5 1 2 3 4 Miles

1:130,000 NAD 83 UTM Zone 6

Generalized geologic map of Jonesville Lease Area

Figure 4

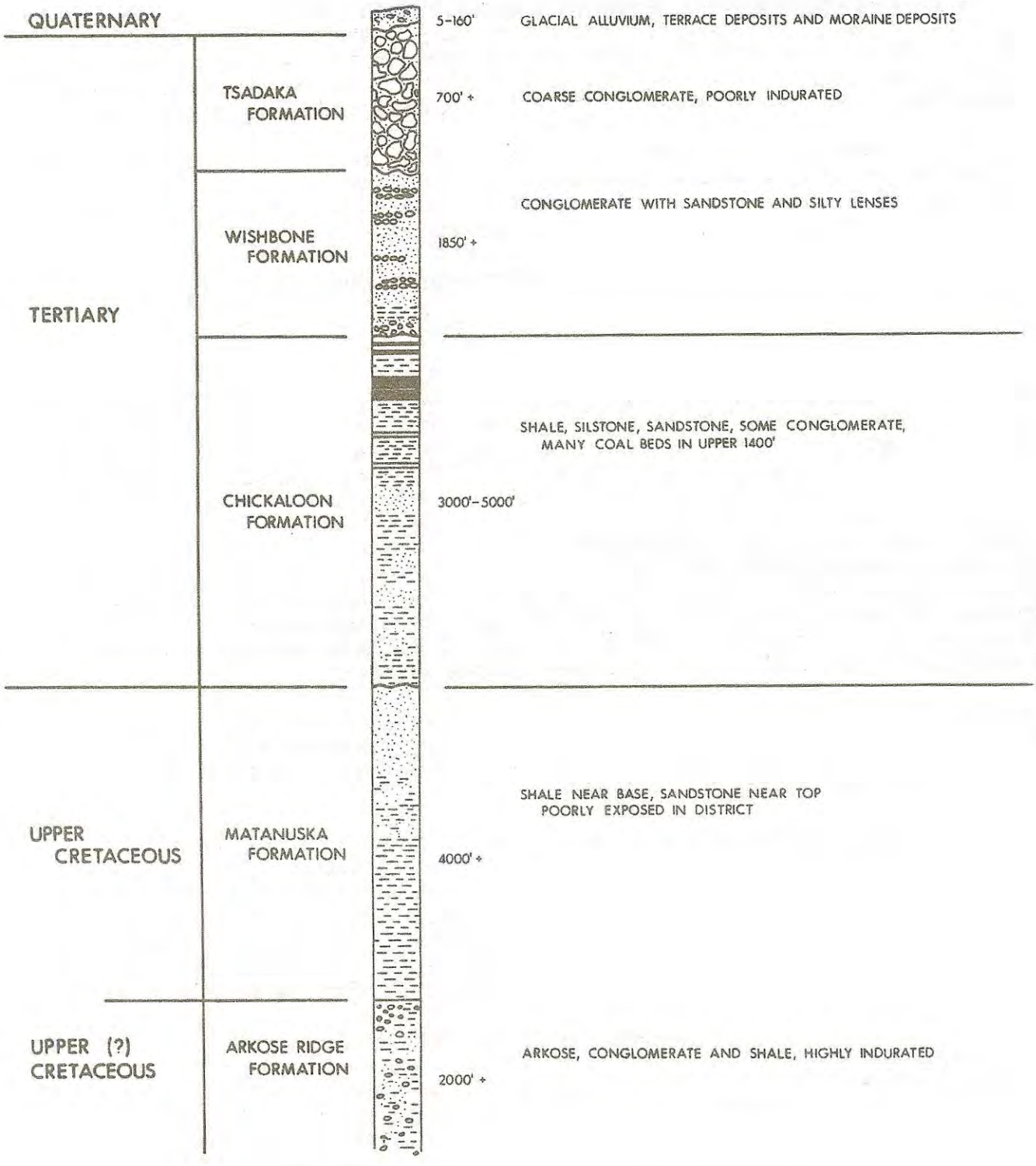


FIGURE 5: Generalized geologic section, lower Matanuska Valley

The base of the Matanuska Valley sedimentary section consists of the Matanuska Formation, a marine sandstone and shale sequence, which comprises more than one-third of the bedrock outcrops in the Matanuska Valley. The Matanuska Formation is more than 4,000 feet thick at its type section along Granite Creek east of Wishbone Hill (Clardy, 1984). Many of the steep cliff-forming rocks along the Glenn Highway and Matanuska River belong to the Matanuska Formation.

The coal-bearing rocks in the Matanuska Valley, and the focus of this exploration permit application, belong to the Paleocene to Eocene-aged Chickaloon Formation. This formation has been measured to be at least 3,000 feet thick with some authors estimating it to have a thickness of 5,000 feet. The main coal measures in the Wishbone Hill district of the Matanuska Valley occur in the upper 1,400 feet of the sequence (Barnes and Payne, 1956). These coal measures become stratigraphically lower in the formation as one moves eastward in the Matanuska Valley. Coal beds within this formation are interbedded with moderately well indurated claystone, siltstone, carbonaceous shales, sandstones, and thin conglomerates.

Overlying the Chickaloon Formation at Wishbone Hill is the Eocene to Oligocene-aged Wishbone Hill and Tsadaka Formations, sometimes referred collectively as the “Eska Conglomerate” (Barnes and Payne, 1956). The Wishbone Formation portion of this conglomerate sequence is predominantly conglomeratic strata with minor sandstones and siltstones and forms the steep escarpments along the northeast, east and southeast flanks of Wishbone Hill. The Tsadaka Formation portion of the conglomerate sequence lies in the far western portions of Wishbone Hill in the vicinity of Moose Creek and is not found outcropping on the Jonesville Coal Lease. Mantling certain areas of Wishbone Hill and the Matanuska Valley are variable thicknesses of Quaternary-aged glacial and landslide deposits. The south structural limb of the coal-bearing Chickaloon Formation is deeply buried beneath slide rock and glacial deposits which limits surface mining to the northern limb only.

The Matanuska Valley is a structural valley that is bounded on the north by the large-scale, high angle Castle Mountain Fault and the Talkeetna Mountains. To the south, the valley is bounded by the Border Range fault complex within the northern Chugach Mountains. The two mountain systems are cored by Mesozoic, Cretaceous and Tertiary-aged plutonic and volcanic rocks as well as metasediments.

Regional compressional deformation in conjunction with mid-Tertiary uplift along the Matanuska Valley boundary faults and more recently the ongoing collision of the Yakutat terrane into southern Alaska, has resulted in some complex structures in the Chickaloon Formation and surrounding lithostratigraphic formations. Complicating this regional deformation is the intrusion of mid-to-late Tertiary hypabyssal igneous rocks (gabbro, diabase, diorite porphyries, andesite and basalt). Both the deformation and the number and size of intrusives increase eastward within the Matanuska Valley. The Wishbone Hill district and the Jonesville coal mine project on the west side of the Matanuska Valley, exhibit the least deformation and intrusive activity within the valley.

The Matanuska Valley deformation resulted in the formation of a dominant synclinal structural feature which underlies and forms Wishbone Hill. The double-ended canoe-shaped fold extends the full length of the district and is cut into distinct segments by northeast trending left lateral oblique-slip faults caused from shear related movements along the nearby Castle Mountain fault system (Flores and Stricker, 1993).

The Wishbone Hill syncline, in the eastern Wishbone Hill area, trends west southwest 55^{0} – 80^{0} and shallowly plunges about 5^{0}–10^{0} to the southwest (Merritt, 1985). Barnes and Payne (1956) note that a nearly flat zone occurs where the old Evan Jones crosscut tunnel crosses the synclinal axis south of the intersected position of #5 seam. Bedding dips on the north and south limbs of the syncline within the Jonesville Coal Lease range from 20 to 40 degrees. The northern limb of the syncline generally exhibits steeper dips forming an asymmetric structure (Figure 6). From aerial photos and past geological investigations, there is a pronounced broadening of the syncline under the Jonesville coal lease to the southwest from its eastern apex near Eska Creek. A large area of relatively shallow dipping strata is present in the southwestern portion of the lease based on existing borehole data. The deeper exploration drilling proposed in this permit application is intended to substantiate the lateral extent of the shallow bedding attitudes on the coal lease, the location of the synclinal axis, and the intersection points of the #3 and #5 seams at the boundary of the synclinal axis and Jonesville Fault.

The old Evan Jones crosscut tunnel, from which the underground mine workings were accessed, intersects the north northeast trending Jonesville Fault just north of the Wishbone Hill synclinal axis (Figure 4). This fault consists of several faults separated by sheared and broken rock in a zone about 50 feet wide. Horizontal movement along this transverse fault is calculated to be around 400 feet and generally restricted past underground mining activity to areas west of the fault zone. Between the Jonesville Fault and the western boundary of the coal lease are a few minor transverse and normal faults that were encountered in past underground mining activities. These structures, however, did not adversely affect operations or drilling operations.

3.0 COAL GEOLOGY

Mid-to-late Tertiary intrusive rock emplacement in the Matanuska Valley coupled with the mid-Tertiary deformation resulted in a distinctive upgrade in coal rank from west to east in the Matanuska Valley within the Chickaloon Formation. In the western portion of the Matanuska Valley at Wishbone Hill, including Jonesville, the coals are of high-volatile B bituminous rank. The coal rank increases to medium and low volatile bituminous (metallurgical grade) in the Chickaloon area approximately 15-20 miles east of Wishbone Hill. Anthracitic coals are present at Anthracite Ridge, approximately 10-15 miles northeast of Chickaloon.

In the Wishbone Hill and Jonesville area, the coal measures occur in four main groups of three or more coal beds. An additional laterally persistent bed that is not part of a group is also included. These coal units are separated by 100 to 300 feet of clastic rock, composed mostly of interbedded sandstones, siltstones, claystones, carbonaceous shale and minor discontinuous coal beds or stringers. Figure 7 depicts a

A

A'

Projected Synclinal Axis

North Limb Area

South Limb Area

DDH-1

WH-9

MC-4

3

5

6, 7 Series, 8

Elev in Ft

2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900

Conglomerate Talus

Conglomerate

Sandstone

Siltstone

Claystone

Coal

0 500 1500 3000

Feet

Generalized Geologic Cross Section of Wishbone Hill - Block 3 Area

Figure 6

WEST

EAST

GEOLOGICAL SURVEY

BULLETIN 1016 PLATE 5

Evan Jones Mine

Premier Mine

Jonesville Coal Group

Premier Coal Group

Midway Coal Bed Group

Eska Coal Group

Burning Bed

Figure 7

Barnes & Payne, 1956
The Wishbone Hill District
Matanuska Coal Field,
Alaska: USGS Bulletin 1016

Wishbone Hill East-West Cross Section

cross section from the old Premier Mine, about six miles west of the Jonesville Mine, which emphasizes the lateral continuity of the coal units under Wishbone Hill. The following names have been applied to the coal units, in order from oldest to youngest, with average stratigraphic thicknesses of the group in parentheses: Burning Bed coal group (125'), Eska coal group (70') Midway coal bed, Premier coal group (175') and the Jonesville coal group (120'). Only one-fifth to one-third of a group's thickness is coal due to interbeds and partings of sandstone, siltstone, claystone, carbonaceous shale, and bone coal. Although all five coal units have been observed in the eastern part of Wishbone Hill, only coal seams within the Jonesville, Premier, and Eska Groups were thick enough to be mined at Jonesville in the past. In the Jonesville area, these coal groups and their numbered or named coal seams from top to bottom are as follows: Jonesville Group (4, 3, 2, and 1 beds); Premier Group (5, 6, 7, 7a. 7b, and 8 beds); and Eska Group (Eska, upper Shaw, lower Shaw, and Martin beds).

Over 20 coal seams with thicknesses in excess of three feet are known to occur in the Wishbone Hill district. In the Jonesville area, 12 coal seams are thicker than three feet; observed from past mining information and existing outcrop and drill data. Of these 12 seams, two (#3 and #5) are consistently over 10 feet in thickness with both seams reaching a measured maximum thickness of 24 feet and average thicknesses of 14 feet and 18 feet, respectively. Seven additional coal seams exhibit thicknesses greater than 5 feet in various areas of the property and three show local thicknesses of 9 (#6), 19 (#7b), and 9 (lower Shaw bed) feet from drill information obtained since 1997.

Bedding attitudes contained within the coal-bearing Chickaloon Formation in the eastern portion of Wishbone Hill range from horizontal to nearly 40 degrees. The shallowest dips occurring at the synclinal axis. Coal beds underlying Wishbone Hill contain interbedded boney coal, claystone, and other fine-grained clastic partings which necessitate coal washing to achieve end-user quality requirements. Coal roof and floor rocks, for most of the coal seams, are comprised mostly of fine-grained siltstones, claystones, coaly claystone and carbonaceous shale. The Premier group's #5 seam, however, exhibits a strong roof comprised of persistent fine-to-coarse grained sandstone.

4.0 PREVIOUS MINE AND OWNERSHIP HISTORY

The presence of coal in the Matanuska Valley was first noted by prospectors from conversations with natives in 1894 (Martin and Katz, 1912). The first mining in the valley occurred in 1913 twenty miles east of Wishbone Hill at Chickaloon when 800 tons was sledded out in the winter for Navy steamship testing. This early coal discovery prompted the building of a railroad spur to the Chickaloon Mine (Bauer, 1985). In 1916, when the railroad reached the Moose Creek area, the first Wishbone Hill coal mine opened near the mouth of Moose Creek. Completion of the railroad to Chickaloon in 1917 opened the way for development of the Wishbone Hill district. From 1917 until the last major Matanuska Valley coal mine was closed in 1968, a total of nine separate mines were developed on Wishbone Hill, although no more than four operated at any one time.

The Evan Jones Coal Mine (now called the Jonesville coal mine prospect), named after the original superintendent of the company, was by far the district's largest and most consistent producer from 1920 until it closed in 1968. Out of the 7 million tons of coal produced from Wishbone Hill, 6 million tons came from the Evan Jones Mine. In its early years, 1920 to 1925, this mine produced coal from the south limb of the Wishbone Hill syncline. In 1925, a roughly 2,500-foot long crosscut tunnel was driven on the level to the north through the hill to reach the beds on the northern limb of the syncline, where all subsequent production would come.

The predominant mining method utilized by the Evan Jones Coal Company in their underground operations was conventional room and pillar. Some limited experimentation using mechanized mining methods was attempted. In 1953, a surface strip mine that started with a small dragline, two bulldozers and a few haul trucks was opened up on the mine property on the north side of Wishbone Hill to supplement production from the underground operation. Production came from the outcropping Jonesville and Premier Coal Groups that had been mined underground. These include #3 and #4 beds from the Jonesville Group and beds 5, 6, 7, 7a, 7b, and 8 from the Premier Group. By 1959, production at the north strip pits was sufficient to warrant termination of the underground mine and it was closed. In 1968, coal mining within the Evan Jones strip pits ceased as electrical power generation plants in Anchorage switched from burning coal to natural gas.

Since 1934, the earliest date for which records are available, 2,300 different personnel have worked at the mine (Patsch, 1980). In 1956, Placer Amex, Inc. (later Placer Dome U.S., Inc.), and now Barrick Gold Corporation purchased an interest in the Evan Jones Coal Company. From 1959 to the mine closing, it was the managing joint venture partner of the property. Also in 1959, as a result of statehood, a newly formed state agency called the Mental Health Trust Land Authority (MHT) selected about a million acres of past Federal property throughout Alaska that it thought could be used to generate future income for the State's disadvantaged through land and resource development. Acreage from Sections 17, 18, 19, and 20 within the Evan Jones Coal Company property was selected. This ownership position within State government has remained to the present.

The Jonesville Coal Mine has remained closed despite some renewed, but limited, exploration activity which occurred between 1990 and 1997 and again in 2004. In 1990, Placer Dome U.S., Inc., the coal leaseholder from the last operational mining period, opted to sublease the Jonesville property. This sublease went to a small entrepreneur, Hobbs Industries Inc. (Hobbs) who intended to truck Jonesville coal to power a new proposed coal-fired power plant on a federal backscatter radar project near Gakona, Alaska. In 1991, Hobbs' federal contract was terminated but he continued with exploration activity at Jonesville until mid-1995. This exploration activity included an effort to reopen the old Evan Jones crosscut tunnel as well as to develop a new boxcut/portal entrance to access the unmined south limb coal reserves. Some limited underground exploration occurred in strata below #3 seam by more modern mechanical mining methods, utilizing a Joy 12CM5 continuous miner, Joy 10SC-22 shuttle car, Lee Norse TD1-43 roof bolter, Pemco power distribution center and a 300 KW electric

generator. The exploration proved that mechanized cross pitch mining on dip slopes up to 32 degrees was possible.

In 1995, Nerox Power Systems of California purchased the coal lease from Placer Dome U.S. and changed the focus of exploration to the north limb of the Wishbone Hill syncline. In 1996, two round multiplate portals were pushed to the face of a 24-foot thick #5 seam after a substantial effort to remove talus material covering the seam within the expansive 3A strip pit. In 1997, Nerox lost funding for the project and development activities ceased before any coal could be mined.

In 1997, Sumitomo Coal Mining Company of Japan identified the project as a potential source of U.S. coal for some Japanese power plants through an international trading company Glencore Ltd. They drilled two deep exploration core holes through the Wishbone Conglomerate and upper coal measures of the Chickaloon Formation. Sumitomo decided not to partner with Nerox in the coal mine project because of a declining economic climate in Japan.

Over the next six years, the active Jonesville coal lease remained in Nerox ownership with a revolving cast of principals. In 2003, the coal property was purchased from Nerox by an investment group in Boise, Idaho (Knoll Acres Associates LLC). Soon thereafter, another company from Omaha, Nebraska (McRal Inc.) was brought in to help in financing some renewed exploration achieving a 50-50 percent stake in the venture. This new cooperative group was collectively called Sutton Partners, LLC. In 2004, an exploration borehole was drilled at the location of a new proposed access portal to the remaining underground coal reserves.

This exploratory hole, while identifying the entry seam's (#5 seam) depth, also revealed a thicker than expected extension of one of the beds of the Eska Coal Group. In 2005, exploration activity was renewed and focused on the estimated 5 million tons of coaly waste tailings remaining from prior mining efforts for its potential to be remined. An extensive shallow exploration drilling program was accomplished to identify waste coal reserves that, through low cost mining methods, might help jump-start the development of a new underground mine project. Unfortunately, drilling results identified lower than projected but marketable coal tailings reserves in most areas, except the old tailings pond. A suspension of activities on the site by Sutton Partners was then ordered.

In late 2005, discussions began between a wholly separate entity from Alaska Earth Science, Inc., Alaska Earth Resources Inc. of Anchorage (AERI) and Sutton Partners (Sutton). Discussions culminated in early 2007 with an agreement between the parties whereby AERI could acquire a 51% ownership interest in Sutton Partners by finding a financial partner that could earn up to 100% interest in the Jonesville property. In late 2007, the Boise, Idaho group or Knoll Acres portion of the Sutton Partners took over the remaining 49% stake in the joint venture when McRal amicably left the project. Ranger Alaska, a subsidiary of Black Range Minerals, is the current lease owner on the Jonesville property.

5.0 PAST EXPLORATION DRILLING

Exploration has occurred on the Jonesville property and adjacent areas of Wishbone Hill at various times during the past 96 years. Over this time, a total of 110 documented diamond drill holes, noted from published reports, have penetrated the Chickaloon Formation coal-bearing strata (Merritt and Belowich, 1984). Of these boreholes, six have occurred relatively recently (since 1990), concurrent with attempts to reestablish mining on the old Evan Jones coal lease. In addition to these 110 boreholes, extensive drilling operations were conducted in both the far western portion of Wishbone Hill and in the Knob Creek area east of Eska Creek during the 1980's and early 1990's. This exploration drilling was conducted by an assortment of coal leaseholders (Hawley Resource Group, Rocky Mountain Energy, Idemitsu Alaska Inc. and Usibelli Coal Mine), whose leased acreage is now held by Usibelli Coal Mine of Healy, Alaska. Information on these latter holes is proprietary and held by the current leaseholder.

Of the 110 earlier drill holes, twenty-four have been drilled in the vicinity of the present Jonesville Coal Lease (ADL324600). Of these 24 boreholes, 10 were drilled along the southern margin of the eastern portion of Wishbone Hill through talus and glacial overburden rock (Warfield, 1962). Seven boreholes were drilled through the Wishbone Formation conglomerate cap rock on top of Wishbone Hill, two of which occurred in 1997 by Sumitomo Coal Mining Company. Three boreholes were drilled at and just west of the Eska Fault zone at the far eastern portion of the coal lease. Finally, the four remaining boreholes were drilled on the southern limb of the syncline between the Jonesville Fault and the Eska Fault zone.

Data gathered from the 24 previous boreholes on or near the Jonesville Coal Lease have met with differing results. Most of the ten boreholes along the southern margin of the lease showed the existence of the Premier Coal Group with one intersecting the Jonesville Coal Group. However, correlation was problematic and some appeared to intersect the Jonesville Fault. The three old angle boreholes drilled near the Eska Fault zone showed much shearing and didn't intersect the Jonesville Group (Jolley, Toenges, and Turnbull, 1952). In addition, two holes were abandoned after passing through fault zones and old workings, while three others were shallow holes to locate a portal entry in #5 seam. Therefore, of these 24 boreholes drilled near Jonesville, only six (6) passed through coal-bearing strata that gave reliable and correlatable information. This has brought the need for additional strategic exploration drilling on the property, one of the reasons for the submission of this exploration permit application.

6.0 COAL RESERVES AND QUALITY

Estimates of remaining coal reserves for the entire Wishbone Hill district suggest that 106 million tons remain in place after the early mining period, with 52 million tons of indicated reserves and 54 million tons inferred (Barnes and Payne, 1956). It is presently thought that nearly half of the remaining mineable reserves of the Wishbone Hill district

are contained under the Jonesville Coal Lease, formerly the old Evan Jones Coal Company (EJCC) property (Patsch, 1980).

In Barne's 1956 United States Geological Survey (USGS) report, coal reserves are broken down into indicated and inferred measurement categories. Indicated measurements in the 1956 report were based on 2,000 feet from a point of measurement and inferred from 2,000 feet to the coal lease boundary. This is in contrast to the normal 0 to ¼ mile and ¼ to ¾ mile distances for similar categories, developed by the USGS (Wood et.al., 1983). Measured reserves were not classified due to scarcity of data and variations in coal bed thickness. The coal reserve estimates used a conservative average thickness of 10 feet for each of the two thickest coal seams on the property, #3 and #5 seams. Given a much greater average thickness of these seams from recent drilling and coal outcrop data, together with more modern mining methods, additional coal reserves beyond the estimates could be expected. However, part of the coal reserve tonnages in the report were calculated on the north limb of the syncline to the western Township Line and included 160 acres of ground that no longer is under coal lease. This would reduce the calculated reserves somewhat under the present lease configuration.

Two other old Evan Jones Coal Company coal reserve analyses, one calculated while still mining in 1958 and another taken just after the end of mining in 1968 estimated between 40,000,000 and 48,000,000 tons of remaining cleaned (washed) coal reserves in all mineable coal beds on the coal lease. In 1980, Placer Amex, later called Placer Dome U.S., (now Barrick Gold) was the leaseholder of the property and estimated that 30 to 50 million (unwashed) recoverable tons of good quality, compliance bituminous steam coal remained in-place on the property (Patsch, 1980).

In 1999, under the direction of new management at the coal lease, a new reserve calculation was put forth. The new calculations took into account newly acquired information from two 1997 deep drill holes drilled by Sumitomo Coal Mining Company of Japan through the conglomerate cap at the top of eastern Wishbone Hill. It also contained adjustments of older USGS data (Barnes and Payne, 1956) to include mining recovery (65%) and washing recovery (65%) factors. For uniformity, indicated and inferred coal reserves were calculated using the same distance determinations as in the 1956 report. Using the two recovery factors resulted in a marketable clean coal tonnage. Reserves for coal seams #2, 3, 5, 6, 7, 7a, 7b and #8 were included in the calculations. It was calculated that approximately 4,907,760 tons of indicated reserves were eliminated when the western boundary of the Jonesville Coal Lease was reduced from the township boundary line to its present configuration. This reduced the indicated coal reserves to 6,791,240 tons.

The 1999 coal reserve calculations conservatively show that over 35 million tons of clean coal is most likely available for recovery on the Jonesville Coal Lease with approximately 27% of the recoverable coal reserves considered measured, predominantly around the western lease drill holes. Most of these coal reserves are contained within the two thickest coal seams (#3 and #5).

In 2007, another coal reserve study was undertaken by Alaska Earth Sciences, Inc. (AES) from existing available data at Jonesville. Measured coal reserves given in this new reserve calculation used USGS methodology of ¼ mile distances from drill holes that showed some correlation of coal seams. This meant that some identified Premier Group coals from the south limb drilling that appeared correlatable to coals intersected in those holes drilled through the conglomerate cap were included in the measured reserve category that weren't previously considered. The rest of the coal reserves on the property were calculated as indicated reserves. This determination was based on known coal seams from underground workings but questionable correlations and accuracy of the old mine maps. The coal reserve calculations used an underground mining recovery factor of 77% (based on old Evan Jones Mine data) and 65% wash plant recovery) as well as a gradient factor for dipping coal seams. Thus, the new data reflects marketable or clean coal tons. Coal seams included in the new reserve calculations are #3, 5, 6, 7, 7b, #8, and a mineable Shaw Bed discovered in 2004 from a borehole east of the Jonesville Fault. Reserves of coal seams over 10 feet thick were calculated using a 10-foot mining height.

Finally, in August, 2012, a Joint Ore Reserves Committee (JORC) compliant reserve and resource estimate was completed. JORC is the Australasian code for reporting of exploration results, mineral resources and ore reserves that sets minimum standards for public reporting of minerals exploration results, mineral resources and ore reserves. The estimate includes seams #3, 4, 5, 6, 7, 7a, 7b, #8, the Eska bed, L Shaw Bed, and Martin Bed. Below is a compilation table of all the coal reserve estimates (tons) through 2012:

Table 1

Compilation of All Reserve Estimates (tons) through 2012

Reference	Measured	Indicated	Inferred	Total
USGS Bull. 1016 (1956)		27,690,000	44,600,000	72,290,000
EJCC – Horton (1958) washed				48,215,000
EJCC – Tucker (1968) washed				40,000,000
PDUS – Patsch (1980)				30-50 Million
BCC (1999) – washed	9,666,800	6,791,240	18,844,000	35,302,040
AES (2007) – washed	18,700,882	19,140,984		37,841,866
AES (2012) – washed (JORC)	6,710,979	11,022,381		17,733,360

Coal resource on the property is estimated at up to 133 million metric tons. The reserve estimates reflect post washing of resources at depths less than 2,000 feet and in coal seams at angles of less than 20 degrees.

In addition to the remaining underground coal reserves at the Jonesville Prospect, there is a considerable tonnage of old mine tailings that warrant exploitation through remining efforts. Most of the remined coal tonnage will come from an old coal

tailings pond that measures roughly 1,600 feet long by 600 feet wide. Estimates of the remaining in-place coal tailings within this structure range from 800,000 to 1,500,000 tons. The reject rate on the tailings material has been calculated from testing to be around 40-60 percent, depending upon material properties and washing efficiency. Therefore, it is surmised that between 320,000 and 900,000 tons, or an average of 600,000 tons of total clean coal can be extracted from the pond located on the adjacent 40-acre coal lease to the main property. Remining of this tailings pond area could provide immediate low cost production and a structure to place new underground development waste.

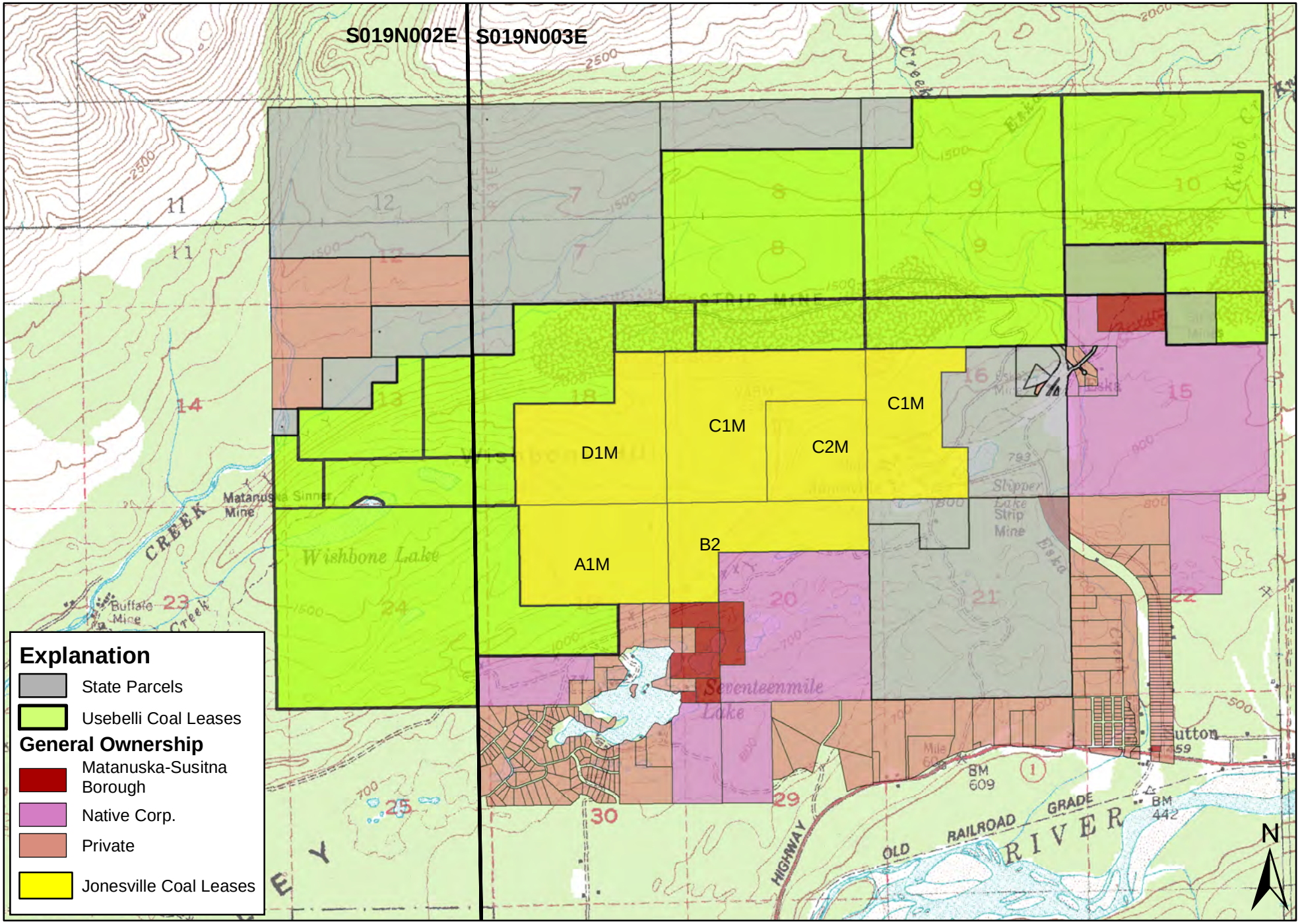
7.0 LAND USE

There are numerous entities involved in the ownership of lands in and adjacent to the Jonesville Mine and eastern Wishbone Hill area of the lower Matanuska Valley. Figure 8 shows land ownership information immediately adjacent to the Jonesville Coal Lease. In addition, numerous private land owners are located mainly along the Jonesville Road and in small subdivisions north of Sutton as well as in the Seventeenmile Lake area. Several small businesses are located along the Glenn Highway in Sutton as well as some private residences. Larger private land owners in the area include the Alaska Mental Health Land Trust, other state-owned lands, Mat-Su Borough and Cook Inlet Regional Corporation land. The area in and around the Jonesville Coal Lease is contained within the Susitna Area Plan, the Matanuska Valley Moose Range Area Plan (Alaska Department of Natural Resources, 1986) and the Sutton Special Land Use District.

In 1986, the Matanuska Valley Moose Range was legislatively established to “maintain, improve and enhance moose populations and habitat and other wildlife resources of the area, and to perpetuate public multiple use of the area, including fishing, grazing, forest management, hunting, trapping, mineral and coal entry and development, and other forms of public use of public land not incompatible with the purposes stated”. The 1986 Moose Range plan understood the existence of high-value coal reserves in the area and stated so in the plan.

In the years since the establishment of the 1986 management plan, a Sutton Comprehensive Plan was established in April of 2000 (MSB, 2000). This plan was developed for guiding the physical, social, and economic development, both private and public, of the Sutton community. In the plan, it was the desire of the Sutton community to “preserve the area’s scenic and residential qualities including air and water quality, quiet atmosphere, and outdoor recreational opportunities”. It also stated that “growth and development is encouraged and fostered where a balance exists between private property rights, use of natural resources, public investment in community facilities and services, and the protection of our natural environment for our continued sustenance”.

During the early coal mining period at Wishbone Hill, coal exploration and development resulted in the construction of several gravel roads, dirt trails and rights-of-way that have since turned to public access routes. One of the gravel roads was originally an old route to access Federal Bureau of Mines drill holes along the



Land Ownership of the Jonesville Area

0 0.5 1 1.5 2 Miles

1:40,000 NAD 27 State Plane Alaska Zone 4

Alaska Earth Sciences
Revised by TEK
August 18th, 2008

Figure 8

southeastern base of Wishbone Hill. This old access road was subsequently extended westward from the old mine site to the Moose Creek area past the northern end of Seventeenmile Lake. This route (ADL52715) remains in place as a public 60-foot wide easement for the Department of Fish & Game. The Matanuska Susitna Borough, in 2005, applied for a separate 50-foot wide public easement on or around the same route and named it the Seventeenmile Lake Trail (ADL229485-B). The eastern extension of this trail, according to status plats heads north along the east side of the Evan Jones tailings pond and then east across the reclaimed tailings to the northern edge of Slipper

Lake and then east to the Jonesville road. The existing Jonesville Spur Road that exits the Jonesville Road and goes to the old mine site is identified by the State of Alaska as ADL2181 and has a 100 foot wide easement on it. Finally, a 3,635-foot long right-a-way corresponding to the lower portion of the old coal haul road to the coal strip pits on the northeast side of Wishbone Hill was applied for along with an underground waterline to Eska by the Evan Jones Coal Company in 1963. This 100-foot wide public easement (ADL20618) was issued in 1963 and remains in place until cancelled.

In addition to gravel roads and trails, there is also an existing 200-foot wide Bureau of Land Management (BLM) right-a-way (USS 9077) owned by the Alaska Railroad that still runs to the mine site along the gravel road that parallels the north shore of Slipper Lake. This old right-a-way also mostly parallels the Jonesville Road to Sutton and then travels westward to Palmer along the north bank of the Matanuska River. The Jonesville Branch of the old railroad reached the Evan Jones Mine in 1921. In recent years, a 12-foot wide pedestrian trail easement (ADL228571) was formed along the same railroad right-a-way from Palmer to the mine site.

Finally, there are no RS 2477 trail easements existing in the area of the Jonesville Coal Lease. An easement does exist (RST 1420), however, on Usibelli Coal Mines coal lease east of Jonesville. This RS 2477 trail accesses an abandoned strip mine area northeast of Eska Creek and is called the Eska Strip Mine Trail. It originates at the end of an unimproved road near the old town of Eska and travels north, dividing into two branches, both of which terminate in the old strip pit.

8.0 CLIMATE

Five climatological zones have been identified for Alaska: maritime, maritime-continental, transition, continental, and arctic (Merritt, 1985). The Matanuska Valley, including the area where the coal exploration will take place, is considered to be in the transition zone between the maritime climate of coastal Alaska and the continental climate of interior Alaska.

Summer temperatures average near 60F and winter temperatures average near 0F (AEIDC, 1989). Precipitation within the region varies with topography. Yearly average precipitation in Palmer, about 13 miles west of the proposed exploration area, is about 15 inches, including 56 inches of snowfall. Precipitation in the mountainous area can be over 80 inches, including over 200 inches of snowfall. Data for the last 37 years in Sutton shows an average precipitation of 19.1 inches, including 78.4 inches of

snowfall. Since the Jonesville Mine site is at a higher elevation when compared to Sutton, higher relative precipitation and snowfall can be expected.

There was some limited site-specific climate data obtained for the mine and Sutton area between 9/20/90 and 1/31/92. During that time, temperature and precipitation events as well as general climate conditions were recorded at the mine site by the company geologist. Between 10/20/91 and 1/31/92, Sutton area climate data was collected by a remote NOAA weather station in town operated under contract by Mr. Rodney Johnson, previously a Jonesville coal miner.

Wind direction and velocity in the eastern Wishbone Hill and Sutton area are also dependent on local topography. Local winds tend to be orientated in the direction of valleys and rivers. Strong northeast winds, often exceeding 60 mph, periodically blow down the Matanuska River Valley in the fall, winter and spring. These winds occur as often as 3 times per year but seldom in the summer (Wishbone Hill Surface Coal Mining Permit Application, 1989). The topography also affects air mass movements. The Talkeetna Mountains serve as a barrier to cold interior air masses moving southward into the Valley, while the Chugach Mountains shelter the area from warm moist air moving northward from the Gulf of Alaska (Merritt, 1985).

Long-term temperature and precipitation data is available for the Matanuska Agricultural Experiment Station in Palmer, approximately 15 miles SW from the proposed exploration area. Wind speed and direction information from the same area is also available. Little long-term climatological data exists in the immediate vicinity of the coal exploration area. Short-term information from Sutton suggests that there is much variability in precipitation and mean temperatures within the area, even at lower elevations. Sutton seems to have the most precipitation, and both Palmer and Sutton have substantially warmer temperature year round than Chickaloon.

Average summer temperatures in the Sutton area (depending on elevation and aspect) range from 46F to 67F. Average winter temperatures range from 0F to -26F. Annual maximum and minimum temperatures are 89F and -36F, respectively (AEIDC, 1989).

The Matanuska-Susitna Borough is classified by the Alaska Department of Environmental Conservation as a Class II PSD (Prevention of Significant Deterioration) area, which is considered to be clean air. Few significant sources of air pollution exist in the area. Naturally-occurring dust exists as “Matanuska Winds” pick up glacial sediment from the Matanuska River floodplain. Dust occurs most often in the spring and fall when high winds correspond with a lack of snow cover.

Past acquired data from an air quality monitoring station adjacent to the Wishbone Hill coal project of Idemitsu Kosan in the 1980’s demonstrated that background pollutant concentrations (i.e., inhalable and suspended particulates) consistently fell below the National Ambient Air Quality Standards (NAAQS). During this past study, only one measurement exceeded the standards and that was during a

November high wind event. It is expected that similar air quality conditions exist at the proposed Jonesville exploration area, approximately 2 miles northwest of Sutton.

9.0 HYDROLOGY – GENERAL

11 AA 90.163 (a) (2) (A) surface water

The Jonesville exploration permit area is located in the Matanuska River basin on the eastern end of Wishbone Hill and is drained by Moose Creek on the west and Eska Creek to the east. The Matanuska River watershed is estimated to cover 2,070 square miles and is depicted in Figure 9. The latter two streams flow into the Matanuska River and form the major watersheds in the area, draining approximately 51.65 square miles and 18.78 square miles, respectively (Jonesville Mine Coal Mining Permit Application, 2005). Still and Cosby (1989) and ADNR (1986) report that miscellaneous water quality and flow measurements have been recorded on the Chickaloon and Kings Rivers and on Moose, Granite, and Eska creeks.Generally, the data is either unpublished or is in various USGS Water Supply Papers and consists of non-continuous chemical water quality samples and flow measurements taken between 1948-1988. The water quality and streamflow data for these stations are summarized in Table 2.

Small intermittent streams that enter a broad relatively flat topographic surface to the south drain most of the southern slope of Wishbone Hill. The surface, created by past glaciation, has numerous irregular depressions often without outlets and containing varying amounts of surface water. This type of topography extends 2 miles to the Matanuska River on the south and is underlain by a mixture of terrace gravels and glacial deposits which are usually permeable and conducive to drainage.

Springs and seeps exist on the southern slope of Wishbone Hill while wetlands, ponds and lakes exist in the flatter topography, where finer material has effectively plugged some of the depression bottoms. Two of the better-known lakes in the area of the mine include Slipper Lake to the east and Seventeenmile Lake, which is approximately one mile to the southwest. Slipper Lake was essentially formed during the early mining period by the damming of small drainage and pond system by deposited coal waste tailings.

For the smaller watersheds of the area that are not associated with present day glaciers, stream hydrology reflects the large seasonal climatic changes typical of a subarctic environment.

A large portion of the annual runoff occurs during breakup in the spring and early summer while discharge decreases during the winter because of cold temperatures and ice formation.

There are two defined surface drainages or watersheds within the proposed exploration area. The largest, approximately 527.44 acres or .8239 square miles, (the rest is contained on Usibelli Coal Mine leased acreage) originates on top of Wishbone Hill and flows generally southwesterly before turning south and emptying into

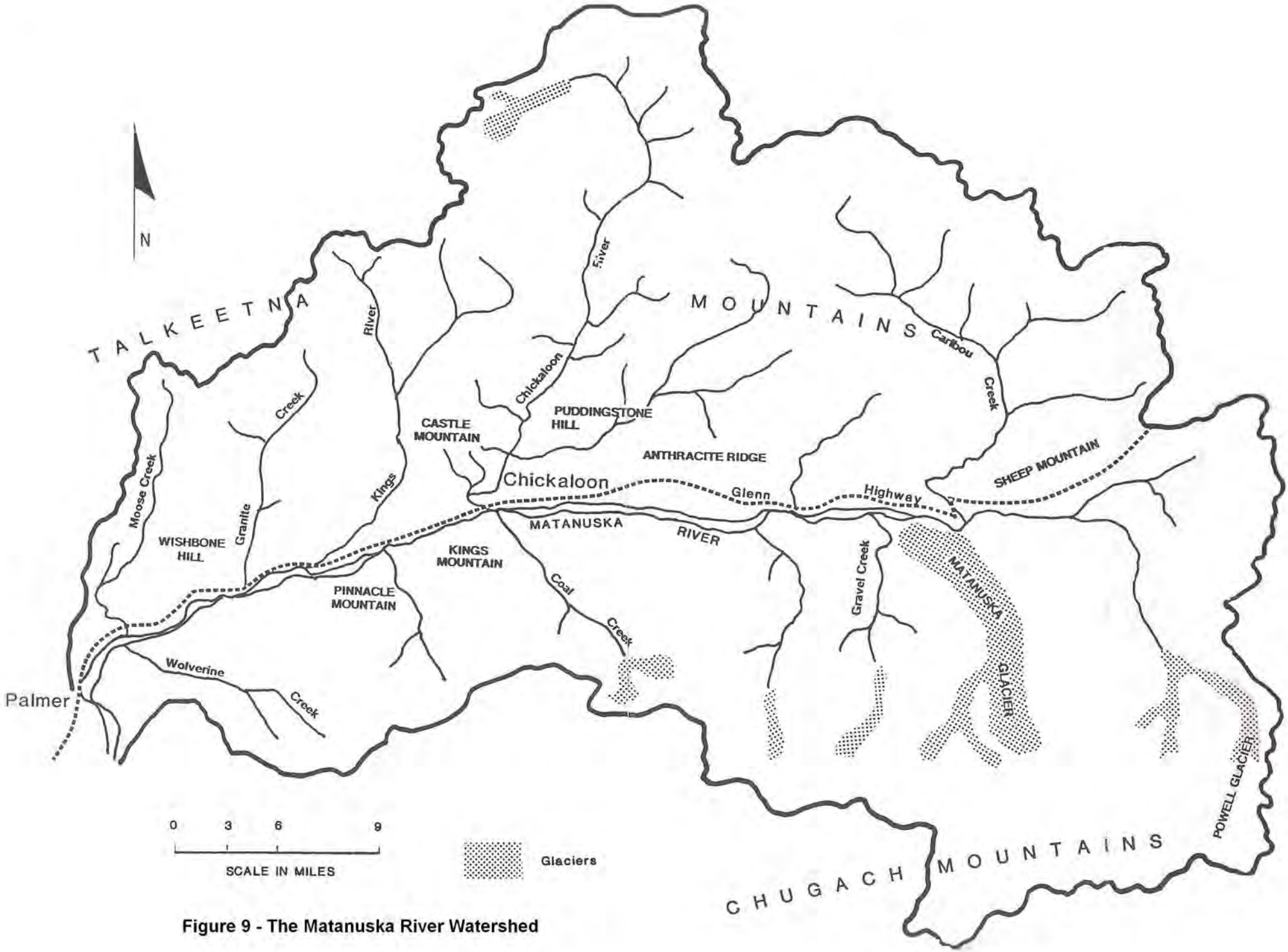


Figure 9 - The Matanuska River Watershed

Table 2

RANGES OF WATER QUALITY PARAMETERS FOR STREAMS IN MATANUSKA VALLEY WATERSHED (FROM USGS ANCHORAGE)

	Eska	Granite	Caribou	Chickaloon	Moose	Kings	Matanuska
T	1.0-8.5	0.0-9.5	0.0-14.5	0.0-9.5	0.0-7.0	0.0-10.0	0.0-11.5
Cond	65-118	74-157	105-911	121-287	54-130	100-179	147-309
pH	7.2-7.6	6.9-7.4	6.9-8.2	6.7-7.9	6.5-7.9	6.0-7.9	6.6-8.3
Alk	21-54	24-39	46-218	48-91	23-53	39-58	49-90
Mg	1.1-2.9	1.3-2.8	1.9-21.0	1.4-6.2	1.3-3.0	1.3-3.6	1.2-12.0
Fe	0-30	10-20	0-1,200	0-80	10-120	0-100	0-3,400
TDS	32-70	59-102	67-623	70-175	41-76	60-113	87-185
TSS	NR	NR	30-13,220	NR	14,200	NR	10-9,250
Years of Records	1950-51 1955-57 1961-62	1948-49 1950-52	1948-49 1950-56 1958-69 1971-72 1975-76	1948-49 1950-55	1948-49 1950-52 1955-56 1970-71	1951-54 1955-56 1957-58	1948-56 1957-68 1971-73 1984-86

Note: T = temperature in degrees Celsius; Cond = specific conductance (umhos/cm): pH in standard units; Alk = alkalinity in mg/l as HCO3; Mg = Magnesium, total dissolved (mg/l); Fe = iron, total dissolved (ug/l); TDS = total dissolved solids (mg/l); TSS = total suspended solids (mg/l).

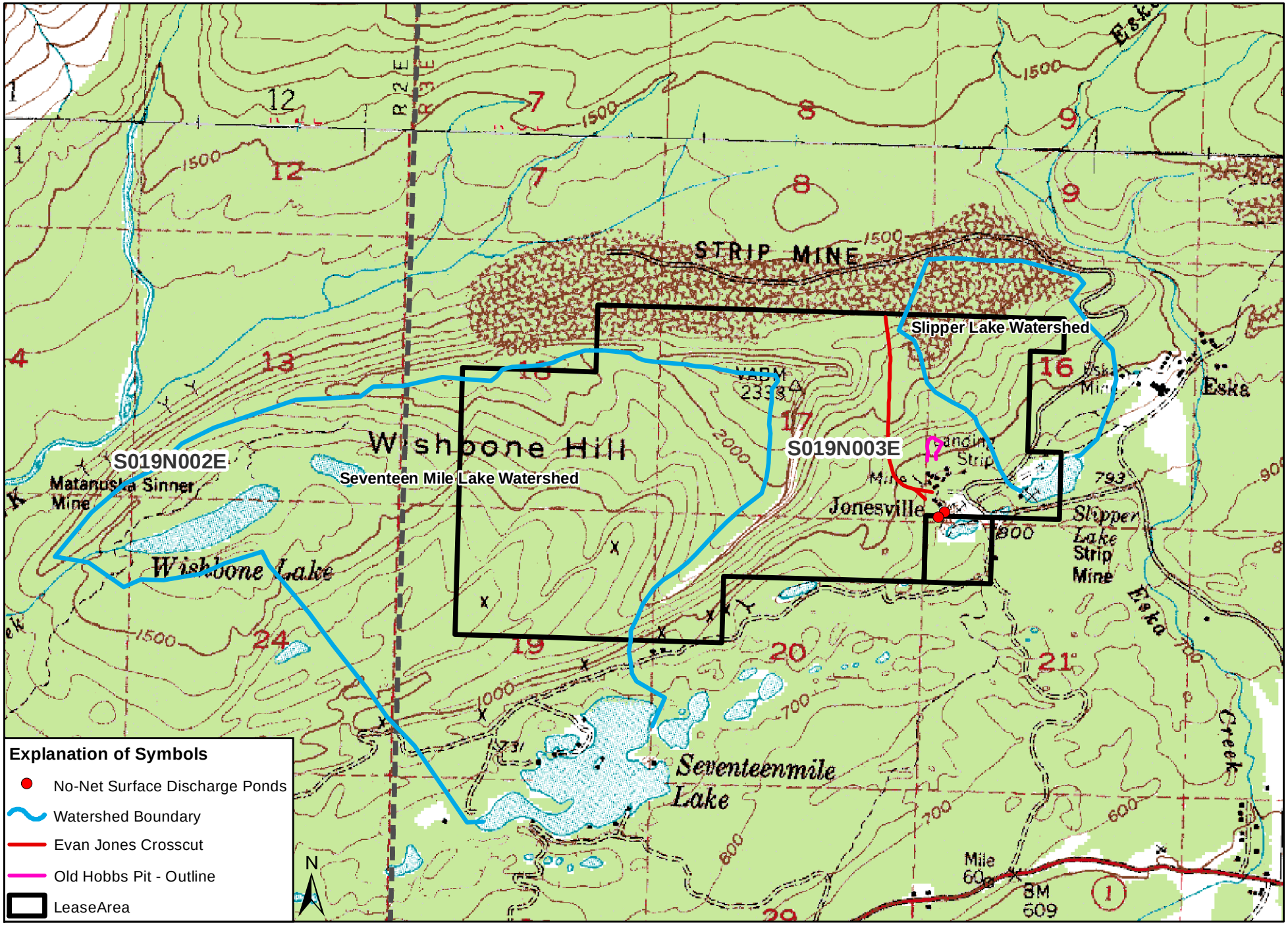
Seventeenmile Lake. The “Seventeenmile Lake” watershed originates on Wishbone Formation conglomerate with limited vegetative growth, especially in its upper reaches. The other permit area surface drainage originates in one of the easternmost strip pits (on Usibelli coal mine coal leases) and flows generally southerly, emptying into Slipper Lake. The “Slipper Lake” watershed encompasses approximately 187.84 acres or .2935 square miles. Figure 10 illustrates these two surface watersheds on the Jonesville Coal lease.

There are two other small surface flows on the permit area that result from surfacing groundwater. One is a flow emanating from the old crosscut tunnel opening. This flow, which averages about 400 gallons per minute (gpm) with increased flow during spring breakup and after heavy late summer and early fall rains, is presently contained in a series of culverts and vertical Corrugated Metal Pipe (CMP) sump collection and transfer stations. This contained flow ultimately empties into one of two no-net discharge pond structures. The crosscut tunnel effluent is monitored and sampled annually. Past analyses show that this water exceeds drinking water maximum contaminant concentrations in total dissolved solids, turbidity, iron and sodium. The other small surface flow emanates from gravels just east of the winding road to the old Hobbs excavation on the southeast section of Jonesville permit area. This surface flow, called the “freshwater spring” has an average flow rate of about 50 gpm. This water is also annually tested and is within limits for drinking water.

The northern portion of the permit area comprises the abandoned North Jones strip pits which were abandoned in 1968 when the Evan Jones mine closed. Surface runoff originating on the north side of Wishbone Hill above the strip pits or precipitation that falls within the pits is captured by the pits and ultimately intercepted by extensive underground mine workings in the extreme northern end of the permit area. There is also a series of vertical ventilation shafts east of the old Edwards Pit where runoff in the area is collected and directed to the underground workings. Eventually, all this captured water is directed to the main crosscut tunnel which drains all underground mine workings from the old Evan Jones mine and discharges to the south side of the permit area. Surface water that originates below the old strip pits flows across spoil piles and undisturbed hillside and reports to the headwaters of Moose or Eska Creeks.

Five main hydrogeologic units have been identified in the Matanuska Valley, including the Wishbone Hill area. These include igneous and metamorphic basement rock, sedimentary rock (Matanuska, Chickaloon, and Wishbone Formations), glacial sediments, alluvial deposits, and landslide debris. In addition, spoil material made up of processed and wasted sedimentary rock exists as a result of previous mining operations.

On Wishbone Hill and the Jonesville coal exploration area, the igneous and metamorphic basement rocks are not exposed, being buried deep under the sedimentary rock packages of the region. Some igneous sill and dike materials intrude the Chickaloon Formation within the permit area but are not extensive. The underlying Matanuska Formation is also not observed in the permit area. The two main sedimentary formations present on the coal lease are the coal-bearing Chickaloon



Eastern Wishbone Hill Watersheds

0 0.5 1 Miles

1:30,000 NAD 83 UTM Zone 6 N

Alaska Earth Sciences
Original by JM, July 30th, 2008
Revised by RY, Aug 2012

Figure 10

Formation and the overlying Wishbone Formation conglomerate. The latter formation is well-indurated and almost impermeable. It is comprised primarily of rounded to subrounded igneous pebbles and cobbles in an arkosic matrix with subordinate amounts of well-indurated sandstone and finer clastics.

The presence of folding and faulting in relatively incompetent strata results in increased primary and secondary permeability and hydraulic conductivity. The fair to moderately-indurated Chickaloon Formation was subjected to such folding and faulting and therefore is a potential aquifer-bearing unit. The overlying Wishbone Formation, being much more competent due to higher degree of induration, is less affected by folding and faulting and is not a potential aquifer-bearing unit except along fault traces.

Mantling the Wishbone and Chickaloon Formations are glacial deposits. These deposits range in thickness from a few inches to 100 feet or more in the Wishbone Hill area and consist of heterogeneous to poorly sorted mixtures of clays, sands, gravels and boulders. The glacial deposits on the Jonesville coal lease are much thinner to non-existent. In the area of the Hobbs excavation, approximately 10 feet of glacial till and glacial outwash sands and pebbles were present. The clay-rich till acted as a groundwater aquitard while the outwash deposits were quite porous and permeable allowing groundwater to flow easily.

A large landslide deposit is observed north, east, and west of the old mine site with a large and very distinguishable lobe of this deposit being to the west. These deposits are characteristically poorly sorted. When variable sizes of material are involved, as is the case here, then voids are commonly present. The landslide deposits provide one of the best avenues for groundwater movement in the area and are the location of several seeps, including the mine site freshwater spring, on the southeast portion of the coal lease. This is especially the case when landslide deposits directly overlie glacial till.

When mine spoils overlie landslide or glacial deposits, they also will act as a conduit for groundwater flow. Water will pass through the spoils making them a relatively dry unit. In places where they directly overlie the low permeability Wishbone Formation, a water-bearing unit can be found at the toe of the spoil.

Two aquifers are considered to be present in the vicinity of the south limb operations area. One is surficial in nature and occupies the fairly porous landslide deposits that blanket the area. This aquifer is referred to as the “landslide aquifer”. The other aquifer is contained within the upper portion of the Chickaloon Formation and contains the Premier and Jonesville coal groups, the interburden between them and the lowermost 100 feet of Wishbone Formation. This has been termed the “Chickaloon Aquifer”. For an estimate of porosities and transmissivities based on comparable rock materials, refer to the Sutton Partners LLC mine permit application of 2005.

The landslide aquifer covers in excess of 300 acres with only about 45 acres associated with the proposed exploration area. A discharge of 51 gpm was calculated for the 45-acre area. Occasional faults and fractures allow a limited amount of

groundwater to percolate into the upper Chickaloon Formation. In this sense, the landslide aquifer is really a series of perched aquifers with some discharging to the lower Chickaloon aquifer.

The freshwater spring that exists east of the Hobbs extraction pit access road is thought to be associated with the Northwest Fault, the western fault boundary of the Eska Fault zone. This fault zone is partially filled with clay gouge from previous geological events. Groundwater recharge in the bedrock units is variable and primarily controlled by topography. At higher elevations where bedrock outcrops, recharge is limited due to the relatively low permeability of these units. Rainfall and snowmelt leaves these areas primarily as surface runoff. The glacial, spoil, and landslide deposits are principally recharged from infiltration of rainfall and snowmelt. This is the main method of groundwater recharge for the mine area.

Information from past underground mining in the form of maps and discussions with men who worked in the mines that most of the groundwater originated in faults. Observations of the extensive outcrops on the north side of Wishbone Hill indicate that small amounts of groundwater exit the ground above coal seams at the locations of faults. This is evidenced by seeps and winter ice accumulations at these locations within the strip pits. Infiltration occurs in areas where the conglomerate cap is not present. The conglomerate is very tight and forms an aquitard over much of the coal lease and exploration permit area.

The crosscut tunnel and several other drifts intercepted the major Jonesville Fault and other minor faults during the early mining period. These areas were reported to be wet but did not contain uncontrollable amounts of water. It is suggested that a major component of the discharge from the crosscut tunnel originates in the extensive Eska Fault Zone east of the existing mine site, between the Northwest Fault and Eska Fault. In this area, the structural plunge of the Wishbone Hill syncline brings coal seams close to the surface in contact with this fault zone. The Landslide aquifer lies directly above this heavily sheared zone and most likely made a direct hydraulic connection with the fault zone as most surface seeps are located in this area. Old underground workings in the area (pre-1925) have intersected the fault zone and tap this source of groundwater. The freshwater spring described above is given as evidence of the groundwater holding capacity of the fault zone.

Finally, the greatest amount of groundwater on the proposed exploration area is thought to originate as surface runoff on the north side of Wishbone Hill. This water is subsequently captured by the old underground workings of the Evan Jones coal mine and collectively reports to the crosscut tunnel. After exiting this tunnel on the south side of the coal lease, it is directed into one of two no net discharge ponds where the flow sinks into glacial gravels to become part of the groundwater table again.

10.0 SOILS

11 AAC 90.163 (a) (2) (A) other physical features;

Two soil surveys have been conducted on the Jonesville Coal Lease. The first was a site specific field survey conducted in advance of the Hobbs Industries south side portal excavation in 1990. In 1996, an aerial photo interpretation soil survey was conducted on the Jonesville Coal Lease that covered the entire 1,410 acres of the lease. This latter survey also encompassed the entire exploration permit area proposed in this permit application. In addition, a Matanuska-Susitna valley soil survey completed in 1995 was referenced. The local soil survey work was accomplished by a representative of the Soil Conservation Service that is now called the Natural Resources Conservation Service.

Six soil types were identified in the eastern Wishbone Hill area within and directly adjacent to the coal exploration permit area. These six soil types are: HSF1 – Kichatna silt loam; HSF2 – Deception silt loam; SUBF2 – Cryod soil; TKBF1 – Talkeetna warm/thick surface soil and Deneka soil; AQ – Cryaquapt soil; and SL – Mine spoils.

Three of the soil types will be encountered during the proposed coal exploration. Mine spoil (SL) or tailings areas will be the location where exploration equipment, supplies, and personnel staging will take place. Areas within these mine tailings will also be the focus of a proposed shallow exploratory drilling program for qualitative and quantitative analysis. These soils encompass large areas of the southernmost part of the permit area. The existing mine spoil material in the area is actually a combination of buried overburden, Deception silt loam (HSF2) soils, and mine processing wastes from previous operations. The rooting depth of the plants that grow on this soil type was about 14 inches.

On top of Wishbone Hill, where one deep borehole is projected to be drilled during the coal exploration, the primary soil type present is Talkeetna warm/thick surface soil (TKBF1). This soil is common between the concentric conglomerate ridges at the top of Wishbone Hill and includes mostly brown with some gray silty to sandy loam having an average thickness to 20 inches before reaching bedrock. They have moderate runoff potential and are often cobbly in their lower part. These soils support the predominant vegetative growth in the area associated with high mountain meadows.

The soil type where the remainder of the proposed deep exploration boreholes will be drilled on is Deception silt loam (HSF2). These soils are considered to be of a loamy-skeletal nature and occur on 12 to 45 percent slopes. The area exhibiting this soil type lies between the steep conglomerate cliffs of eastern Wishbone Hill and the flat mine spoil areas. These sloped and heavily forested areas are characterized by very deep, well drained, steep to very steep soils formed in a thin mantle of silty loess. The loess overlies extremely cobbly and stony colluvium and can be as thick as five feet thick (60”) but usually averages less than three feet (36”). The thickness of the loess above the coarse colluvium is usually less than one foot (12”).

11.0 VEGETATION

11 AAC 90.163 (a) (2) (A) vegetation cover and plants, including any endangered or threatened species listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 – 1543);

A pre-mining vegetation inventory was conducted in the field in September 1990 in advance of the Hobbs excavation. The scope of the work was to describe and classify the vegetation, map the distribution of vegetation types, determine the percent cover of plants, and to obtain tree/shrub densities in the south limb area of the Jonesville coal lease. This vegetation survey was conducted by Dot Helm of the Palmer Agricultural Experiment Station. In 1996, Ms. Helm conducted an aerial photo interpretation survey for the remainder of the 1,410 acre coal lease in advance of a new mine permitting project that resulted in an approved mine permit for entering the coal reserve from the north strip pits. This latter study was supplemented with personal observations by Ms. Helm during her numerous years of dealing with revegetation of abandoned coal mine areas, one of which took place immediately northeast of the Jonesville coal lease in old Evan Jones strip pit #6.

The south limb area where most of the proposed coal exploration will take place was identified as a closed deciduous paper birch – balsam poplar – aspen forest with a vegetative cover of about 60 percent. The remainder of this area is essentially barren due to coaly waste left over from earlier mining operations. This is the area where equipment and personnel staging for the proposed exploration program will take place as well as a shallow drilling program.

The top of Wishbone Hill, which was surveyed via aerial photo interpretation, exhibits predominantly alder thickets. Alders in these thickets are taller (up to 5 meters) to the west down slope from the crest of Wishbone Hill, while those along the higher elevations of the hill are stunted (1-3 meters). Scattered amongst the alders in the lower elevations are paper birch and white spruce. In various places along the top of Wishbone Hill, woody species are in the minority. These areas are high mountain meadows where bluejoint reedgrass predominates. Accompanying woody vegetation species found isolated in these meadows are paper birch, balsam poplar, aspen, and white spruce. These vegetation communities also predominate between the concentric conglomerate ridges where alder thickets seem to predominate. Vegetative cover comprised of woody species on top of Wishbone Hill is about fifty percent with meadows and barren outcrop areas comprising the remaining thirty and twenty percent, respectively. Two deep exploration boreholes are proposed on top of Wishbone in the bluejoint reedgrass meadows or on bare bedrock to minimize vegetative impact. The bluejoint reedgrass areas recovered extremely quickly after the Sumitomo Coal Mining Company drilling project in 1997. It was difficult to find the borehole location when reclamation activities occurred during the summer of 1998 due to natural revegetation.

The potential for renewable forest resources was also examined in the Jonesville Coal Lease area. The Matanuska Valley Moose Range Management Plan categorizes the forest resources into zones. Zone 1 (below 1000’ elevation) is characterized as

having high potential. Zone 2 (between 1000' and 1500') has moderate potential and Zone 3 (above 1500') low potential. Most of the planned borehole drilling will occur between 1000' and 1500' which denotes moderate forest potential. The two holes planned for the top of Wishbone Hill are above 1500' and are characterized as having low forest resource potential. Regarding forest resources on the Jonesville Coal Lease, there are no plans by the coal lease holders to develop these resources.

12.0 BIRDS AND OTHER TERRESTRIAL WILDLIFE

Bald and Golden Eagle Protection Act of 1940 as amended (16 U.S.C. §§ 668-68d) Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703-12)

11 AAC 90.163 (a) (2) (A) fish and wildlife, including any endangered or threatened species listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 – 1543);

Numerous species of wildlife inhabit or are occasional visitors to the Wishbone Hill area, some of which traverse the proposed exploration area in search of food or for temporary residences. Bird species are prevalent and some that have been recognized in the area include the varied thrush, kinglet, alder fly catcher, snipe, junco, chickadee, magpie, raven and several species of warblers and sparrows. Game species such as ptarmigan and spruce grouse are also present. Ducks have been observed inhabiting some of the local lakes and ponds in summer. A complete list of bird species that are likely to occur at Wishbone Hill is shown in Table 3.

Small mammals observed in the Wishbone Hill area include arctic ground squirrels, hoary marmots, porcupine, beaver, red squirrel, snowshoe hare, lemming, mice and shrews, and several species of vole. Since the south limb mine facility and the north limb strip pit portion of the mine permit area is covered with mine spoils or waste rock due to past mining operations, many of the species popular in more vegetated or forested parts of the Wishbone Hill district are probably not present in comparable proportions within these mostly barren areas. In addition, the use of these areas for human recreation purposes also contributes to diminished small mammal distribution. The equipment staging area for the exploration drilling project is proposed to be on vegetation-free tailings area so impact to wildlife will be minimal. On top of Wishbone Hill, where two deep boreholes are planned, this high tundra area between 1,700 and 2,300 feet elevation with its predominantly stunted woody plant and grass population, should see minimal impact from the exploration. The remainder of the proposed exploratory boreholes will take place on the more timbered eastern flanks of Wishbone Hill. These areas may see more varied wildlife species but should be minimally impacted due to the small surface imprint of the drilling.

Larger species of wildlife that have frequented the Wishbone Hill area during the past include moose, black and brown bear, coyote, wolf, and fox. A complete listing of mammals likely to occur within the Wishbone Hill area and possibly the exploration permit area is shown in Table CIX-4 of the Jonesville Coal Mine Permit application. Since Wishbone Hill, including the exploration permit area, are located within the

TABLE 3

BIRDS LIKELY TO OCCUR IN THE WISHBONE HILL AREA

Spruce Grouse
Willow Ptarmigan
Rock Ptarmigan
White-tailed Ptarmigan
Bald Eagle
Golden Eagle
Sharp-shinned Hawk
Northern Goshawk
Merlin
Rough-legged Hawk
Swainson's Hawk
Red-tailed Hawk
Peregrine Falcon
Gyrfalcon
Boreal Owl
Saw-whet Owl
Great Gray Owl
Great Horned Owl
Short-eared Owl
Hawk Owl
Common Snipe
American Robin
Varied Thrush
Water pipit
Northern Shrike
Orange-crowned Warbler
Yellow Warbler
Yellow-rumped Warbler
Townsend's Warbler
Wilson's Warbler
Tree Sparrow
Song Sparrow
Golden-crowned sparrow
White-crowned sparrow
Cliff Swallow
Gray Jay
Black-billed Magpie
Raven
Dark-eyed Junco
Lapland Longspur
Snow Bunting
Pine Grosbeak
White-winged Crossbill
Common Redpoll
Hoary Redpoll
Pine Siskin
Horned Lark
Harlequin Duck
Mew Gull
Downy Woodpecker
Hairy Woodpecker
Three-toed Woodpecker
Black-backed Woodpecker
Northern Flicker
Olive-sided Flycatcher
Alder Flycatcher
Western Wood-Pewee
Tree Swallow
Violet-green Swallow
Cliff Swallow
Black-capped Chickadee
Boreal Chickadee
Red-breasted Nuthatch
Brown Creeper
Dipper
Golden-crowned Kinglet
Ruby Crowned Kinglet
Northern Wheatear
Townsend's Solitaire
Swainson's Thrush
Hermit Thrush
Bohemian Waxwing

Source: Bronson (1988)

Matanuska Valley Moose Range where measures are taken to maintain and enhance moose populations, a sizable moose population should exist. However, due to the continual presence of recreationalists in the area, target shooting, off road ATV, bike, and snow machine riding, fossil hunting, and camping, moose presence and activity is somewhat reduced. The best areas for moose habitation at Wishbone Hill are south of the mine permit area in the lowlands and in the valleys north and east of the massive strip pits. While some moose summer near the crest of Wishbone Hill, the largest concentration is located in the western part of the hill in the vicinity of the Wishbone Hill coal mine project leased by Usibelli Coal Mine. According to the ADF&G, moose rutting areas incorporate most of Wishbone Hill west of the Jonesville mine area and also east of Eska. It seems that the mine and exploration permit area is in a zone between theserutting and high inhabitant level areas where occasional movement between the two occurs. These two adjacent rutting areas are better suited for moose because the habitat provides a good blend of forage along with escape and thermal cover. Exploration is proposed to occur on the south limb staging area, which is almost barren of vegetation, and on east Wishbone Hill where vegetation is variable due to high elevational stunting. Public access near the proposed exploration area tends to spook wildlife species, preventing long term habitation. Heavy 4-wheeler and dirt bike traffic occur in and around the old mine site.

Large mammals have been observed within the exploration permit area, but the habitat does not seem to be conducive to inhabitation. These mammals include black and brown bear, coyote, wolf, and fox. The less conducive habitat is mainly due to human occupation and past mining activities. There have been reports of bears using old mine tunnels along Eska Creek as den sites. This area is east of the proposed exploration and will not be affected by the proposed activity.

The main recreational pursuit that impacts the wildlife resources of Wishbone Hill is hunting, mainly of moose, although black and brown bear, ptarmigan, spruce grouse, and hares are also popular. For the purposes of harvest and permit reports, the eastern Wishbone Hill area is in Area 14A, Unit 0801, and is in Unit 118 for aerial surveys. All of these areas encompass much more area than the eastern part of Wishbone Hill where the mine and exploration permit areas are located. Moose and bear harvest data obtained from Tim Peltier of the Palmer office of the Alaska Department of Fish & Game is provided below for the period from 1999 to 2006.

Table 4

Moose and Bear Harvest Data

Year	Black Bear Harvested	Brown Bear Harvested	Moose Harvested	Moose Hunters
1999/00	5	1	30	358
2000/01	3	0	30	347
2001/02	2	0	60	383
2002/03	6	1	68	420
2003/04	7	1	74	408

2004/05	5	0	41	318
2005/06	4	0	47	314
2006/07	Incomplete	Incomplete	50	328

From past aerial moose census counts, most of the moose were in the lowlands between Seventeenmile Lake and the Matanuska River, as well as areas north and west of Moose Creek, east of Eska Creek and along the lower and moderate elevations of Wishbone Hill. Very little hunting occurs on the Jonesville Coal Lease because of its inaccessibility on three sides by sheer conglomerate cliffs and because of a lack of trails on Wishbone Hill. Minimal moose hunting occurs on the eastern portions of the lease because of steep ground and poor habitat. Because of these hunting impediments, a conflict between exploration activities and moose hunting season should not be realized.

There are no federally recognized endangered species of wildlife in the Wishbone Hill area. The peregrine falcon and bald eagle, protected under the Migratory Bird Act of 1918 and Bald Eagle Protection Act of 1940, respectively, (Jeff Schively – HDR, personal communication, 2008) are migratory or seasonal visitors to the area but should not be affected by the proposed exploration activities at Wishbone Hill.

13.0 AQUATIC WILDLIFE

11 AAC 90.163 (a) (2) (A) fish and wildlife, including any endangered or threatened species listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 – 1543);

On Jonesville Coal Lease ADL324600, there are very few streams and only one lake, Slipper Lake. The main reason for this is that the lease mostly encompasses the easternmost promontory of Wishbone Hill with its steep and occasionally vertical topography. The west half of the nine-acre Slipper Lake, which drains east to Eska Creek, lies within the coal lease.

Slipper Lake was first stocked with rainbow trout in 1982. Grayling was introduced in 1986 but did not survive. This lake has a partial winterkill most years and because of potential escapement of fish into Eska Creek through the small Slipper Lake outlet stream, only catchable triploid female rainbows are now stocked in the lake (Alaska Department of Fish and Game, 2012, Lake Fishing Information). This stocking occurs in early spring to late summer and most fish are harvested by winter. The most recent stocking was June 14, 2012 where 1,670 rainbow trout averaging 7.4 inches and 2.6 ounces were released (Alaska Department of Fish and Game, 2012, Hatcheries and Stocking). Stocking of Slipper lake is noted as “Annual” by the Alaska Department of Fish and Game and the Sport Fish 5-Year Stocking Plan lists 1,500 rainbow trout per annum as projected through 2016. The staging area for the proposed deep exploration drilling project or the proposed shallow tailings drilling will not impact Slipper Lake with the activities centered on the Jonesville south limb development area and old tailings pond about 1,500 feet west of this small lake.

A couple of surface drainages occur on the Jonesville Coal Lease. One is in the far eastern part of the lease and is called the Slipper Lake watershed as it ultimately empties into Slipper Lake. No fish resources are contained within this small watershed that contains minimal flowing water. Another larger watershed originates on top of Wishbone Hill. This drainage is called the Seventeenmile Lake watershed since it ultimately empties southward into the 100 acre Seventeenmile Lake. Seventeenmile Lake which has contained an arctic grayling and rainbow fishery in the past is now stocked with rainbow trout and arctic char only. The most recent stocking event occurred in August, 2012 when 13,000 rainbow trout averaging 2.3 inches and 0.1 ounces were released (Alaska Department of Fish and Game, 2012, Hatcheries and Stocking). Stocking of Seventeenmile Lake is noted as “Annual” by the Alaska Department of Fish and Game and the Sport Fish 5-Year Stocking Plan lists 10,000 rainbow trout per annum as projected through 2016. Arctic Char are listed as alternating years at 800 fish every other year through 2016 (Alaska Department of Fish and Game, 2012, Lake Fishing Information). The lake is located about 1,000 feet south of the coal lease boundary or 4,500 feet from the nearest proposed drill hole on top of Wishbone Hill. The small stream contained within the Seventeenmile Lake watershed does not contain enough water to contain a fishery, especially on the high elevation area of Wishbone Hill within the coal lease where some of the proposed exploration drilling will take place. The proposed drill holes on top of Wishbone Hill will be located away from surface drainages with flowing water so as not to impact water that will eventually lead to Seventeenmile Lake.

Only one other freshwater lake, Wishbone Lake, is adjacent to the coal lease. This lake which contains a good population of catch and release only rainbow trout, is located 3,600 feet west of the coal lease and exploration permit boundary and over two miles west of the nearest proposed exploration drill hole. As such, exploration activities will have no effect on this waterbody.

14.0 CULTURAL AND HISTORICAL RESOURCES

11 AAC 90.163 (a) (2) (B) a description of known cultural or historic resources listed or eligible for listing on the National Register of Historic Places and known archaeological features within the proposed exploration area. The commission will, in the commissioner’s discretion, require additional information regarding known or unknown historic or archaeological resources if these resources are likely to be affected by activities under this section;

The Wishbone Hill area is incorporated in the larger upper Cook Inlet region cultural resource area. This Cook Inlet area was occupied in the early history of the area by the Dena’inas, an Athapaskan Indian people. These people were mainly involved in fishing the rich upper Cook Inlet waters for their primary subsistence. Regional bands of these Dena’ina populated the area around Knik Arm and the Matanuska River drainages. These bands, called the K’enaht’ana were both hunters and fisherman and maintained a close association, mainly trade, with the Ahtna people, a regional group of native people from the Copper River region of Alaska. No prehistoric or historic cultural

resource sites from the Dena'ina, K'enaht'ana or Ahtna peoples are known to exist at Wishbone Hill or the proposed exploration area.

Most of the eastern Wishbone Hill area where the proposed exploration will take place has been previously disturbed by mining activities associated with earlier operations. Descriptions of these operations together with pictures of the old mines in the Matanuska Valley and a cultural resource survey of the mine areas were conducted by the Cultural Resource Division of the Matanuska Susitna Borough in two matching grant awards during 1989 and 1991. The lead archeologist on these surveys was Fran Seager-Boss. Attributes of setting, location, and resource availability suggest that the potential for locating prehistoric cultural resource sites in the area is poor and this was documented by Ms. Seager Boss in the surveys. The area was probably used by native peoples in the past for travel and hunting, but the expected types of sites resulting from such usage would be small, difficult to locate, and highly subject to alteration and destruction by natural and past mining processes. The State Historic Preservation officer (Alaska Department of Natural Resources, Division of Parks) also reviewed the Jonesville Mine site area in 1990 in advance of a submission of an underground coal mining application by Hobbs Industries Inc., and the officer, Doug Reger, stated that no reconnaissance survey was necessary. It is therefore the position of the applicant that no reconnaissance survey was or is necessary because of the following: there are no places listed in the National Register of Historic Places either within or adjacent to the proposed exploration and coal lease area, and there are no known cultural resources either within or adjacent to the permit boundaries.

PART C - EXPLORATION AND RECLAMATION PLAN

11 AAC 90.167 (a) Coal explorations that substantially disturbs the land surface and associated reclamation operations must be conducted to minimize, to the extent practical, environmental damage. The operations must comply with this section; however, the commissioner will, in his or her discretion, waive certain requirements of this section upon a written finding that the requirement will be superseded by subsequent permitted operations. The commissioner will, in his or her discretion, impose additional performance standards to minimize environmental damage if the particular type of exploration activity requires them.

This section does not require specific information from the application. However, this application does not request waiver of any of the performance standards of this section.

11 AAC 90.163 (a) (4) a map of the 1:63:360 scale series enlarged at least 2.5 times showing, based on available information, the area to be disturbed by the proposed exploration and reclamation activities, including existing roads, structures, pipelines, and the proposed location of trenches, roads, rights-of-way and other access routes, land excavations to be conducted, water or coal exploratory holes and wells to be drilled or altered, earth or debris disposal areas, bodies of water, historic, archeological and cultural features, topographic and drainages features, and the habitats of endangered or threatened species identified in (2) (a) of this section; and

Figures 3 and 12 relate the proposed exploration and reclamation activities and meet the 11 AAC 90.163 (a) (4) scale requirements. All other figures are regional maps, schematics or pictures that are not required to meet those requirements.

11 AAC 90.163 (b) Extraction of more than 250 tons of coal under an exploration permit is allowed only with the commissioner's prior written approval. 11 AAC 90.163 (c) The demonstration required in (b) of this section must also include…

During this proposed exploration program coal extraction of significant portions is not included.

Not applicable for this proposed exploration as less than 250 tons will be extracted.

11 AAC 90.163 (a) (5) a statement as to whether coal exploration is proposed for an area designated unsuitable for mining under AS 27.21.260.

The Jonesville coal lease is not in an area designated as unsuitable for mining under AS 27.21.260.

11 AAC 90.163 (d) (2) an explanation of why other means of exploration are not adequate to determine the quality of the coal or the feasibility of developing a surface coal mining operation.

The method of retrieving the coal – by standard HQ and NQ size drill core for the deep exploration boreholes, and fine coal tailings – by various rotary drilling sampling systems are the only ways to explore for coal or coal tailings resources to obtain samples of each for qualitative and quantitative analysis. In addition, the upper portions of the exploration area on top of Wishbone Hill are inaccessible by vehicular traffic and can only be reached by helicopter.

11 AAC 90.167 (o) Known acid-forming or toxic forming materials must be handled and disposed of in compliance with 11 AAC 90.335 and 11 AAC 90.445 or other measures required by the commissioner.

No acid-forming or toxic materials will be handled or disposed of during drilling. None of the soil, overburden or coal is acid-forming or toxic. The coal cores will be transported off-site.

1.0 INTRODUCTION

11 AAC 90.163 (a) (2) (D) an estimated timetable for each phase of exploration and reclamation

11 AAC 90.167 (c) The applicant must utilize impact control measures, management techniques, and monitoring methods to protect endangered or threatened species listed under the Endangered Species Act of 1973 (16 U.S.C. Sec. 1531, et seq.), and their critical habitats; species such as eagles, migratory birds or other animals protected by state or federal law, and their habitats; and habitats of unusually high value for fish and wildlife.

11 AAC 90.167 (h) Excavations, artificial flat areas, or embankments created during exploration must be returned to the approximate original contour when no longer needed.

11 AAC 90.167 (i) Topsoil must be removed, stored, and redistributed on disturbed areas as necessary to assure successful revegetation

Exploration activities by Ranger Alaska LLC on their Jonesville Coal Lease is tentatively planned to commence upon issuance of the coal exploration permit and last up to two years, the length of the exploration permit term. Due to the likely issuance of this exploration permit during winter, 2012/2013, exploration is proposed to commence no earlier than March, 2013. Exploration equipment, logistics and personnel would benefit from the increasing light and temperatures.

Exploration at Jonesville is presently intended to be conducted in two separate phases. Phase 1 will involve shallow rc drilling in the tailings areas. Phase 2, involves exploration core drilling and both borehole types will be at vertical dip angles.

The purpose of the Phase 1 coal tailings exploration is twofold. First, is to more accurately identify the tailings (including fine coal) resource on the southeast side of the Jonesville coal lease. Previous exploration of these deposits was conducted by shallow

excavator trenching and by rotary drilling with little discernible quantification of the deposits. The second purpose of the shallow tailings drilling is to understand the resource quality, both laterally and vertically. During earlier trenching exploration in the upper fine tailings pond, samples were gathered from large excavated piles of fine material where a representative sample was difficult to obtain. The trenching also rarely reached the bottom of the deposit and the location of these trenches is unidentified. The earlier shallow drilling in the tailings areas was conducted by a rotary auger rig. Although this exploration did reach the bottom of the tails and their locations are known, auguring produces contamination from various portions of the borehole and accurate analyses from varying vertical horizons are questionable.

The proposed new shallow tailings rc drilling is proposed to occur in two areas, the old upper fine tailings pond and coarse refuse area 2, the latter which is located directly north of the upper tailings pond. The other refuse areas which will not be part of the new shallow exploration drilling plan, identified in the recently renewed Jonesville Mine Permit (Figure DI-5), are coarse refuse area 3, the south refuse pile, and the additional coarse refuse area north of Slipper Lake. The south refuse pile is not included because only a small part of it is on the coal lease (northeast corner) and the Alaskan Mined Land Reclamation Department (AML) claimed responsibility for its reclamation. Coarse area 3 and the coarse tailings north of Slipper Lake were dismissed due to their poor quality and quantity as determined from the aforementioned shallow auguring. In addition, these areas, including the south refuse pile, were a part of a recent State AML reclamation project which extinguished underground waste spoil fires.

Phase 2 of the planned coal exploration at Jonesville is core drilling, some of which is atop Wishbone Hill and will require helicopter support. There are several purposes of the proposed core drilling exploration activities at Jonesville. One is further understanding the subsurface geology of the coal lease, which includes locating the Wishbone Hill synclinal axis, limbs, and major faults, especially the Jonesville and the unnamed fault approximately 2,000 feet west of it.

The exact location of the Wishbone Hill synclinal axis on the coal lease property has only been postulated in the past from previous exploration activities. The precise location of the axis has never been positively identified. Knowing the position of this structure is critical in planning the layout of an underground mine. Old mine reports also note a flattening of the structure to the south, which could result in a potential new unknown resource. The proposed core drilling will help with this determination. Deep core drilling will be used to better locate this structure as well as the two mentioned faults. Another purpose of the core drilling is locating the Jonesville Coal Group in the vicinity of the old U.S. Bureau of Mines diamond drill hole WH-9. In this borehole from 1950, the Jonesville Group is missing, likely because of the aforementioned unnamed fault, in a highly sheared zone observed around 1,500 feet from surface. Without the presence of the Jonesville Group’s #3 seam, the second thickest seam, a major producer from the Evan Jones Mine, and arguably the cleanest seam on the coal lease, a major absence of coal resource exists. A new core hole is proposed to be drilled in this area to intersect the unnamed fault in the overlying coal-barren Wishbone

conglomerate rather than in the coal-bearing Chickaloon Formation below it. The below table outlines the seven Phase 2 drill holes.

Table 5

Phase 2 Drill Holes

Hole ID	Depth	Easting UTM NAD83	Northing UTM NAD83	Primary Reasoning
J-1	200 feet	397521	6845958	Portal Entry Seam Depth
J-2	750 feet	397116	6845958	Synclinal Axis and Jonesville Fault Location
J-3	1,500 feet	397389	6846085	Synclinal Axis and Jonesville Fault Location
J-4	2,200 feet	396475	6845609	Synclinal Axis Location and Geotech
J-5	2,200 feet	395681	6845411	Synclinal Axis Location and Geotech
J-6	750 feet	397986	6845495	South Limb Exploration
J-7	750 feet	397986	6845519	South Limb Exploration

Initial underground mine development will likely need to cross the extensive Jonesville Fault zone to access the large coal reserves west of this geologic structure. The planned core drilling is intended to locate this major fault, identify the lithostratigraphy, the roof and floor rock type for qualitative, quantitative, and geotechnical analysis, and the potential mineable coal resource to the west. Further reasons to conduct the exploration at Jonesville are to locate all the mineable coal beds on the property, increase the measured coal reserve base, and obtain new coal samples. Some of the coal core may be placed in special pressurized containers for desorption measurements. This information would be used to determine the coal's gas content. This information is critical for underground ventilation purposes as well as for general underground mine safety.

Drilling equipment and methods will stay the same for all exploration phases and access to later phase exploration sites will either be by helicopter or tracked and/or large-tired (low ground pressure) vehicles, depending on location and the time of year. Some trenching may occur in the shallow tailings areas but not in the area of deep core drilling. There are no plans to utilize blasting during any of the Jonesville coal exploration phases. In all cases, a primary responsibility of the exploration is to minimize disturbance to the natural environment. If helicopters are used to transport the drilling rig and other equipment to drill sites, wooden drill platforms may be constructed over sloping or frozen ground with an emphasis on limiting ground clearing.

In addition to the geologic information gained during the Jonesville drilling exploration, some environmental baseline data will be collected to help facilitate the

filing of a future major mine permit revision to the existing Jonesville mine permit. This environmental baseline data will include gathering new surface and subsurface hydrological information of the exploration area as well as obtaining updated soil, vegetation, fish and wildlife, climate and other required data to successfully permit a new underground mine under the federal Surface Mining Control and Reclamation Act of 1977.

2.0 PHASE 1 – COAL TAILINGS DRILLING PROGRAM

11 AAC 90.163 (a) (2) (C) a description of the methods to be used to conduct coal exploration and reclamation including, types and uses of equipment, drilling, blasting, road or other transportation facility construction, and earth and debris disposal areas;

It has been known for years that there may be a valuable coal resource remaining on the Jonesville coal mine property in the form of old mine tailings. According to old Evan Jones Coal Mine records, approximately 5.5 million cubic yards of tailings lay around the old facility area and outlying regions adjacent to the old mine site. According to Tucker (1968), the method of washing the coals from the old Evan Jones Coal Mine between 1920 and the 1950's was less than desirable although there were improvements after the installation of a heavy media washer in the 1950's. In the Tucker report, much of the fine fraction of the washed coal was lost to the tailings pond while other areas received coarser tailing fractions due to either poor coal washing procedures or lack of experience with the equipment. Spoil banks presently range as far east as Slipper Lake and south along the beginning stretches of Seventeenmile Lake Road. To the west, they were deposited in large and small tailings ponds separated by a 60 foot deep and 100 foot wide impoundment embankment. Between 2007 and 2010, there was a multiyear effort to contain and then put out underground fires in the coarser spoil areas through assorted reclamation projects funded by the State of Alaska and their Abandoned Mine Land Program.

In 2000, samples were taken from the tailings within the old tailings pond and analyzed. The locations of the sampling areas were either not recorded or lost. In early 2005, Knoll Acres submitted a tailings development plan as part of a new mine permit application to the State of Alaska. In June of 2005, a shallow drilling program was conducted using auguring. The 2005 drilling and sampling program was laid out in a grid pattern on 200-foot centers. Drilling was concentrated in the central and eastern parts of the large tailings pond as well as in the coarser tailings areas in the vicinity of the old mine facility area and airstrip.

The 200-foot spacing used during the 2005 drilling program was adequate but the grid was laid out in an east-west orientation that was diagonal to the trend of the tailings deposits. This conflicting layout was coupled with an incomplete grid drilled. And an undulating bottom topography of the tailings that was not understood prior to the drilling program. The ultimate result of the above was a poor estimate of the actual tailings coal resource and calculated recoverable coal reserves in the tailings.

The 2005 Knoll Acres shallow drilling plan also used augers to obtain the tailings samples for subsequent quality analyses. Representative cuttings samples using auger drilling are difficult to obtain due to the inherent contamination of samples by including materials from various portions of the borehole into the collected sample. This resulted in poor quality information for the tailings. In order to correct the deficiencies of the 2005 shallow tailings drilling and sampling program, a new program is proposed in this application.

The proposed 2013 tailings drilling program will be comprised of between 40 and 45 shallow air rotary drilled boreholes at an average depth of 40 feet. These new boreholes will again be laid out in a grid with 200-foot centers (Figure 11). The boreholes will be laid out parallel to the long axis of the upper fine tailings pond. This same orientation will be extended to coarse refuse area 2. By using this orientation of shallow boreholes, excellent cross sections in three directions within the fine tailings pond and coarse refuse area 2 will be developed. The cross sections should also better show bottom topography trends and this will improve raw coal resource and calculated reserve estimations.

In order to improve the quality of the samples, an air-rotary drill is being proposed. This type drill rig provided by a contractor yet to be decided, will be either truck or Tuggster mounted and will have an accompanying air compressor and other assorted equipment. The air rotary rig and support equipment will most likely be mobilized out of Wasilla, Alaska upon word that the exploration permit has been approved and other arrangements have been made. The Tuggster carrier has an overall dimension of 9.6 feet wide by 20 feet long (wheel base) with the rubber-tired truck rig being slightly shorter. A small air compressor (6 by 7 feet) will be pulled behind the drilling rig.

The air rotary drill rig and air compressor will be placed side-by-side at the drilling site along with the drillers' work truck. Given room for maneuvering, it is anticipated that an area approximately 30-foot square will be affected during the drilling process. The drill will be set up at a specified location and leveled. The physical disturbances at the site will be at the actual borehole location and the immediately surrounding area where cuttings will accumulate. There will also be some disturbance at the location of the equipment levelers. In the area of the Jonesville coal tailings, everything has been previously disturbed and little, if any, soil has developed on them since they weredeposited in the 1950's and 1960's. Some grass, shrubs and small trees have since grown on top of the old coal tailings in isolated areas. The entire coal tailings area at Jonesville has been previously disturbed, however, any damage to the tailings area from Tuggster and worker truck traffic will be regraded and reseeded.

For the purposes of this shallow tailings exploration program, the drill cuttings from the tailings (coarse or fine) will either collect on the ground surface in the direction of the diverter, or will be directed into sausage tubes or super sacks, the latter of which is illustrated in Figure 14. This figure shows a rotary drill rig with diverter and attached hose going into a sampling sack. Upon completion of the hole, a portion of the cuttings will be returned to the borehole while the remainder will be spread around the drill site

Shallow Coal Tailings Drilling Program

0 100 200 400 600 800 1,000 Feet

1:4,000

N

NAD 83 UTM Zone 6 N

Alaska Earth Sciences
Aug 2012

Figure 11

as part of the reclamation grading plan. The shallow rotary drilling will use some water during the drilling process, while some water will naturally be in the tailings depending on how close the drilling is to the existing water body lying in the far southwestern portion of the upper tailings pond. A few of the boreholes will be drilled through the upper tailings pond surface while frozen during the early part of the drilling program scheduled to start in February or March, 2013. This is the only time of year the tailings under the pond can be drilled. Neither the 2000 nor the 2005 tailings exploration projects drilled in the vicinity of the pond itself. As a result, there is no existing information on the thickness or quality of the fine tailings under the water surface. No exploratory drill holes are planned within 100 feet of a freshwater stream or water bodies not on tailings.

There will be no drilling muds used in the shallow drilling program. The reverse circulation drill uses air to drill, with water used only for lubrication, as necessary. This water will be drawn from the water source that is to be selected to support the core drilling. Water from this source will be pumped into a tank on the back of a service pickup which will be with the drill rig at all times.

After completion of each hole, the drilling rig and associated support equipment will be driven to the next drill hole where the set-up process will repeat. Drilling methods will be the same for each hole. Also after each hole, the hole will be backfilled immediately with cuttings.

3.0 PHASE 2 – CORE DRILLING PROGRAM

11 AAC 90.163 (a) (2) (C) a description of the methods to be used to conduct coal exploration and reclamation including, types and uses of equipment, drilling, blasting, road or other transportation facility construction, and earth and debris disposal areas;

On the Jonesville Coal Lease, seven medium to deep exploration coreholes are planned (Figure 12). Two deep exploratory coreholes are planned for the top of Wishbone Hill. One is planned near its easternmost promontory (J-4) and the other projected to be southwest of it approximately 0.5 miles (J-5). The latter site is proposed to be near an old U.S. Bureau of Mines exploratory diamond drill hole WH-9, drilled in 1950. Access to both these sites will be via helicopter. A medium depth corehole is proposed just east of the Wishbone Hill promontory below a talus slope (J-2). A drill pad was constructed at this site in 2004. Another medium depth corehole (J-3) is proposed to be located about quarter of a mile northeast of the corehole below the talus slope. A new access trail, approximately ¼ mile long, will be built mostly on the original Evan Jones Coal Company mining road to the strip pits that was constructed in the early 1940's. The new proposed trail to the second medium depth corehole will involve rehabilitating a portion of this old road from just below the talus corehole pad to a position about 1/4 mile north of it. At this point, a new trail will be built to the east southeast about 500 feet to the new drill site. The 3rd medium depth corehole with be drilled on top of the large landslide deposit about 1/3 mile west of the exploration staging area. This borehole (J-6) will be accessed from the existing 2004 refurbished road and a new 800' trail heading south from it. The last medium depth corehole will be


Jonesville Proposed Core Holes
Explanation of Symbols
Proposed Core Hole
Existing Drill Hole
Monitoring Well
Area of Shallow Drilling
Proposed Access Route
Existing Access Road
Proposed Staging Area
Lease Area
Nerox Portals
Old Hobbs Pit - Outline
Old_Tunnels
Fault
Fault - Inferred
Syncline
Syncline - Possible
N
0 100 200 300 400 500 Meters
1:6,000
NAD'83 UTM z6N
Alaska Earth Sciences
R Young - Jan 2013
BLOCK 3
BLOCK 2
BLOCK 1
WESTERN FAULT
UNNAMED FAULT
JONESVILLE FAULT
NORTHWEST FAULT
ESKA FAULT ZONE
ESKA FAULT
SYNCLINAL AXIS
Evan Jones Crosscut
Hobbs Pit
DDH1
DDH2
DDH 13-16
DDH15-16
DDH14-16
BH1
BH2
BH3
KA-1
J-1
J-2
J-3
J-4
J-5
J-6
J-7
MW-1
MW-2
WH-1
WH-2
WH-4
WH-5
WH-6
WH-9
WH-10
WH-11
WH-12
WH-13
EJ-1
VABM 2333
Jonesville
STRIP MINE
Figure 12

set in the eastern end of the upper tailings pond just below the slope of the turn-a-round area at the end of Jonesville Spur Road (J-7). One shallow corehole (J-1) is proposed and will be placed just south of the Knoll Acre corehole (KA-1) drilled in 2004 in order to reach the portal entry coal seam at a shallower depth.

Two different type drill rigs, air-rotary and wireline coring, are planned to be used for the new exploration herein proposed. The rotary drill rig will be used to install protective surface casing through surface overburden such as landslide deposits, rock talus and glacial outwash on the three easternmost and lower elevation boreholes. The rotary boreholes will be 4.5-inch diameter holes with projected depths ranging from 50 to 250 feet. Since all the rotary boreholes will become coreholes, threaded surface casing will be top driven through the surface gravels and into the upper few feet of the coal-bearing formation.

Drilling-related equipment for the Phase 2 exploration will be mobilized from their home base and transported to the exploration area via private carrier. The company selected to complete the shallow rotary drill holes will use either a nodwell-type carrier or an oversized rubber-tired "Tuggster"-type truck to carry the air rotary drill. A picture of a Tuggster carrier without the drill is seen in Figure 13. Nodwell or Tuggster carriers with on board drill rigs have lower overall weight and corresponding lower ground pressure compared with normal tired or treaded off-road drill rigs. The Tuggster carrier has an overall dimension of 9.6 feet wide by 20 feet long with the Nodwell being slightly shorter. A small air compressor (approximately 6 by 7 feet) will be pulled behind the drilling rig.

FIGURE 13: Tuggster Rotary Drill Carrier

The air rotary drill rig and air compressor will be placed side-by-side at the drilling site along with the drillers' work truck. Given room for maneuvering, it is anticipated that an area approximately 45 by 60 foot square will be affected during the drilling process. The drill will be set up at a specified location and leveled. The physical disturbances at the site will be at the actual borehole location and immediately surrounding area where cuttings will accumulate. There will also be some disturbance at the location of the equipment levelers. The root mass of native plants will be left in place during the exploratory drilling to help maximize native species regrowth after cuttings have been redistributed over the site. Any damage to the tundra from the Tuggster and worker truck traffic will be reclaimed and revegetated. Reclamation and revegetation procedures are discussed in Part C, Sections 4.0 and 5.0.

FIGURE 14: Rotary Drill Rig with Diverter

For the purposes of this exploration program, the surficial overburden drill cuttings and upper formational cuttings will collect on the ground surface in the direction of the diverter, which rises and falls during the drilling process. In general, the cuttings will accumulate roughly in a 10 foot by 10 foot area. Figure 14 shows a rotary drill rig with diverter and attached hose going into a sampling sack. With no need to collect samples from the overburden, the hose and sampling sacks will not be needed. Upon completion of the hole, a portion of the piled-up cuttings will be returned to the borehole while the remainder will be spread around the drill site as part of the reclamation plan. The excess cuttings will cover any areas of surface damage from the drilling process. Since the rotary drilling will only involve water during the drilling process, all cuttings are inert and will return to soil. No exploratory drill holes will be placed within 100 feet of streams or water bodies.

The core drilling company will be used to provide a continuous wireline coring operation for the proposed Phase 2 core drilling program. The drilling rig will be a LF-70 (or equivalent) typically used for mineral exploration in Alaska. Figure 15 shows a typical LF-70 core rig courtesy of Boart Longyear Drilling Company. For the three lower elevation coreholes, the core drilling rig and the air compressor unit accompanying it will either be mounted on a tracked Nodwell or placed on skids and pulled to the location by a dozer. For these lower elevation boreholes, the core rig's coring bit will be positioned over the casing left in the ground from the rotary drilling. At this time the coring bit and attached drill rods will be lowered through the inside of the threaded surface casing until the core bit reaches the undrilled bedrock at the bottom of the casing. At this point coring will commence. For the higher elevation coreholes, the rig will be flown to the top of Wishbone Hill in pieces and reassembled on top of wooden platforms. These wooden platforms will be comprised of timbers and planks and used on the site to form a level working platform for the drill rig and drillers. Upright timbers will be dug into the soil to support the platform.

FIGURE 15: LF-70 Core Rig on Location

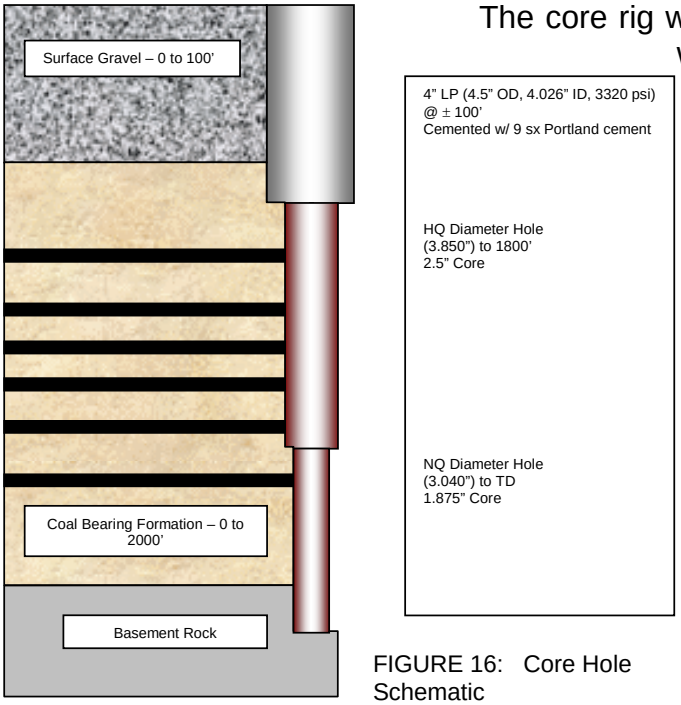


FIGURE 16: Core Hole Schematic

The core rig will start each new corehole with HQ core which has a core diameter of 2.5 inches, has a 3.895 inch bit and 3.5 inch-OD drill rods. The hole will be downsized to NQ core, diameter 1.875 inches, when drilling HQ is no longer feasible. The thinner and lighter NQ rods, set inside the heavier and larger diameter HQ rods, will be used to complete the hole. NQ drill bits are 3.032 inches with rod OD of 2.75 inches. A sample core hole schematic is illustrated in Figure 16. After all cores have been retrieved and logs run, the hole will be permanently abandoned by approved methods.

For the drill holes below the Wishbone Hill talus slope and above the scarp, the anticipated coring depth is between 750 feet and 1,500 feet. The borehole adjacent to the old portal boxcut is anticipated to be less than 200 feet deep. The anticipated depth of each borehole proposed on top of Wishbone Hill is up to 2,500 feet. Coring will commence on these high elevation boreholes after a few feet of soil is penetrated. This shallow soil covering was noted during a 1997 coring operation on the same property. No surface casing is proposed to be installed at the two helicopter assisted boreholes.

After the drilling reaches the total depth mark of each cored borehole, the drill rods will be removed and the hole electrically logged by a contracted geophysical logging consultant. Particulars on the open-hole logging suite are discussed in Part C, Section 4.0. After logging is complete, hole plugging and reclamation techniques will then commence per procedures described in Part C, Sections 4.0 and 5.0.

The core drilling rig, associated compressor and associated support equipment will occupy a larger area (45 by 60 feet) when compared with air-rotary drilling rig (Figure 17). Since core will be cut from the formation, brought to the surface, and taken away for study, only minor amounts of drill cuttings will collect on the surface. These cuttings will accumulate around the drill collar behind the drill rig. Upon reaching TD, the core rig will move on to the next corehole location to repeat the

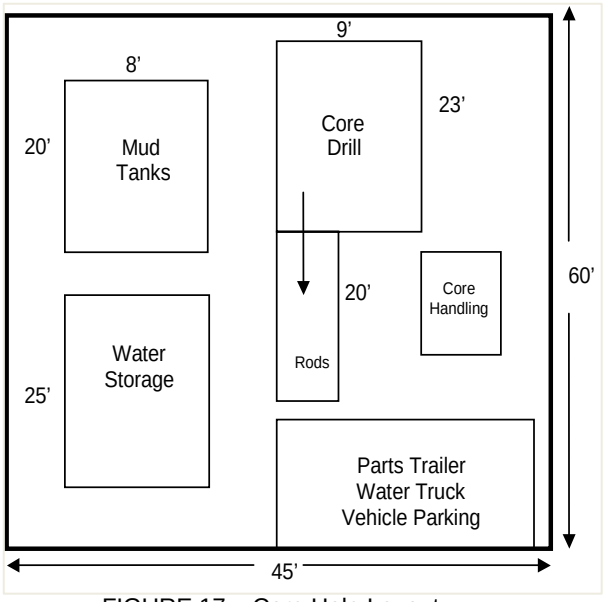


FIGURE 17: Core Hole Layout

process. Any leftover cuttings will either be used to backfill the hole or to repair any damaged areas as will be done at the rotary borehole sites.

There will be no caustic materials used in the drilling process. The core hole drilling fluid will be water based. Benign additives such as soda ash, cellulose fiber (ground paper), bentonite and barite may be added as needed to maintain pH, prevent lost circulation, facilitate drilling, improve core recovery, etc. The proposed additives are widely used by Alaska's water well and mineral coring operations. Please refer to the relevant MSDS Sheets at the end of this permit application for particulars on the various drilling fluids that may be used at the site. The products names are: Dextrid E, EZ Mud Plus, FEB Hyseal No. 1, Drispac Polymer, Quick Seal, and Bentonite Pellets. The Tuggster mounted auger/downhole hammer drill rig will use air to drill, with minimal water for lubrication, as necessary. In addition, only normal motor oils, hydraulic oils, and assorted greases will be used. These will be stored on the Tuggster carrier or workers truck above plastic liners or absorbent cloth. Some cement (stored in bags on the Tuggster or workers truck) will be used for topping off holes during the borehole plugging and reclamation process. For those coreholes on top of Wishbone Hill that will be accessed by helicopters, the aforementioned oils and greases will be set on top of plastic liners used to cover the native vegetation under the drill rig, worker deck, and fuel drum storage area. Additional oil absorbent cloth and/or duck ponds will be placed under those areas where leakages or spills could possibly occur.

Ranger Alaska LLC intends to soon submit a Temporary Water Use Permit application to the Alaska Water Resources Section of DMLW. In that application Ranger Alaska will propose several possible water sources to obtain water for the drilling process. Four of the sites are in the southeast corner of the coal lease in and around the facility area of the old Evan Jones Coal Mine. They are: 1) The existing tailings pond in northwestern corner of T19N, R3E, Section 21; 2) The washplant or fire trench pond in T19N, R3E, Section 16; 3) An unnamed pond mostly on CIRI owned land but whose northeast corner is on the Jonesville coal lease in T19N, R3E, Section 20; and 4) An unnamed pond on top of Wishbone Hill east of Wishbone Lake in T19N, R2E, Section 13. This latter pond is located on Usibelli leased land a little less than ½ mile west of the western boundary of the Jonesville coal lease. A fifth possibility is the existing water monitoring well (MW-1) in T19N, R3W, Section 16 that could be used to fill a water tank that could be brought to the three eastern corehole sites that will have vehicle access.

In order for the necessary drill water to reach the proposed borehole sites, a high pressure waterline, a Bean 35 triplex pump, or equivalent, and a floating suction device placed on the chosen waterbody to be utilized for providing the make-up feed water for the drilling operation. Plastic liners, absorbent cloths or duck ponds will be employed below the triplex pump that will be utilized to pump the water into the waterlines. The 1 1/2 inch diameter high pressure water line will be slung by helicopter for those holes on top of Wishbone Hill. It is possible that up to 6,000 feet of water line could be used, not an uncommon task. The core drilling contractor will have experience in pumping drill water over long distances and steep topography. This same method was used by Boart Longyear Ltd. for Sumitomo Coal Mining Company of Japan to drill two deep boreholes atop Wishbone Hill on the Jonesville Coal Lease in 1997.

The staging area for the drill rig company will be the flat area adjacent to the present crosscut tunnel discharge ponds and the area between the ponds and the crosscut tunnel portal within Section 16 of the coal lease (Figure 12). If additional room is needed for support equipment, they will be stored in the adjacent coal storage area. This support equipment includes drill rods, fuel drums, pallets of drilling products, chemical toilets, refuse container and a small office/core examination facility. Although no living quarters are planned during the exploration program, a person will be on site overnight during the exploration to provide security.

Fuel, (diesel and unleaded regular) used during the exploration will be purchased in Palmer or Sutton and brought to the coal lease area as needed in a 150 gallon tank at the back of a pickup truck or in 55 gallon steel drums. Regular runs from a local distributor's fuel truck are also being considered. Drilling and support equipment for the easternmost and lower elevation coreholes will be refueled from the service tank on the back of the pickup on an as-needed basis. The fuel drums will be placed next to the wooden drilling platforms for the two coreholes on top of Wishbone Hill. They will be placed above plastic liners or duck ponds to contain any inadvertent spillages. The drilling operators and other heavy equipment operators will also have extra absorbent materials and containment equipment readily available at all drilling sites. No fueling will be done within 100 feet of any creek or any other permanent water body.

All non-coal waste that accumulates during the drilling exploration will be collected and hauled off site to the nearest approved recycling or disposal facilities in either Sutton or the main Mat-Su Borough landfill off the Palmer-Wasilla Highway west of Palmer. The staging area and the drill sites will be kept clean. All employees will be required to keep their work areas clean and safe.

It is presently envisioned to have only one daytime operating shift of 10 to 12 hours for the lower elevation coreholes that can be reached with rubber-tired or tracked mounted drill rigs. Any decision to extend the drilling around-the-clock on these first three coreholes will depend of progress of drilling and formation conditions. The upper elevation coreholes on top of wishbone hill will utilize two 12-hour drilling shifts with changeovers presently envisioned to occur at 7:00 AM and 7:00 PM. The upper elevation coreholes will be drilled after the completion of the lower elevation coreholes to ensure more daylight is available for helicopter flying operations on top of Wishbone Hill.

4.0 EQUIPMENT TYPES/USES

11 AAC 90.167(m) all facilities and equipment must be removed when no longer needed, unless the commissioner approves retention for a specified period to (1) provide additional environmental quality data; (2) reduce or control the on- and off-site effects of the activities; (3) facilitate future operations under an approved permit or exploration approval.

All equipment and facilities will be removed from the exploration site at the conclusion of the drilling operations.

Table 6

Equipment and Use Table

Equipment	Use
One (1) Mobile B61 air rotary drill (or equivalent)	Drill shallow test holes and monitoring wells drill (on Tuggster or Nodwell carrier)
One (1) LF-70 (or equivalent) core drilling rig (on Nodwell carrier)	Drill core holes and deeper water monitoring wells
One (1) Service Nodwell with air	Provide air for core-drilling and store drill rods and supplies
One (1) small Air Compressor	Provide air for air rotary drilling rig
300 gallon water tank (on Pickup)	Provide water for drilling, as needed
150 gallon fuel tank (on Pickup)	Provide fuel for drilling, as needed
2,500 feet of drill rods and drill bits on Nodwell and rod trailer	Used for core drilling
300 feet of drill rods and drill bits	Used for shallow gravel drilling on Tuggster carrier
One (1) D5-H bulldozer (or equivalent)	Trail work to coreholes J-3 and J-6
One (1) Fecon Track unit	Work on trails to J-3 and J-6
One (1) Service Pickup	Transportation of workers and water
Three (3) ATV four-wheelers	Personnel transportation on site
One (1) office trailer or tent	Office, core-logging, storage, meetings
Portable Generators	Power office trailer, if present
Three (1) Portable Toilets	Shamrock Septic or Rent-A-Can Toilet Co.

5.0 BOREHOLE PLUGGING AND RECLAMATION

11 AC 90.167(l) each exploration hole, borehole, well, or other exposed underground opening must comply with 11 AAC 90.303 – 11 AAC90.305.

At the completion of drilling and before the core holes are abandoned, each core hole will be geophysically logged, by an experienced contractor. The logging suite will consist of gamma ray, caliper, compensated neutron density, array induction, and sonic porosity. A memory style quad-combo logging suite will be run from intermediate total depth (TD) to surface casing. After the drill rods are removed, the tools will be lowered through the casing into the open hole below and set in place using the same principles and equipment as the retrievable core barrel. The depth of the logging should not exceed 1,800 feet in the deepest boreholes.

Each surficially drilled deep exploration borehole during the Jonesville exploration project will be sealed at the conclusion of drilling. This is to prevent any

potential drainage from entering ground or surface waters, to minimize disturbance to the prevailing hydrologic balance, and to ensure safety of people, wildlife and machinery in the area. The proposed deep exploratory boreholes will range in depth from 200 feet to about 2,500 feet. The deepest boreholes will be drilled on the top of Wishbone Hill. In the deeper boreholes, the estimated upper 1,500 feet will be drilled through predominantly coarser-grained conglomerate and sandstone rock (Wishbone Formation). This portion of drill hole may be drilled with a tri-cone bit and not cored. For the shallower boreholes to the east, many of these will also pass through the same coarse-grained formation but it should be correspondingly thinner. The same method of rotary drilling through the overlying Wishbone Formation at the shallower locations may be considered. The bottom portion of each borehole will be core drilled through finer-grained Chickaloon Formation strata, which is the focus of the exploration effort as it contains the coal-bearing strata.

None of the Chickaloon Formation rock strata (i.e. fine-grained sandstone, siltstone, claystone, carbonaceous shale, siderite nodules and coal have toxic or acid-forming characteristics from extensive overburden and coal characteristic studies and water quality sampling conducted on the Jonesville coal lease and adjacent property over the last 18 years). These studies and sampling efforts also reveal that if any groundwater aquifers are present in bedrock, they will most likely occur adjacent to the coal-bearing strata within the Chickaloon Formation or at fault zones. It is also within the coals in this formation where underground mining might be taking place (i.e. #3 and #5 seams predominantly and to a lessor degree #6, #7, and #8 seams). It is within these coal-bearing intervals and along fault planes where any potential groundwater contamination from drilling could occur.

Therefore, to protect the existing surface and groundwater regime on and under Wishbone Hill within the Jonesville Coal lease, it is proposed that at the conclusion of drilling of each borehole, the coal-bearing zones be isolated from the borehole by the introduction of cement into the borehole within this zone. The top of the borehole within the non coal-bearing Wishbone Formation, excluding the top 12 feet, should then be backfilled with a bentonite slurry and drill cuttings. Fault zones, if intersected, will be treated in the same manner by the introduction of cement.

Since there is an observed transition zone between the coal-bearing Chickaloon Formation and the overlying conglomeratic Wishbone Formation, it is proposed that each borehole be cemented to 100 feet above the highest of the coal-bearing intervals. This means 100 feet above the top of the Jonesville Coal Group or #4 seam. This measure will protect from groundwater intermingling in this area where it is common, in outcrop, to see groundwater exiting above the Chickaloon Formation’s # 4 seam and through the bottom of the Wishbone Formation. For the shallow boreholes, it is proposed that they be backfilled with cuttings to within 12 feet of the surface. For the top 12 feet of the hole, it is proposed that a mixture of cement, bentonite and cuttings be used and the final two feet comprised of soil, overburden, or cuttings. These shallow hole cement caps may be subsequently removed during future creation of a portal boxcut. When filling the last two feet soil, overburden, or cuttings, a 4 by 4 by 4-inch treated wooden post will be placed in the hole to permanently mark the location. The

post will be positioned so that two feet of it protrudes above the surface. On this marker post will be the hole number and depth of hole and any other pertinent information that may be needed. The reclaimed drill hole will then be revegetated with grass seed compatible to the growing conditions of south-central Alaska.

The cement plugs described above for the coal-bearing zones and faults of the deeper boreholes will be comprised of a typical Portland cement mixed on site within the mud tanks.

Set-up time is approximately 24 hours. Above these plugs, a 3/8-inch chip Bentonite hole plug product (HOLEPLUG) and cuttings will be used. Upon the introduction of the bentonite pellets and water into the hole with the cuttings, the pellets will swell and seal off the hole.

Drill site reclamation will be accomplished by removing all foreign materials from each drill site and by spreading excess drill cuttings evenly across each site. Drill cuttings generated by the core drilling project will be initially contained within the mud tanks. When drilling ceases and reclamation commences, the cuttings from these tanks together with associated mud products will be pumped back down the borehole within Wishbone Formation strata. There will be approximately 5 cubic yards of cuttings per hole based on an average 2,200-foot drill depth for the holes on top of Wishbone Hill. This volume will be less for the shallower boreholes. Through past abandonment experience, drilling contractors see no more than 50% of the cuttings being brought to the surface due to loss of circulation caused by fractures and void spaces within the rock. With most of this 50% being sent down the borehole in a slurry from the mud tanks, the remaining cuttings will be spread out evenly over the disturbed drill site. All drill cuttings during coal exploration are inert sandstone, siltstone, claystone, carbonaceous shale, or coal mixed with drilling mud products. There are no metal-bearing cuttings within the Wishbone and Chickaloon Formations that might be toxic to the vegetation. All mud products used on this project will be supplied by Baroid Drilling Fluids, a world leader in drill fluid products.

In the case of the shallow tailings reverse circulation boreholes, these holes will be backfilled immediately at the conclusion of the drilling with cuttings brought to the surface. The location of the hole will be noted on a portable GPS unit and a temporary surveyors lath with hole ID and depth. This shallow drilling will occur in barren areas of the property where little or no vegetation is growing. As such, reclamation of these areas will be limited to backfilling the shallow holes which should occur naturally given the unconsolidated nature of the tailing material.

6.0 REVEGETATION PROCEDURES

11 AAC 90.167 (j) All disturbed areas must be reseeded or planted to the same seasonal characteristics of growth as the original vegetation. The vegetative cover must be capable of stabilizing the soil against erosion. Revegetation must be carried out in a manner that encourages prompt vegetative cover and recovery of productivity levels compatible with the approved post exploration land use. If both the pre-exploration and

post-exploration land use is intensive agriculture, planting of crops normally grown will meet the requirements of this section

Upon the completion of the exploration activities, disturbed grounds, whether from drilling or access road construction, will be reclaimed and revegetated. After the completion of the deep drill holes, backfilling and grading of any overburden or topsoil that was disturbed during the exploration will be returned. Once the topsoil has been redistributed over the disturbed areas, the area will be scarified perpendicular to the slope of the land to minimize erosion and the formation of rills and gullies.

Revegetation will only occur during the summer months. Prior to summer revegetation efforts, hay bales or other sediment control measures will be made available and utilized if the preceding spring breakup noted any erosional tendencies, which might occur mainly along newly developed access roads or where the soil mat was broken. Seeding and fertilizing will then occur on the disturbed sites, again only in the summer. The fertilizer will be at least the equivalent of N20-P20-K10 with possible liming as necessary. Approximately 400 pounds per acre or 9 lbs per thousand square feet of fertilizer will be utilized.

Seed and seedling requirements for proper revegetation of the disturbed Jonesville Coal Lease exploration areas will be dictated partially by the native species that inhabit the region. Vegetation types that are prevalent at the lease site will dominate percentages of seed and seedlings. As noted in Part B of this permit application, the most prominent vegetation types are cottonwood, paper birch, alder, willow, high bush cranberry, prickly rose, blue joint grass, bunchberry and fireweed. A horticulturist from the University of Alaska agricultural experimental station in Palmer will be determining the appropriate seeding mix for lands disturbed during the exploration.

The replanting of rooted moose browse vegetation, although in line with revegetation guidelines established within the Matanuska Valley Moose Range Management Plan, is not practical to rapidly establish groundcover on disturbed ground because this vegetation grows too slowly to prevent erosion. Therefore, in order to establish groundcover quickly, it is proposed that a grass seed mixture be used at least initially. One possible mixture consists of “Arctared” red fescue (Festuca rubra), “Norcoast” tufted hairgrass (Deschampsia beringensis), and “Gruening” alpine bluegrass (Poa alpina). This grass seed mixture has been used with success on disturbed coal land areas within the Matanuska Valley at Wishbone Hill. These grasses are proven in Alaska, especially on disturbed coal mine areas. These grasses generate quickly, holding the soil and minimizing erosion. A proposed grass-seeding rate in pounds per acre for the above mix is “Arctured” (32) lbs., “Norcoast” (4) lbs., and “Gruening” (4) lbs. for a total of 40 lbs. per acre. In the past there has been a shortage of seed other than “Arctured”.. Thus, revegetation costs at the end of this permit application reflect only “Arctured” seed costs.

7.0 HYDROLOGIC BALANCE CONTROL MEASURES

11 AAC 90.167 (n) Exploration and reclamation must minimize disturbance to the prevailing hydrologic balancing, including, if necessary, sedimentation control measures that comply with 11 AAC 90.329 and 11 AAC 90.331 or other measures required by the commissioner.

Neither the exploration camp/staging area nor the drill sites will be near streams. Transportation is on existing roads and trails or on frozen ground with low-ground pressure vehicles. These activities will not affect the prevailing hydrologic balance nor disturb areas such that any sediment control is necessary.

11 AAC 90.167(k) Except for small and temporary diversions of overland flow of water around new roads, runways, marine facilities, drill pads, and support facilities, no ephemeral, intermittent or perennial stream may be diverted. Overland flow must be diverted in a manner that prevents erosion and complies with all other applicable federal and state laws and regulations.

No ephemeral, intermittent or perennial stream will be diverted during the proposed exploration.

The main hydrologic concern with the exploration drilling proposed at Jonesville involves potential impacts to surface and underground water streams. In regards to surface waters, a portion of the exploration drilling is proposed near the eastern headwaters of the Seventeenmile Lake Watershed, near the crest of Wishbone Hill. The individual surface drainages on the top of Wishbone Hill originate between the conglomerate ridges in linear topographic depressions. The meadows are also linear in extent, mostly paralleling the concentric ridges. Since the exploration drilling proposed in this area is at the extreme limits of the headwaters of Seventeenmile Lake watershed, only rudimentary surface drainages will have been formed at this point. There are locations in the extensive bluejoint reedgrass meadows on top of Wishbone Hill will be within the meadows that are not connected to the developing surface drainages. It is in these areas where exploratory drilling will take place in order to minimize impact to the surface water hydrology of the area.

In addition to the two deep boreholes on top of Wishbone Hill, five shallower boreholes between 200 and 1,500 feet are proposed east of the crest of Wishbone Hill. All of these shallower boreholes lie in areas without any integrated surface drainage. The surface strata on these areas is comprised of at least one hundred feet of landslide deposits or in the case of the borehole south of the AML project, old spoil material from previous mining operations. These surficial deposits are so porous that any precipitation falling on them (rainfall or snowmelt) quickly infiltrates the ground not allowing the development of surface drainages. Thus, drilling in these areas will not pose any surficial drainage impacts.

No acidic or toxic drainage is anticipated from surface runoff from the drill cuttings brought to the surface from the drilling on the Jonesville Coal Lease. Much of

the material that will exit the higher elevation drill holes via cuttings will be small chunks of conglomerate and sandstone, the predominant lithologies from the Wishbone Formation. These materials are not invariably different from the extensive inert and non-toxic gravel deposits found throughout the Matanuska-Susitna Borough area except that they are more indurated which resists erosion and thus form steep cliffs in various places in the Matanuska Valley, including Wishbone Hill. The target zone of the exploratory drilling is the underlying coal-bearing Chickaloon Formation. Drill cuttings from this formation will consist of small chunks of sandstone, siltstone, claystone, carbonaceous shale, and coal. Samples from each of these materials have been sent to laboratories for analysis as baseline information for obtaining past Jonesville Coal Mine permits. Analytical results show that there are no acidic or toxic characteristics to these lithologies. This exploration permit application proposes the Chickaloon Formation strata to be core-drilled in its entirety which will minimize the amount of cuttings and their effect on the local hydrologic regime.

No hydrologic balance control measures should be necessary for the exploration staging area on the south limb of the Jonesville Coal Mine property. The staging area proposed for the exploration operation is blanketed by old coaly waste refuse (mine and processing spoils). No bodies of water or surface streams are present. A crosscut tunnel effluent exiting the old Evan Jones crosscut tunnel is channeled into a 12-inch CMP culvert and directed approximately 400 feet to either of two manmade pond structures where the water sinks into the underlying spoils and gravels resulting in a no-net discharge. There are a series of 4-feet diameter vertical CMP distribution boxes along the route, one configured with gate structures to alternatively direct water to either of the ponds. This allows periodic scarification and cleanout of the empty ponds, as necessary. These no-net discharge ponds are a potential water source for the proposed exploration drill program.

Drilling through the non coal-bearing Wishbone Formation should not encounter any groundwater except along faults or fractures or near the formational contact with the Chickaloon Formation. Groundwater within the coal-bearing Chickaloon Formation, if encountered, should be within the coal intervals and also along fault and fracture planes. Past discussions with old coal miners that worked at the old Evan Jones underground coal mine on the same property stated that the underground mine was generally dry except along structural faults where actual flow was minor. Also, since Wishbone Hill is essentially a plateau with limited recharge capability and a suspected deep water table, the potential for an artesian well is almost non-existent.

In order to minimize impacts to groundwater contained below the water table of Wishbone Hill during the proposed drilling project, proper and approved Department of Environmental Conservation (DEC) borehole plugging and reclamation techniques, discussed previously, will be used.

The above borehole reclamation techniques will effectively minimize the intermingling of groundwater aquifers that may be intersected during the deep exploration drilling process. It will also prevent surface waters from entering the boreholes and becoming mixed with groundwater. Since there is a possibility of mining

through these boreholes in the future, the sealing of the boreholes will minimize any potential of waters entering the new workings via these boreholes which may cause flooding or inundation problems.

The Jonesville coal exploration project, as noted previously, will also involve drilling of 40-45 shallow holes in abandoned coaly tailings left over from the previous mining operation. In the case of the shallow tailings area boreholes, only coaly tailings will be encountered. These may be of the fine-grained variety that will predominate in the old Evan Jones Coal Mine tailings pond, or coarser reject rock that is comprised of different sized chunks of Chickaloon Formation strata or coaly rich deposits that sank in the coal washing deposits because they contained mineral or high ash contents. Below the tailings are either clay-rich deposits representing the old buried marsh deposits or glacially derived gravels or outwash deposits.

The tailings areas around Jonesville exhibit different levels of groundwater. In the old tailings pond, a pond presently exists just east of the old spoil embankment structure that separates the large upper tailings pond from the small lower tailings pond. From previous drilling work in the upper tailings pond, groundwater was encountered at the bottom of the shallow augur holes in decreasing levels as one progressed to the east within this old tailings disposal structure. This lessening of the water levels to the east reflects the water level in the pond and the increasing elevation of the deposit to the east. At the east end of the old upper tailings pond, no water was present at the bottom of the holes.

In the old auger holes within the coarser tailings to the north and east of the upper tailings pond, the only groundwater encountered was within the Hobbs coal storage area that presently holds old mining equipment. This groundwater, which is seen at a depth of 33 feet in monitoring well MW-1 located near the eastern end of this storage area, has been surmised to be a result of the old freshwater spring that surfaces in the woods north of this storage area, flows on the surface to the northern end of the storage area where it eventually infiltrates the old tailings in this area to become groundwater again.

The proposed shallow drilling of the tailings deposits will intersect groundwater in various places. However, since the drilling will be accomplished with air from a reverse circulation equipped drill rig, with only water used as a drilling fluid, if necessary, no effect on the hydrologic balance of the area will be realized. To further protect the groundwater, absorbent cloths will be placed beneath parts of the drilling equipment that may have the potential to leak fuel or hydraulic fluids.

8.0 TRANSPORTATION AND FACILITIES

11 AAC 90.167 (e) Construction of new roads, aircraft runways, and marine facilities must be limited to the minimum necessary for the approved exploration and reclamation activities. Travel must be confined to existing roads, trails, runways, and marine facilities when excessive damage to vegetation or rutting of the land surface could result.

No aircraft runways or marine facilities will be constructed. There are existing trails and an unimproved gravel and dirt road within the exploration area.

New roads/trails will not be necessary to gain access to the exploration area, though some brush clearing of overgrown vegetation may be required along the unimproved road and trails to widen the cleared area for the width of the equipment. Once within the exploration area, travel will be mostly on existing road and trail surfaces. Approximately 1760 feet of combined new trail through previously unimproved tracks will be required to reach two of the proposed borehole locations. Limited off road travel with tracked or large rubber-tired low ground pressure vehicles will be necessary on these two-track temporary trails. All and tracks disturbances will be re-seeded and fertilized after the drill program has been completed.

11 AAC 90.167 (f) Existing roads, trails, runways, and marine facilities may be used under the following conditions: (1) All applicable federal, state, and local requirements must be met. (2) If the road, trail, runway or marine facility is significantly altered or its use contributes additional suspended solids to streamflow or runoff, (j) of this section applies to those portions of the activity. (3) After exploration and reclamation activities are completed, the road, trail, runway, or marine facility must be restored to a condition equal to or better than the pre-exploration condition.

All applicable federal, state, and local requirements are met by this application. The application does not propose to significantly alter any of the roads/trails. Only one ephemeral surface drainage will be crossed and this drainage is encapsulated in an existing culvert beneath the existing gravel/dirt road surface. This crossing on an existing road surface will not contribute additional suspended solids to the stream.

11 AAC 90.167 (g) Roads, trails, runways, and marine facilities constructed or significantly altered for the exploration and reclamation activities must comply with 11 AAC 90.491 for 61 design, construction, maintenance and removal. The commissioner will, in his or her discretion, require the use of rolligons and air-cushioned vehicles or winter roads when necessary to minimize environmental impacts.

The existing paved Jonesville Road that exits the Glenn Highway near Mile 61 to the north and an east-west trending gravel spur road that intersects the Jonesville Road just beyond the termination of pavement will be utilized for the exploration project. These two roads lead approximately 2 miles northwest of Sutton to the south limb facility area of the Jonesville Coal Mine. It is this area where the exploration project will be staged. The most likely areas for the actual staging of drilling equipment and miscellaneous supplies are the area between the two drainage ponds and the old crosscut tunnel. The coal storage area is also a possibility.

As mentioned in earlier sections, the exploration program proposed on the Jonesville Coal Lease will be comprised of a core drilling program and a shallow tailings drilling program. The core drilling program will utilize both tracked Nodwell mounted equipment and a helicopter supported operation. For the helicopter program, Bell 204's, 205's, 212's or A-Stars will be required to transport drilling equipment, supplies and

personnel to and from the top of Wishbone Hill and the staging area. The helicopters may also be used during moves to other deep drilling sites for at least the core drilling equipment and supplies. Another use of the helicopters could include slinging waterline between the drill sites and the water supply. The high pressure waterline that will be used comes in 300-foot sections. Since two boreholes atop Wishbone Hill are proposed as well as another moderate depth hole north of the old Hobbs pit, there will be a minimum of three helicopter rig moves. The lower four boreholes can be reached via existing roads, trails, or with the construction of new trail. Rig move and setup time is anticipated to take a minimum of 3 hours flight time.

In addition to the major equipment moves in the deep drilling program, personnel in two shifts must be ferried to and from the drilling sites and staging area. Shift changes are proposed to be at 7:00 AM & 7:00 PM daily with a total of one hour flight time each 12 hour period. Also anticipated is a periodic two hour flight time for transportation of drilling mud, core, and supplies. This will occur after the morning shift between 8:00 AM and 10:00 AM, weather permitting. Helicopter flights for personnel moves and minor supplies will be accomplished with aircraft such as Hughes 500D, Bell Long Ranger/Jet Ranger, A-Star or equivalent model helicopters.

For the shallow tailings drilling program, either rubber-tired or Nodwell mounted drill rigs will be used. A helicopter is not anticipated to be involved in this program. Access to the tailings area will be via the same access roads noted above.

Facilities are proposed to be included in the south limb staging area and the discharge pond pump station (Figure 12). At the staging area will be one 40-foot semi-trailer van and numerous rod racks for pipe storage. At the pump station will be a 10’ x 10’ area consisting of a fuel tank and skid mounted 2 cycle diesel Bean 35 pump. This pump will run 24 hours a day, 7 days a week.

A temporary drilling office will be set up on site to assist the operation and double as a changing area, office and core viewing area. This trailer will be heated using an outside propane fuel tank. A security person may be hired to provide security for the staging site while personnel are not present.

9.0 RECLAMATION BOND

11 AAC 90.167 (b) the commissioner will, in his or her discretion, require a performance bond. In determining the amount and conditions of the bond and the criteria for bond release, the commissioner will consider the relevant provisions of 11 AAC 90.201 – 11 AAC 90.213 and will specify the bond amount, conditions, and release criteria in the decision under 11 AAC 90.165 (e).

Exploration activities within the Jonesville Coal Lease that will require reclamation bonding under the Alaska Surface Coal Mining Program are those which substantially disturb or have the potential to substantially disturb the surface of the exploration acreage. In addition, reclamation bonding takes into account those costs that will occur at the point in the exploration when the greatest area of disturbance is

realized. Since the proposed exploration will consist of exploratory boreholes (both shallow and deep), construction of short trails to some of the proposed deep boreholes, and the placement of temporary structures on site, the reclamation bond will reflect the largest amount of deep boreholes presently envisioned (7), the largest amount of shallow boreholes envisioned (45), the amount of known trail to be constructed (1760 ft), and the greatest number of structures at any one time on the equipment staging site.

In the proposed deep exploration program, seven boreholes are proposed with a total maximum cumulative footage of 7,250 feet. The maximum areal disturbance for each drill site is expected to be about 2,700 square feet based on an average equipment layout dimension of 45' x 60'. As stated in Part C, Section 2.0 of this permit application, the root mass of the vegetative mat at each drill site will be left in place to maximize native species regrowth. Only excess extracted cuttings will be distributed over the drill pad area at the conclusion of drilling. For the construction of the short trails to access to two of the shallower eastern coreholes, only the removal of trees to ground level along the trail's course will be undertaken. This will minimize the effect on the vegetative mat and discourage "new trail" use by the public.

Cuttings returned during the surface casing drilling will cover a small area after most of them are backfilled down the completed borehole. These excess cuttings will be spread out over the drill site at the conclusion of drilling. Some extracted cuttings will be placed at the leveling spots where the vegetative mat might be depressed. The root mass of native plants will be left in place during the drilling program to maximize native species regrowth after cuttings have been redistributed over the site.

For the shallow tailings drilling, up to 45 shallow (average depth of 40 feet) boreholes are proposed. All of these boreholes will be placed in areas that exhibit little to no vegetative growth. As such, no revegetation work is being proposed for this shallow tailings drilling program. The only reclamation that will be accomplished is to immediately backfill the holes upon completion of drilling. There is a good possibility that the soft caving tailings will accomplish this by itself. However, the below bonding costs will reflect the filling in of these shallow boreholes.

The following is a breakdown of the individual cost items involved with the proposed deep and shallow exploration drilling program at Jonesville. It includes direct cost from facility removal, borehole plugging and reclamation, and revegetation as well as indirect costs coming from having the reclamation done by a third party government approved contractor.

DIRECT COSTS

Deep holes @ ~2,200 ft. **(x2)**	0' – 1,500'	HQ core – 3.895" diameter
	1,500' – 2,200'	NQ core – 3.032" diameter

0' – 1,500'	Bentonite Hole Plug @ 7 feet per bag	
	215 bags @ $18.00 per bag=	$ 3,857.40

1,500’ – 2,200’	Cement @ 14.35 feet per bag 49 bags @ $13.00 per bag=		$ 634.15
		Subtotal : **(x2 holes)**	**$ 8,982.58**

<u>Deep drill holes @ 200 – 1,500 ft.</u> 0’ – 1,500’ HQ core – 3.895” diameter

1,500’ drill hole	0’ – 100’	Bentonite Hole Plug @ 7 feet per bag 14 bags (1/2” casing) @ $ 18.00 per bag =	$ 257.14
	100’ – 500’	Bentonite Hole Plug@ 7 feet per bag 57 bags @ $ 18.00 per bag =	$ 1,028.57
	500’ – 1,500’	Cement @ 14.35 feet per bag 70 bags @ $ 13.00 per bag =	$ 905.92
		Subtotal: **(x1 hole)**	**$ 2,191.64**
750’ drill hole	0’ – 100’	Bentonite Hole Plug @ 7 feet per bag 14 bags (1/2” casing) @ $ 18.00 per bag =	$ 257.14
	100’ – 300’	Bentonite Hole Plug @ 7 feet per bag 29 bags @ $ 18.00 per bag =	$ 514.29
	300’ – 750’	Cement @ 14.35 feet per bag 31 bags @ $ 13.00 per bag =	$ 407.67
		Subtotal: **(x3 holes)**	**$ 3,537.28**
200’ drill holes	0’ – 100’	Bentonite Hole Plug @ 7 feet per bag 14 bags (1/2 in casing) @ 18.00 per bag =	$ 257.14
	100’ – 200’	Cement @ 14.35 feet per bag 7 bags@ $ 13.00 per bag =	$ 90.59
		Subtotal: **(x1 holes)**	**$ 347.74**
<u>40’ rc holes (x45)</u>	0’ – 40’	Bentonite Hole Plug @ 7 feet per bag 257 bags @ 18.00 per bag =	**$ 4,628.57**

<u>Labor</u>

2200 ft. holes:	5 hrs lowering and raising grout pipe 1 hr mixing and pumping cement 2 hrs filling and pluggin remaining hole 8 hrs total x 2 holes =	16 hrs
1500 ft. holes:	4 hrs lowering and raising grout pipe	

	1 hr mixing and pumping cement 2 hrs filling and pluggin remaining hole 7 hrs total x 1 hole =	7 hrs
750 ft. holes:	2 hrs lowering and raising grout pipe 1 hr mixing and pumping cement 2 hrs filling and pluggin remaining hole 5 hrs total x 3 holes =	15 hrs
200 ft. holes:	1 hr lowering and raising grout pipe 0.5 hr mizing and pumping cement 0.5 hr filling and plugging remaining hole 2 hrs total x 1 hole =	2 hrs

40 hours labor @ $103.86 per hour for one driller ($ 54.64)and one helper ($ 49.22) on Davis-Bacon wages **$ 4,154.40**

Helicopter time Three hour minimum (x3 holes) **$ 14,400.00**

Total Backfilling Cost: **$ 38,242.20**

FACILITY/STRUCTURE REMOVAL

The following pieces of equipment and related facilities would need to be removed offsite at the conclusion of exploration. Assuming the rental use of a truck with lowboy trailer and three personnel (truck driver and two laborer helpers), this material should be totally removed offsite in a two day period.

Rented Office Trailer, Drill Rig – Core Drill Rig, Air Compressor, Nodwell, Rod Trailers, Rented Portable Fuel Tanker, Drilling Product Pallets, Core Box Pallets, Rented Chemical Toilet, Refuse Container, Pump Equipment, and Water Lines, Mud Tanks, Timbers and Planks, Rented Light Plants, and Rented Generators

The breakdown of the costs associated is as follows:

Truck/trailer rental	16 hours @ $150.00 per hour	$ 2,400.00
Truck Driver	16 hours @ $54.64 per hour (Davis-Bacon)	$ 874.24
Laborers	16 hours @ $49.22 per hour (Davis-Bacon) x 2	$ 1,575.04
	Total Facility/Structure Removal:	**$ 4,849.28**

REVEGETATION

The revegetation portion of the required reclamation to be conducted at the conclusion of proposed deep exploration activities (or the following summer) at Jonesville will entail fertilizing and reseeding disturbed sites. The areas to be revegetated are drill hole sites (roughly 45' by 60' dimension) and trail areas (15 feet wide) that lead to these drill sites. Shallow tails drilling is not anticipated to disturb any vegetation, as all planned locations are on areas barren of any vegetation. Although the proposal is to not disturb the vegetative mat in the construction of the short trails to up to three drilling sites, this revegetation plan will include fertilizing and revegetating these trails. Some touch-up work to areas disturbed by the turning Nodwells is also anticipated and included in the cost summary.

Drill sites (45 by 60 square feet at 7 drill locations = ~0.43 acres)

Drill sites (45 by 45 square feet at 20 drill locations = 0.93 acres)

Grass Seed – 1.36 total acres @ 40 lbs/acre @ $6.20/lb. =	$ 337.28
Fertilizer – 1.36 total acres @ 400 lbs/acre @ $0.67/lb. ($33.52/50 lb bag) =	$ 364.48

Trails (1/3 mile or 1760 ft. of trail @ 15' wide = ~ 0.61 acres)

Grass Seed – 0.61 total acres @ 40 lbs/acre @ $6.20/lb. =	$ 151.28
Fertilizer – 0.61 total acres @ 400 lbs/acre @ $0.67/lb. ($33.52/50 lb bag) =	$ 163.48

Labor

Two Laborers – total of 14 hours @ $49.22 per hour (Davis-Bacon) x 2 =	$ 1,378.16
Helicopter time Three hour minimum (x3 holes)	$ 14,000.00
Total Revegetation Costs:	**$ 16,794.68**
TOTAL DIRECT RECLAMATION COST:	**$ 59,886.16**

INDIRECT COSTS

Mobilization/Demobilization (Direct cost x 10%)	$ 5,988.62
Contingencies (Direct cost x 10%)	$ 5,988.62
Engineering Redesign Fee (Direct cost x 5%)	$ 2,994.31
Contractor Profit/Overhead (Direct cost x 15%)	$ 8,982.92

Project Management Fee (Direct cost x 4%) $ 2,395.45

Total Indirect Costs: **$ 26,349.91**

GRAND TOTAL – RECLAMATION BOND **$ 86,236.08**

10.0 TIME TABLE

11 AAC 90.163 (a) (2)(D) an estimated timetable for each phase of exploration and reclamation;

Exploration Period	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Exploration Trail Construction	x	x																						
Exploration Drilling		x	x	x	x	x																		
Revegetation of Disturbed Sites			x	x	x	x	x								x	x	x	x	x					

Ultimately depending on the approval and issue date of the exploration permit, work is estimated to begin in spring, 2013. Exploration trails are proposed to be under construction, for use in the drill program, as early as March and April, 2013. By mid to late April the drill program is anticipated to be underway and could be ongoing through summer, 2013. Revegetation will follow the disturbance areas as the drill program progresses and work is expected to cease for the year in early autumn, 2013. In the spring of 2014, revegetation will again commence through the growing season.

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HALLIBURTON

SAFETY DATA SHEET (2001/58/EC)

Product Trade Name: **DEXTRID® E**

Revision Date: 16-Feb-2004

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Identification of Substances or Preparation

Product Trade Name: DEXTRID® E
Synonyms: None
Chemical Family: Modified Starch
Application: Fluid Loss Additive

Company Undertaking Identification

Halliburton Manufacturing Services, Ltd.
Deveron Facility, Howemoss Place
Kirkhill Industrial Estate
Dyce
Aberdeen, AB21 0GS
United Kingdom

Emergency Phone Number: +44 1224 795277 or +1 713 753 3000

Prepared By

Chemical Compliance
Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	EINECS	UK OEL/MEL	Germany MAK/TRK	Netherlands MAC	EEC Classification
Complex carbohydrate		60 - 100%		10 mg/m^3	Not applicable	Not applicable	Not applicable

3. HAZARDS IDENTIFICATION

Hazard Overview No significant hazards expected. Airborne dust may be explosive.

4. FIRST AID MEASURES

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Wash with soap and water. Get medical attention if irritation persists.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media Water fog, carbon dioxide, foam, dry chemical.

Unsuitable Extinguishing Media None known.

Special Exposure Hazards Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential. Decomposition in fire may produce toxic gases.

Special Protective Equipment for Fire-Fighters Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid creating or inhaling dust. Avoid dust accumulations.

Storage Information Store away from oxidizers. Store in a cool, dry location. Product has a shelf life of 36 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use in a well ventilated area.

Respiratory Protection Not normally needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (95%)

Hand Protection Normal work gloves.

Skin Protection Normal work coveralls.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	White to Off white
Odor:	Starch
pH:	7.1
Specific Gravity @ 20 C (Water=1):	1.5
Density @ 20 C (kg/l):	Not Determined
Bulk Density @ 20 C (kg/m^3):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined

Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m^3):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m^3):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	Keep away from heat, sparks and flame.
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	May cause allergic respiratory reaction.
Skin Contact	None known.
Eye Contact	None known.
Ingestion	None known
Aggravated Medical Conditions	None known.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.

Toxicity Tests

Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined

Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Readily biodegradable

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

EC Supply labeling Requirements This product is not subject to the labeling requirements of EC Directives 67/548/EEC and 88/379/EEC as amended.

*OEL in Section 2 is for dust.

Classification Not Classified

Risk Phrases	None
Safety Phrases	None
EINECS Inventory	This product, and all its components, complies with EINECS
Germany, Water Endangering Classes (WGK)	WGK 0: Generally not water endangering.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS
Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF MSDS*****

HALLIBURTON

MATERIAL SAFETY DATA SHEET

Product Trade Name: **EZ-MUD® PLUS**

Revision Date: 03-Jan-2008

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: EZ-MUD® PLUS
Synonyms: None
Chemical Family: Blend
Application: Additive

Manufacturer/Supplier
Baroid Fluid Services
Product Service Line of Halliburton
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000
Emergency Telephone: (281) 575-5000

Prepared By
Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Hydrotreated light petroleum distillate	64742-47-8	10 - 30%	200 mg/m^3	Not applicable

3. HAZARDS IDENTIFICATION

Hazard Overview
May cause eye, skin, and respiratory irritation. May cause headache, dizziness, and other central nervous system effects. May be harmful if swallowed.

4. FIRST AID MEASURES

Inhalation
If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult give oxygen. Get medical attention.

Skin
Wash with soap and water. Get medical attention if irritation persists. Remove contaminated shoes and discard.

Eyes
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion
Get medical attention! If vomiting occurs, keep head lower than hips to prevent aspiration.

Notes to Physician
Not Applicable

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined**Min:** > 200
Flash Point/Range (C):	Not Determined**Min:** > 93
Flash Point Method:	PMCC
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media Water fog, carbon dioxide, foam, dry chemical.

Special Exposure Hazards Decomposition in fire may produce toxic gases. Use water spray to cool fire exposed surfaces.

Special Protective Equipment for Fire-Fighters Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

NFPA Ratings: Health 2, Flammability 1, Reactivity 0
HMIS Ratings: Flammability 1, Reactivity 0, Health 2

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning / Absorption Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Wash hands after use. Launder contaminated clothing before reuse.

Storage Information Store away from oxidizers. Keep container closed when not in use. Product has a shelf life of 12 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls A well ventilated area to control dust levels. Local exhaust ventilation should be used in areas without good cross ventilation.

Respiratory Protection Organic vapor respirator with a dust/mist filter.

Hand Protection Impervious rubber gloves.

Skin Protection Rubber apron.

Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	White to gray
Odor:	Mild hydrocarbon

9. PHYSICAL AND CHEMICAL PROPERTIES

pH:	Not Determined
Specific Gravity @ 20 C (Water=1):	1.0
Density @ 20 C (lbs./gallon):	8.3
Bulk Density @ 20 C (lbs/ft3):	Not Determined
Boiling Point/Range (F):	347
Boiling Point/Range (C):	175
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	70
Evaporation Rate (Butyl Acetate=1):	< 1
Solubility in Water (g/100ml):	Partially soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	Keep away from heat, sparks and flame.
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Ammonia. Oxides of nitrogen. Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	May cause respiratory irritation. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.
Skin Contact	May cause skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	Aspiration into the lungs may cause chemical pneumonitis including coughing, difficulty breathing, wheezing, coughing up blood and pneumonia, which can be fatal. May cause central nervous system depression including headache, dizziness, drowsiness, muscular weakness, incoordination, slowed reaction time, fatigue blurred vision, slurred speech, giddiness, tremors and convulsions.
Aggravated Medical Conditions	Lung disorders.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.

Other Information None known.

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Not determined

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity: Not determined
Acute Crustaceans Toxicity: TLM48: 98 mg/l (Acartia tonsa)
Acute Algae Toxicity: EC50: 16.70 mg/l (Skeletonema costatum)

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Disposal should be made in accordance with federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	All components listed do not apply to the California Proposition 65 Regulation.
MA Right-to-Know Law	Does not apply.
NJ Right-to-Know Law	Does not apply.
PA Right-to-Know Law	Does not apply.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2B Toxic Materials

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS
Not applicable

Additional Information	For additional information on the use of this product, contact your local Halliburton representative. For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF MSDS*****

REVISION DATE: 22/09/06

BASF

The Chemical Company

SAFETY DATA SHEET
FEB Hyseal No.1

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

PRODUCT NAME: FEB Hyseal No.1

PRODUCT NO.: 118338

SUPPLIER:
BASF Construction Chemicals UK Limited
Albany House
Swinton Hall Road
Swinton
Manchester
M274DT
+44(0)161 794 7411

CONTACT PERSON: EHSQ Officer

EMERGENCY TELEPHONE: Telephone: 0161 794 7411. If outside normal working hours, please listen to answer machine message for emergency contact numbers.

2 COMPOSITION/INFORMATION ON INGREDIENTS

Name	EC No.	CAS-No.	Content	Classification
Portland Cement	266-043-4	65997-15-1	30-60%	Xi;R38,R41.

The Full Text for all R-Phrases are Displayed in Section 16

COMPOSITION COMMENTS

Modified sand - cement mixture

3 HAZARDS IDENTIFICATION

Irritating to skin. Risk of serious damage to eyes.

CLASSIFICATION: Xi;R38, R41.

4 FIRST-AID MEASURES

GENERAL INFORMATION

This product contains cement. Cement produces an alkaline reaction with moisture or gauging water and therefore splashes of mortar, slurry or gauging water may cause skin irritation and/or caustic burns to mucous membranes (e. g. eyes). Avoid contact with eyes and prolonged skin contact.

INHALATION

Fresh air. Get medical attention if any discomfort continues.

INGESTION

Rinse mouth thoroughly. Drink plenty of water. Get medical attention if any discomfort continues.

SKIN CONTACT

Wash the skin immediately with soap and water.

EYE CONTACT

Important! Immediately rinse with water for at least 15 minutes. Get medical attention promptly if symptoms occur after washing.

5 FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

The product is non-combustible.

PROTECTIVE MEASURES IN FIRE

No special measures required.

6 ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS

Avoid inhalation of dust.

ENVIRONMENTAL PRECAUTIONS

No special measures required.

SPILL CLEAN UP METHODS

Remove spillage with vacuum cleaner. If not possible, collect spillage with shovel, broom or the like.

7 HANDLING AND STORAGE

USAGE PRECAUTIONS

Avoid spread of dust.

STORAGE PRECAUTIONS

No specific storage precautions noted.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

INGREDIENT COMMENTS

MAK: Lower toxic limit for cement 5 mg/m3. OES-LTEL: 4 R / 10 I mg/m3. Otherwise the product contains no relevant quantities of substances with workplace-related limit values.

ENGINEERING MEASURES

Not relevant.

RESPIRATORY EQUIPMENT

Wear respirator if there is dust formation.

HAND PROTECTION

Nitrile impregnated cotton-gloves. The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

EYE PROTECTION

Wear goggles/face shield.

OTHER PROTECTION

The usual precautionary measures when handling chemicals should be adhered to. The product contains < 2 ppm Cr VI.

HYGIENE MEASURES

When using do not eat, drink or smoke. Wash hands after handling. Use appropriate skin cream to prevent drying of skin.

SKIN PROTECTION

Protection suit must be worn.

9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Powder, dust
COLOUR	Grey
ODOUR	Almost odourless
SOLUBILITY	Miscible with water.

BOILING POINT (°C)	not applicable	MELTING POINT (°C)	not determined
pH-VALUE, DILUTED SOLUTION	12 - 13	FLASH POINT (°C)	not applicable
SOLUBILITY VALUE (g/100g H2O@20°C)	< 0,2		

10 STABILITY AND REACTIVITY

STABILITY

Stable when stored in a dry place.

HAZARDOUS DECOMPOSITION PRODUCTS

No hazardous decomposition products.

11 TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION

The product shows the following dangers according to the calculation method of the General EC Classification Guidelines for Preparations as issud in the latest version: Irritant

GENERAL INFORMATION

When used and handled according to specifications, the product does not have any harmful effects in our experience and according to the information provided to us. The product does not contain asbestos or any other mineral fibres or inhalable fine quartz dust hazardous to health and causing silicosis. The product is chlorine-free and contains no formaldehyde.

SKIN CONTACT

Irritating to skin.

EYE CONTACT

Risk of serious damage to eyes.

HEALTH WARNINGS

The product is reduced in chromate (contains < 2 ppm Cr VI). Within the indicated storage time sensitization is not expected.

12 ECOLOGICAL INFORMATION

ECOTOXICITY

Do not allow product to reach ground water, water bodies or sewage system. No ecological studies are available. Harmful effects on man and environment are unknown and are not to be expected when application is in accordance with the instructions and the advice in this Safety Data Sheet. When handled properly and used as intended the product has no ecotoxic effects on the basis of our significant experience in ready-to-use cement motars and chemical building materials and the information available to us.

WATER HAZARD CLASSIFICATION

WGK 1

13 DISPOSAL CONSIDERATIONS

GENERAL INFORMATION

Waste is classified as special waste. Disposal to licensed waste disposal site in accordance with the local Waste Disposal Authority. Smaller quantities can be disposed of with housedhold waste.

DISPOSAL METHODS

Dispose of waste and residues in accordance with local authority requirements.

WASTE CLASS

EWC: 01 04 07 wastes containing dangerous substances from physical and chemical processing of non-metalliferous minerals.

14 TRANSPORT INFORMATION

GENERAL	The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

15 REGULATORY INFORMATION

LABELLING

Irritant

CONTAINS Portland Cement

RISK PHRASES

R38	Irritating to skin.
R41	Risk of serious damage to eyes.

SAFETY PHRASES

S2	Keep out of the reach of children
S24/25	Avoid contact with skin and eyes.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S27/28	After contact with skin, take off immediately all contaminated clothing, and wash immediately with plenty of water and soap.
S37/39	Wear suitable gloves and eye/face protection.
S46	If swallowed, seek medical advice immediately and show this container or label.

EU DIRECTIVES

System of specific information relating to Dangerous Preparations. 2001/58/EEC.

16 OTHER INFORMATION

GENERAL INFORMATION

This data is based on our present knowledge. However, it shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

REVISION DATE 22/09/06

RISK PHRASES IN FULL

R38	Irritating to skin.
R41	Risk of serious damage to eyes.

FRANCIS DRILLING FLUIDS, LTD.

MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

Trade Name(s): Drispac Polymer (Regular, XT and Superlo)

Generic Name(s):

Chemical Name(s): Proprietary (Chemical family Cellulosic Polymer)

Francis Drilling Fluids, LTD.
P.O. Box 1694
Crowley, LA 70527-1694

Emergency/Telephone No.: 800-960-6610
337-783-8685
Hazardous Materials No.: 800-255-3924
Poison Control Center No.: 800-256-9822

II. HAZARDOUS INGREDIENTS

Ingredient	CAS No.	%	Hazard
This product does not meet the definition of a hazardous chemical given in 29 CFR Part 1910-1200 (OSHA). Information on this form is furnished as a customer service.			

III. NFPA/HMIS HAZARD IDENTIFICATION SYSTEM

0=LEAST 1=SLIGHT 2=MODERATE 3=HIGH 4 =EXTREME

Health: 0

Fire: 1

Reactivity: 0

IV. PHYSICAL DATA

Boiling Point (°F): NA	Specific Gravity (H_20=1): 1.6
Vapor Pressure (mm. Hg): NA	Melting Point: ND
Vapor Density (Air = 1): NA	Evaporation Rate: NA
Solubility in Water: Complete	pH: (1%)
Density (at 20° C): ND	Odor: Odorless
Appearance: Light colored powder	Freezing Point: NA

V. FIRE AND EXPLOSION DATA

Flash Point: ND	Flammable Limits: LEL: ND UEL: ND

Special Fire Fighting Procedures: Evacuate area of all unnecessary personnel. Use NIOSH/MSHA approved self-contained breathing apparatus (SCBA) and other protective equipment, if conditions warrant. Water fog or spray may be used to cool

exposed containers and equipment.

Unusual Fire and Explosion Hazards: Carbon oxides and various hydrocarbons formed when burned. If in a finely divided and suspended state, treat as a flammable dust.

Extinguishing Media: Dry chemical, foam or carbon dioxide, water spray or fog.

VI. REACTIVITY

Stability: Stable

Hazardous Polymerization: Will Not Occur

Incompatibility: ND

Hazardous Decomposition: ND

VII. HEALTH HAZARD INFORMATION

Routes of Exposure and Effects:

Skin: May produce slight irritation with prolonged contact with moistened product.

Eyes: Dust may produce mechanical irritation.

Inhalation: Non-irritating to mucous membranes, however, breathing high concentrations of the dust may cause mechanical irritation of the nose, throat, and upper respiratory tract.

Ingestion: Passes through relatively inert. May cause come gastrointestinal upset.

Permissible Exposure Limits: (for air contaminants)

OSHA PEL (8hr. TWA): Respirable - 5 mg/m3; Total dust - 15 mg/m3

ACGIH TLV: Respirable - ND; Total dust - 10 mg/m3

Carcinogenicity:

Listed By NTP: ND	Listed By: IARC: ND	Listed By OSHA: ND
Acute Oral LD50: >25 g/Kg (rats)	Acute Dermal LD50:	Aquatic Toxicology LC50:

Emergency and First Aid Procedures:

Skin: Wash skin with soap and water. If irritation or adverse symptoms develop, seek medical attention.

Eyes: Flush eyes with running water. If irritation or adverse symptoms develop, seek medical attention.

Ingestion: If illness or adverse symptoms develop, seek medical attention.

Inhalation: Remove from exposure. If illness or adverse symptoms develop, seek medical attention.

Additional Health Hazard Information: Subchronic and Chronic Effects of Overexposure - No adverse effects have been noted in chronic feeding studies using laboratory animals and humans. Sarcomas were exhibited at injection sites of animals receiving repeated massive subcutaneous injections of aqueous solutions of the material. The effects may have been the result of trauma.

Long term exposure to high dust concentrations may cause non-debilitating lung changes.

VIII. HANDLING AND USE PRECAUTIONS

Steps to be Taken if Material is Released or Spilled: Evacuate area if all unnecessary personnel. Contain spill. Sweep up spill and place in disposal container. If wet, material becomes very slippers. Wear protective equipment and or garments if

exposure conditions warrant. Keep out of water sources and sewers.

Waste Disposal Methods: (Insure Conformity with all Applicable Disposal Regulations): Manage in a permitted waste management facility. Prior to disposal, consult your environmental contact to determine if TCLP (Toxicity characteristic Leaching Procedure, EPA Test Method 1311) is required. Reference 40 CFR Part 261.

Handling and Storage Precautions: Avoid contact with eyes, skin or clothing. Avoid breathing vapors, mist, fume or dust. Wear equipment and/or garments if exposure conditions warrant. Launder contaminated clothing before reuse. Wash thoroughly after handling Use with adequate ventilation.

Store in a well-ventilated area. Store in closed containers.

IX. INDUSTRIAL HYGIENE CONTROL MEASURES

Ventilation Requirements: Use adequate ventilation to control concentration below recommended exposure limits.

Respirator: Not generally required unless needed to prevent respiratory irritation. For concentrations exceeding the recommended exposure limit, use NIOSH/MSHA approved air purifying respirator.

Eye Protection: Use safety glasses with side shields

Gloves: Cotton gloves.

Other Protective Clothing or Equipment: Avoid unnecessary skin contamination with material. Personal protection information shown above is based on general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

X. SPECIAL PRECAUTIONS

Contact immediate supervisor for specific instruction before work is initiated. Wear protective equipment and/or garments if exposure conditions warrant.

XI. ENVIRONMENTAL/SAFETY REGULATION

SARA 313
As of the preparation date, this product did not contain a chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Environmental Toxicity
The 96-hour LC50 for Drispac Regular Polymer for freshwater trout uas >32,000 ppm; for saltwater stickleback it was >56,000 ppm. The 96-hour LC50 for Drispac Superlo Polymer for freshwater trout was >21.000 ppm; for saltwater stickleback it was >56,000 ppm.

Environmental effects testing has been conducted using Drispac Polymer (both Regular and Superlo) in generic mud. The tests were conducted following the Environmental Protection Agency's (EPA), Region II drilling mud bioassay procedures.

The results of these tests classify Drispac Regular Polymer and Drispac Superlo Polymer as non-toxic drilling mud additives.

DEPARTMENT OF TRANSPORTATION

Shipping Name: NA	Hazard Class: NA
Hazardous Substance: NA	
Cautionary Labeling: NA	
NA=Not Applicable; ND=Not Determined or No Data	Date Prepared: June 14, 1995

File Name: drispac

The data presented is true and correct to the best of our knowledge and belief; however, neither seller nor preparer make any warranties, express or implied, concerning the information presented. The user is cautioned to perform his own hazard evaluation and to rely upon his own determinations.

PRO-CHEM, INC.
1475 BLUEGRASS LAKES PKWY.
ALPHARETTA, GA 30004
EMERGENCY/ NFO # (800) 241-8180
ADDITIONAL EMERGENCY # INFO TRAC 1-800-535-5053

MATERIAL SAFETY DATA SHEET

QUICK SEAL / 3350

APRIL 2006

HEALTH	1
FIRE	0
REACTIVITY	0
P.P.E.	B

Complies With USDL Safety and Health Regulations, (29 CFR 1910.200)

SECTION 1 – Chemical and Company Identification

CHEMICAL FAMILY: Clay

SECTION 2 – Composition on Ingredients

CHEMICAL NAME	CAS #	OSHA PEL	ACGIH TLV	WT %
Bentonite Clay	1302-78-9	5 mg/m^3 respirable dust	5 mg/m^3 respirable dust	100
Crystalline Quartz	14808-60-7	0.1 mg/m^3	0.1 mg/m^3	<2

Contains no chemicals subject to the reporting requirements of SARA Title III Section 313.

SECTION 3 – Hazards Information

ROUTES OF EXPOSURE: Inhalation
HEALTH HAZARDS (ACUTE): Inhalation of dust may cause irritation of the nose, throat, and respiratory passages.
HEALTH HAZARDS (CHRONIC): Inhalation of dust may cause delayed respiratory disease over a prolonged period of time. Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling and sometimes fatal disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Respiratory diseases including asthma and bronchitis. Eye irritation.
IARC has determined that crystalline silica inhaled in the form quartz from occupational sources in carcinogenic to humans. NTP classifies respirable crystalline silica as reasonably anticipated to be a carcinogen.

SECTION 4 – First Aid Measures

EMERGENCY AND FIRST AID PROCEDURES:

IF INHALED: Remove person to fresh air. If breathing is difficult, administer oxygen. If breathing has stopped, administer artificial respiration. Seek prompt medical attention.

SKIN CONTACT: No first aid is required since this product does not affect the skin. Wash with soap and water to remove accumulated material from skin.

EYE CONTACT: Flush eyes immediately with large amounts of water while holding eyelids open. If irritation persists or material is imbedded, seek immediate medical attention.

IF INGESTED: DO NOT INDUCE VOMITING. If large quantities are swallowed, get immediate medical attention.

SECTION 5 – Fire Fighting Measures

FLASH POINT: N.A. **FLAMMABILITY LIMITS:** N.A.
AUTOIGNITION TEMPERATURE: N.A.
EXTINGUISHING MEDIA: N.A., Does not burn
SPECIAL FIREFIGHTING INSTRUCTIONS: Inorganic mineral/Non-flammable
UNUSUAL FIRE AND EXPLOSION HAZARDS: None

SECTION 6 – Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED: Vacuum if possible to avoid generating airborne dust. Avoid breathing dust. Wear an approved respirator. Avoid adding water as material becomes slippery when wet.

SECTION 7 – Handling and Storage

PRECAUTIONS FOR STORAGE AND HANDLING: Do not breathe dust. Avoid creation of respirable dust. Use good housekeeping procedures to prevent accumulation of dust in work areas. Use with adequate ventilation and dust collection. Launder clothing that has become contaminated before it is reused.

SECTION 8 – Exposure Controls/Personal Protection

RESPIRATORY PROTECTION: FOR OUTDOOR USE ONLY. Use appropriate respiratory protection for particulates based upon airborne workplace concentration and duration from intended use. Refer to the most recent standards of ANSI (Z88.2), OSHA (29 CFR 1910.134), MSHA (30 CFR Parts 56 and 57), and NIOSH Respirator Decision Logic.
VENTILATION: FOR OUTDOOR USE ONLY. Use local exhaust as required to maintain exposure below occupational exposure limits.
EYE PROTECTION: Wear safety glasses or goggles
PROTECTIVE GLOVES: Recommended
PROTECTIVE CLOTHING: As appropriate for the work environment.

SECTION 9 – Physical and Chemical Properties

BOILING POINT (°F):	N.A.	**MELTING POINT:**	N.A.
SPECIFIC GRAVITY:	2.5	**EVAPORATION RATE** (BUAC=1)	N.A.
VAPOR PRESSURE:	N.A.	**VAPOR DENSITY:**	N.A.
% VOLATILE BY VOL:	0	**SOLUBILITY, WATER:**	Insoluble
pH:	N.A.	**APPEARANCE/ODOR:**	Pale gray to buff powder or granules, no odor

SECTION 10 – Stability and Reactivity

STABILITY: Stable
CONDITIONS TO AVOID: None known.
INCOMPATIBILITY: None known.
HAZARDOUS DECOMPOSITION BYPRODUCTS: None known.
HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11 – Toxicological Information

No Data Available

SECTION 12 – Ecological Information

No Data Available

SECTION 13 – Disposal Consideration

WASTE DISPOSAL: Dispose of material in accordance with applicable Federal, State and local regulations for disposal of solid waste.

SECTION 14 – Transport Information

DOT PROPER SHIPPING NAME: Not regulated

HALLIBURTON

MATERIAL SAFETY DATA SHEET

Product Trade Name: **BENTONITE PELLETS 3\8 Inch**

Revision Date: **06-Jan-2005**

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BENTONITE PELLETS 3\8 Inch **Synonyms:** None **Chemical Family:** Mineral **Application:** Weight Additive

Manufacturer/Supplier

Baroid Drilling Fluids a Product Service Line of Halliburton Energy Services, Inc.
P.O. Box 1675 Houston, TX 77251 Telephone: (281) 871-4000
Emergency Telephone: (281) 575-5000

Prepared By

Chemical Compliance Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.05 mg/m3	1/2 x 10 mg/m3 %SiO2 + 2
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m3	1/2 x 10 mg/m3 %SiO2 + 2
Crystalline silica, quartz	14808-60-7	< 3	0.05 mg/m3	10 mg/m3 %SiO2 + 2
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep

exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (MSDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation **If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.**

Skin **Wash with soap and water. Get medical attention if irritation persists.**

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion **Under normal conditions, first aid procedures are not required.**

Notes to Physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Not applicable.

Fire-Fighters NFPA Ratings: Health 0, Flammability 0, Reactivity 0 **HMIS Ratings:** Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary	None known.
Measures	
Procedure for Cleaning /	Collect using dustless method and hold for appropriate disposal. Consider possible
Absorption	toxic or fire hazards associated with contaminating substances and use appropriate
	methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions **This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.**

Storage Information **Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.**

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls **Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.**

Respiratory Protection Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection Normal work gloves. **Skin Protection** Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing. **Eye Protection** Wear safety glasses or goggles to protect against exposure. **Other Precautions** None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Solid **Color:** Various **Odor:** Odorless **pH:** 8-10 **Specific Gravity @ 20 C (Water=1):** 2.55 **Density @ 20 C (lbs./gallon):** 62 **Bulk Density @ 20 C (lbs/ft3):** 71 **Boiling Point/Range (F):** Not Determined **Boiling Point/Range (C):** Not Determined **Freezing Point/Range (F):** Not Determined **Freezing Point/Range (C):** Not Determined **Vapor Pressure @ 20 C (mmHg):** Not Determined **Vapor**

Density (Air=1): Not Determined **Percent Volatiles:** Not Determined **Evaporation Rate (Butyl Acetate=1):** Not Determined **Solubility in Water (g/100ml):** Insoluble **Solubility in Solvents (g/100ml):** Not Determined **VOCs (lbs./gallon):** Not Determined **Viscosity, Dynamic @ 20 C (centipoise):** Not Determined **Viscosity, Kinematic @ 20 C (centistrokes):** Not Determined **Partition Coefficient/n-Octanol/Water:** Not Determined **Molecular Weight (g/mole):** Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable Hazardous Polymerization: Will Not Occur

Conditions to Avoid **None anticipated**

Incompatibility (Materials to Avoid) Hydrofluoric acid.

Hazardous Decomposition Amorphous silica may transform at elevated temperatures to tridymite (870 C) or

Products cristobalite (1470 C).

Additional Guidelines Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	**Eye or skin contact, inhalation.**
Inhalation	**Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).** Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).
Skin Contact	**May cause mechanical skin irritation.**
Eye Contact	**May cause eye irritation.**
Ingestion	**None known**
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation,

should not be exposed to quartz dust.

Chronic Effects/Carcinogenicity

Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information

For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity: Not determined **Dermal Toxicity:** Not determined **Inhalation Toxicity:** Not determined **Primary Irritation Effect:** Not determined **Carcinogenicity** Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).

Genotoxicity: Not determined

Reproductive / Not determined

Developmental Toxicity:

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not Determined

Ecotoxicological Information **Acute Fish Toxicity:** Not determined **Acute Crustaceans Toxicity:**Not determined **Acute Algae Toxicity:** Not determined **Chemical Fate Information** Not determined **Other Information** Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation **ICAO/IATA** Not restricted

Sea Transportation **IMDG**
Not restricted

Other Shipping Information **Labels:** None

15. REGULATORY INFORMATION

US Regulations	
US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely	Not applicable
Hazardous Substances	
EPA SARA (311,312) Hazard	Acute Health Hazard
Class	Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical
	Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund	Not applicable.

Reportable Spill Quantity For This

Product EPA RCRA Hazardous Waste If product becomes a waste, it does NOT meet the criteria of a hazardous waste as **Classification** defined by the US EPA.

California Proposition 65 The California Proposition 65 regulations apply to this product.

MA Right-to-Know Law One or more components listed.

NJ Right-to-Know Law One or more components listed.

PA Right-to-Know Law One or more components listed.

Canadian Regulations

Canadian DSL Inventory All components listed on inventory.

WHMIS Hazard Class D2A Very Toxic Materials

Crystalline silica

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS
Not applicable

Additional Information For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF MSDS*****