GEOLOGY (880-X-8E-.06(2))

1. Geologic Description of the Permit and Adjacent Area

The Reed Minerals, Inc.- No. 5 Mine is located in Sections 10, 14 and 15; Township 15 South, Range 6 West; Walker County, Alabama as seen from the Goodsprings Quadrangle (see attached Mine Site Location Map and Hydro-Geo Map). The proposed mine site will occupy approximately 178 acres. Surface mining methods will be utilized at this mine site.

This site is structurally located within the Warrior Coal Basin. The strata that underlies and outcrops in this region is of the Pottsville Formation of the Pennsylvanian Age. The Warrior Basin is the southern most of a series of Pennsylvanian basins of the Appalachian Plateau. The Pottsville Formation in this area consists of thin to thick-bedded sandstones, siltstones, shales clays and coal seams. Structurally, the Warrior Basin is formed by a large gentle syncline that extends from north-central Mississippi in the west to north-central Alabama in the east. The syncline is tilted southwestward with a regional dip of 30 to 200 feet per mile. Toward the interior of the Warrior Basin, the regional southwest dip of Pottsville strata is modified by a series of three synclines and two anticlines. Of these, the major structures are the Warrior and Coalburg synclines, and the Sequatchie anticline. The fold axes are parallel to the Appalachian system in a northeast-southwest direction and a plunge to the southwest with the regiaonal dip. Locally, this permit area is located on the northwest limb of the Arkadephia Syncline and this geologic feature influences the structure of the strata. According to the "Coal Resources of Walker County, Alabama" Special Map 205, a geological survey of Alabama, this area appeal's to be influenced by local faulting. The strata that

outcrops in the immediate vicinity of the mine site includes siltstones, shales, sandstones, underclays and coal seams associated with the Mary Lee coal group. According to "Depositional Settings of the Pottsville Formation in the Black Warrior Basin", the Mary Lee group lies approximately 40 to 130 feet above the Black Creek coal group and from 140 to 400 feet below the Pratt coal group.

The target seams at this facility are the New Castle and Mary Lee seams of the Mary Lee coal group. The New Castle seam and the Mary Lee seam do not outcrop within the permit area. The interburden between the New Castle and the Mary Lee seams in this area ranges between thirty (30) to thirty-six (36) feet in thickness. According to exploratory drill holes from Alabama By-Products Corporation and Sloan Mountain Mining, LLC, the Mary Lee seam averages approximately 33.6 inches thick within the proposed permit area. The thickness of the New Castle seam averages approximately 10 inches. The New Castle and Mary Lee seams are the primary seams to be recovered at this site.

This site is an area mine located on a previously disturbed industrial site that is relatively flat with trending ridges whose reliefs are approximately 120 feet above the receiving above the New Castle seam reaches a maximum thickness of approximately 90 feet within the permit boundary and consists of, in descending order, weathered shale-15 feet thick, followed by an interval of gray siltstone-20 feet thick, followed by approximately 35 feet of shale, followed by approximately 5 feet of siltstone, followed by approximately 35 feet of shale followed by approximately 10 feet of shale and sandstone, followed by approximately 8 feet of shale, followed by the New Castle seam approximately 0.9 feet thick. The interburden between the New Castle and Mary Lee seams at this site is approximately 33

feet thick and consists of approximately 4 feet of underclay and shale, followed by approximately 5 feet of sandy shale, followed by approximately 15 feet of sandstone and shale, followed by approximately 9.0 feet of shale, followed by the Mary Lee seam approximately 2.8 feet thick, followed by approximately 3 feet of fireclay. The above description is a result of site-specific drilling within the proposed permit area and is typical in nature for the whole area although the intervals described above may vary in thickness or content depending upon their location within the permit area.

According to "Depositional Settings of the Pottsville Formation in the Black Warrior Basin", investigations have shown that the depositional environment of the coal and enclosing strata has direct bearing on the character of the coal seams; that the thickness and extent of the seam is largely determined by the relief of the surface on which the coal swamp developed and that the nature of the sediments which overlie the coal (overburden) have a strong influence on coal quality, including sulfur and trace element content. The reference also states that the prevailing theory is the Pottsville Formation represents a progradational sequence that ranges from Barrier Island deposits near the base of the Formation grading through Lower Delta Plain and transitional deposits into Upper Delta Plain deposits as you ascend into the upper part of the Formation. In addition, the references states that all depositional systems comprise one or more interrelated depositional environments which are in turn represented in the rock record by one or more lithofacies defined by the sedimentologic and biologic processes active within each environment. The above stated site-specific lithologic description from drill holes within and adjacent to the proposed permit area indicates that the Mary Lee seam formed in a wetland (swamp) within the Interdistributary Bay environment of the Lower

Delta Plain while the Mary Lee overburden developed in a interrelated Distal Bar and Distributary Mouth Bar environment of the Lower Delta Plain. According to the above stated reference, the Interdistributary Bay environments are those areas of marine or brackish water that lie between active distributary channels. They are the most aerially extensive and laterally persistent environments in the delta system. The material that accumulates in the bays is either fine-grained sediment earned into the bays in suspension during floods or organic material (plants) that accumulated within this environment. Siltstone, organic shale and coal (which are found in the site-specific lithologies of lithologies of the proposed permit area) are the dominant lithologies of bay deposits. Fossil content is a prime indicator of this type of environment however; no fossils were discovered because of the method of exploratory drilling (air rotary). As stated above, the Mary Lee overburden developed in an interrelated Distal Bar and Distributary Mouth Bar environment of the Lower Delta Plain. The Distributary Mouth Bar deposits are found at the mouth of Distributary channels and grade from coarse grained siltstones to medium grained sandstones. Bedding in these deposits irregular and there is little lateral continuity however; there may be some graded bedding along the margins of the deposits. Fossils are rare in the Distributary Mouth Bar deposits. Distal Bar deposits border Distributary Mouth Bar deposits. Lithologically, the Distal Bar deposits are interbedded siltstone and shale with occasional sandstone (in other words, are smaller grained and in general are a lower energy depositional environment).

Information utilized to describe the orientation, lithology and geochemistry of Reed Minerals, Inc., Reed Minerals No. 5 Mine, and adjacent areas include overburden geochemistry sites

30373C and 30376C, monitoring wells H255, H256, and H257, and numerous exploratory drill holes listed at the end of this section of the report which are utilized for baseline information specifically related to this proposed permit area. In June of 2005 personnel of Sloan Mountain Mining, LLC drilled geochemistry monitoring sites, 30373C, 30376C, groundwater monitoring wells sites H255, H256, H257, and numerous exploratory drill holes with a Gardner-Denver 1000 air rotary drill utilizing a 4 and 3/4 inch drill bit. Samples were collected from drill cuttings of 30373C and 30378C every five feet or change in lithology and a log was kept of the lithology encountered by personnel of Sloan Mountain Mining, LLC. Collected samples were cataloged and stored in plastic reseal able bags for later inspection and testing. These samples were transported to the Drummond Company, Inc. laboratory where chemical analysis, including pH and neutralization potential was conducted according to ASTM guidelines. Monitoring wells H255, H256 and H257 were drilled onsite to observe groundwater conditions. The only information collected from the exploratory drill holes were location, depth to, and thickness of the. New Castle and Mary Lee Coal Seams. See the attached drill logs for surface elevations and target coal seams elevations. See the Hydro-Geo Map for location of the drill holes.

Lithologic logs were constructed from the drill logs mentioned above by qualified consultants of Sloan Mountain Mining, LLC.

The average total sulfur content of the New Castle seam from numerous exploratory drill holes within and adjacent to the proposed permit area was analyzed as 2.3 percent. As shown in the

acid-base account analysis for 30373C and 30376C, there is an interval directly above the New Castle coal seam that is potentially acid-forming and averages approximately five feet thick.

The overburden intervals at this site are inconsistent in that they do not occupy equal areas or have equal volumes. This is indicated by the drill logs, attached in the results of the geochemical analysis, where the upper intervals occupy lesser volumes than the intervals located closer to the bottom. Consequently, the upper intervals' acid-base accounts do not contribute as substantially to the overall chemistry of the overburden as do the lower intervals. In an attempt to more accurately describe the acid-base potential of the overburden at No. 5 Mine, a spreadsheet developed at the Pennsylvania Dept. of Environmental resources, Bureau of Mining and Reclamation, was employed. This spreadsheet not only takes into account the volume occupied by each interval tested, but also the amount of coal lost in to the spoil. The results of this method from groundwater monitoring/geochemical monitoring are favorable. Overburden at Reed Minerals No. 5 Mine contains an average of 5.65 (tons CaCO3/l000 tons overburden) excess neutralization potential. Another important consideration is that previous mining in adjacent areas have illustrated that the mining of Mary Lee Group coal seams has not historically created acid mine drainage problems.

Numerous exploratory drill holes within and adjacent to the proposed permit area were utilized to construct a Structure-Contour map for the Mary Lee Coal Seams. See the attached Hydro-Geo Map.

The strike and dip of strata within the permit area is complex because of local open folding and faulting however; in general, the strike is approximately North 40 degrees West and the strata dips to the southwest at approximately less than one degree. The strike and dip of the local strata was determined by utilizing the drill hole data for the top of Mary Lee seam elevation. No faults are known to exist within the permit area. However, according to "Coal Resources of Walker County, Alabama" Special Map 205 and area drilling/ underground mapping, there is one normal fault to the southwest of the permit area which is the northeastern mining limit of Barney Mine.

2. Geochemistry:

The rocks outcropping within the permit area belong to the upper Pottsville Formation and consist of clastic sediments of a deltaic environment. Generally the coals of the Warrior Coal Field are separated by sequences of gray sandstone, conglomerate, siltstone, shale and underclay according to the “Hydrologic Assessment, Eastern Coal Province Area 23, Alabama”. All drill holes available at this site showed similar cyclothemic beds of sandy shales, sandstones.

Two (2) drill holes were used to describe the lithology within the permit and surrounding area. All drill holes were dilled at least ten (10) feet below the Mary Lee Coal Seam. Drill hole 30373C and 30376C were drilled by Sloan Mountain Mining, LLC. in June of 2005. All drill holes were drilled with cuttings or cores being retained for analysis. For the core holes, the upper unconsolidated material was collected as cuttings in five-foot intervals or at each strata change. Core material was sampled continuously. For the most part, cuttings, from the rotary air drilled holes, were collected in five-foot intervals throughout. For the lithologic description of the drill

holes and monitoring wells see the attached Lithologic Description 30373C and 30376C and drill logs. For the locations of drill holes and monitoring wells see the attached map entitled Hydro-Geo Map. All analyses were performed by Sloan Mountain Mining's.

The following chart shows the thickness-weighted averages for each overburden hole.

Drill Hole ID	Percent Sulfur	Neutralization Potential	Acid-Base Account	Tons/Acre Excess CaCO3
30373C	0.1673	14.0909	8.8636	716
30376C	0.1640	15.3750	10.2500	414
Average	0.1657	14.7330	9.5568	565.0

According to the overall average Acid Base Accounts of the overburden sampled in the overburden holes, there is a five foot interval of possible acid forming material above the New Castle seam in both 30373C and 30376C. The weighted averages indicate that there is sufficient alkaline material contained in the overburden at this mine to neutralize the small amounts of acid forming material contained within the overburden.

For the chemical analyses of the overburden materials see the Over burden Analysis Spreadsheet. See the attached Hydro-Geo Map for the locations of the overburden holes and attached Theisson Polygon Map for overburden hole area of influence.

3. Sulfur Content of Coal:

The total sulfur percentages of the coal seams to be mined at this site are listed below. The total sulfur percentages of each coal seam are based on averages of many coal samples.

Seam	Percent Sulfur (raw Dry)
New Castle	2.3
Mary Lee	0.82

4. Coal Seam(s) Information:

Based on drilling results there is two (2) mine able seams, the New Castle and Mary Lee at this mine site. The New Castle and Mary Lee will be mined as deep as economically possible. For coal seam information, see the following table:

SEAM	THICKNESS	OVERBURDEN	STRIKE/DIP
New Castle	0.9’	90’	S 43 ^{O} 52’ 00” E S 0.0180 ^{O} W
Mary Lee	2.8’	123’	S 3 ^{O} 37’ 13” E S 0.0192 ^{O} W

5. Coal Cropline(s) Location:

For a map showing the outcrop location with respect to the proposed permit area; see the attached Hydro-Geo Map.

6. Geologic Description Support Data:

For maps or cross-sections used to support the geologic description see the attached map(s) entitled Geologic Investigation Cross-Section A-A'.

7. Drill Hole Locations and Elevations:

For elevations and locations of drill holes and other sample sites, see attached Hydro-Geo Map and Lithologic Description Drawings. (H-255, H-256, H-257, 30373C, and 30376C) and drill logs.

8. Sampling and Analytical Data:

Samples for 30373C and 30376C were collected by capturing cuttings blown from the hole with a clean shovel. Samples were taken every five (5) feet or change in lithology. Care was taken to blow the hole clean at each interval to insure a clean sample. Each overburden sample was described and analyzed. Samples for 30373C and 30376C were collected by personnel of Drummond Coal Company. Chemical analysis, including Paste pH, Total Sulfur, and Neutralization Potential were conducted in accordance with Field and Laboratory Methods Applicable to Overburden and Minesoils developed, USEPA, Environment Protection Technology Series, EPA-600/2-78-054 dated March 1978 guidelines.

9. Required Additional Overburden Testing:

Indications of additional overburden testing or additional parameters have not been received at this time. If drilled or sampled during the preparation of this application, portions of all of the overburden samples shall be retained for additional testing at the office of McGehee Engineering Corp. until the issuance of the permit. Based on the geologic data (acid base account), no acid or toxic forming materials were disclosed in the overburden holes.

10. Certification Statement:

I, Robert W. Usher, hereby certify that the information contained in Attachment II-E, and all maps, plans, and cross-sections included in the answers to Parts II-E, of this application were either prepared under my direct supervision or prepared and certified by other professional engineers or geologists, and that the information included herein is correct and accurate to the best of my knowledge and belief.

McGehee Engineering Corp.

Robert W. Usher, P.E.
AL Reg. No. 15917

7-5-11
Date

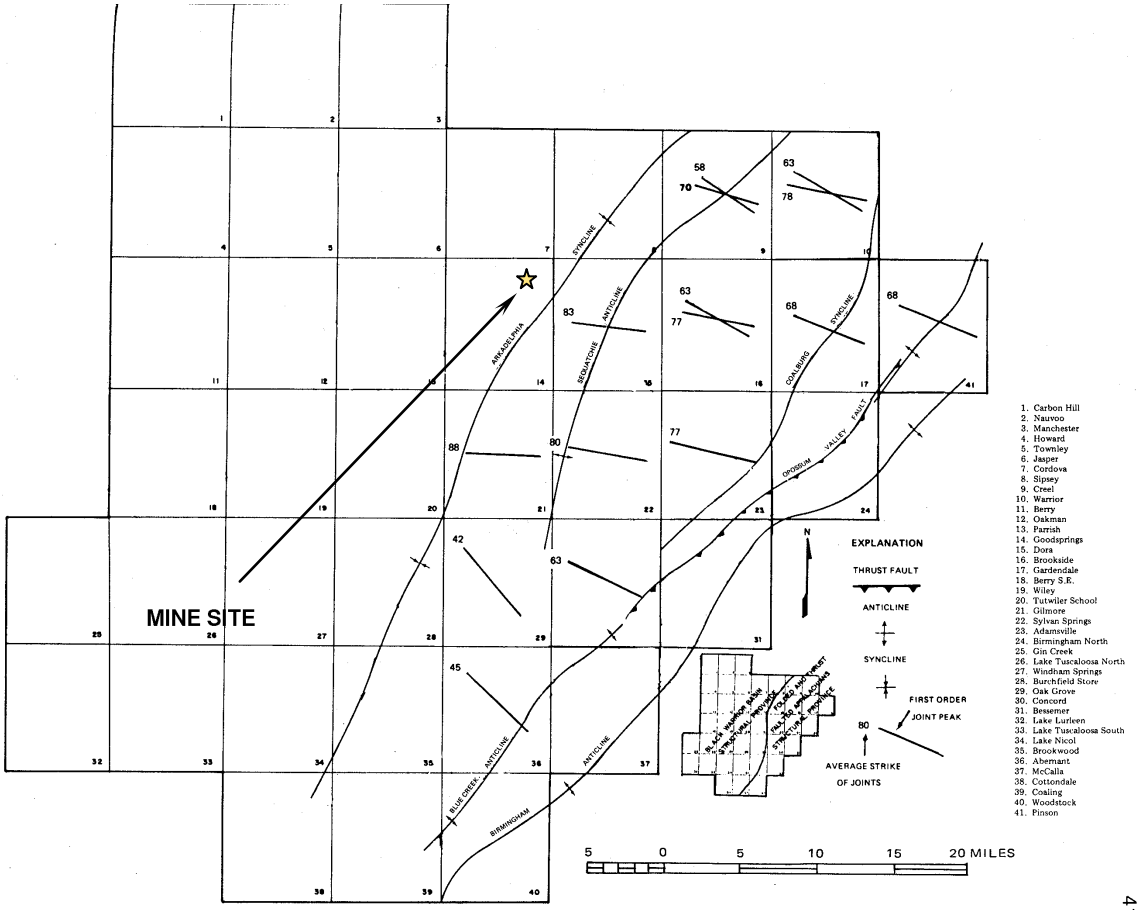

Figure 24.--Major fold axes in area of study and northwesterly oriented first order joint peaks in the Folded and Thrust-Faulted Appalachian structural province. Each numbered grid cell corresponds to a 7½-minute quadrangle. Key to individual quadrangle names is in column at right of figure.

REED MINERALS, INC.
NO. 5 MINE

MAJOR STRUCTURES MAP

SECTION 10, 14, AND 15
TOWNSHIP 15 SOUTH, RANGE 6 WEST,
WALKER COUNTY, ALABAMA
AS SHOWN ON THE GOODSPRINGS U.S.G.S. QUADRANGLES

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