ATTACHMENT II-H

DETERMINATION OF THE PROBABLE HYDROLOGIC CONSEQUENCES

See attached baseline data collected at Surface Water Monitoring Sites BCJMSW-4 and P3546SW1 (see attached Mine Site Location Map) by the PERC Engineering Laboratory. Parameters analyzed include pH, Total Iron, Total Manganese, Specific Conductance, Acidity, Alkalinity, and Sulfates. The log values of these parameters (except pH, acidity, and alkalinity) were plotted vs. the corresponding log value of the flow (discharge) using NWA Statpak by Northwest Analytical, Inc. The pH was plotted vs. the log of the flow (discharge) without alteration. The log value of sulfates were plotted vs. the log value of specific conductance. **These plots are attached.** The data values mentioned above were regressed by the 'least squares' method using the NWA Statpak by Northwest Analytical, Inc. Values for the square of the multiple correlation coefficient (R2), the intercept (a), and the slope (b) for each plot are attached. The regression line shown was used to predict surface water quality values below the mine site in the receiving stream at specific flowrates before mining by Global Met Coal Corp. occurs.

These specific flows are at the 7Q2, average, and 2 year floods. The method for calculating the 7Q2 flowrate in the receiving streams is shown in "Low-Flow Characteristics of Alabama Streams", Geological Survey of Alabama, Bulletin

117. Calculating average flow in the receiving streams is shown in "A Method of Estimating Average Streamflow and Headwater Limits in U.S. Army Corps of Engineers, Mobile District, Alabama and Adjacent States", U.S. Geological Survey, Water-Resources Investigations, Open-File Report 81-59. The method of calculating the 2-year flowrate in the receiving streams is shown in "Magnitude and Frequency of Floods in Alabama", Water Resources Investigations Report 84-4191.

Surface water quality values for baseline conditions at these specific flowrates for the receiving stream is shown on the attached 'Water Quality & Quantity Projections' page. Notice that no parameter exceed EPA effluent limitations at any flowrate calculated. **See the attached 'Water Quality & Quantity Projections' page** for water quality and quantity values for baseline conditions.

Comparisons should also be made between baseline surface water quality in the receiving streams and effluent limitations specified by the Alabama Dept. of Environmental Management for the receiving streams' use classification, which is 'Fish and Wildlife', as referenced by Chapter 335-6-11-.02 in their Water Quality Program, and mentioned previously in this report. As referenced from Chapter 335-6-10 in the Water Quality Program of the Alabama Dept. of Environmental Management, the best usage of the 'Fish and Wildlife' classification for the Locust Fork is fishing, the propagation of fish, aquatic life,

and wildlife, and any other usage except utilization as a supply for drinking or food processing, or for swimming and water contact sports. According to the same reference, the following water quality restrictions are imposed by ADEM for this use classification: Wastes shall not cause the pH to deviate more than one unit from the normal pH, nor be less than 6.0 or greater than 8.5. The temperature shall not exceed 90 degrees Fahrenheit. Dissolved oxygen concentrations will not be less than 5 mg/l. Only such amounts of toxic substances or taste, odor, and color producing substances will be allowed which will not exhibit acute or chronic toxicity. Fecal coliform will not exceed a geometric mean of 1,000/100ml on a monthly average. Radioactive materials will not exceed the requirements of the State Dept. of Public Health and there shall be no turbidity of other than natural origin that will cause substantial visible contrast with the natural appearance of the waters or interfere with any beneficial uses which they serve. Officials from ADEM were contacted and asked what parameter concentrations would degrade this use classification for parameters not listed in Chapter 335-6-10. They responded that if the parameter is not specifically listed in the above referenced Chapter, baseline quality of the body of water would be used to determine whether or not degradation is taking place. As shown on the attached 'Water Quality & Quantity Projections' page, no parameter exceeds the effluent limitations listed in Chapter 335-6-10 for the 'Fish and Wildlife' classification.

On-site geochemical analysis shown in Part II-E revealed two acid forming layers in the overburden at the Black Creek Mine. These layers were from 109.3 - 110.1 ft and 112.5 - 115.0 ft. in Geochemical Analysis Site GMCBCOB4. The interval from 109.3 - 110.1 ft. was found to be contaminated with coal. The interval from 112.5 - 115 ft. is adjacent to the coal seam and is probably contaminated by the above coal seam. Due to the fact that all overburden at this site does not occupy similar areas, intervals shown in the overburden analysis which are located in the upper portions of the drill log occupy a smaller volume than intervals which are located closer to the bottom, consequently, their acid-base accounts do not contribute as substantially to the overall chemistry of the overburden. In an attempt to more accurately describe the acid-base potential of the overburden at the Black Creek Mine site, a spreadsheet which was 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 into the spoil. The results of this method from overburden geochemical analysis site GMCBCOB4 (as shown in the attached Volumetric Overburden Calculation Sheets) are favorable: overburden at the Black Creek Mine contains an average of +11.70 (tons CaCO3/1000 tons overburden) excess neutralization potential. This excess neutralization potential will neutralize the acid found in the acid forming layers discussed above and no acid drainage is anticipated at this site.

'During Mining' water quality estimates for the receiving stream is also given in **the attached 'Water Quality & Quantity Projections' page**. All estimates for quality and quantity of the receiving stream during the mining of the proposed permit area is based on: 1) baseline surface water quality, 2) the size of the proposed permit area within the watershed, 3) the drainage area of the watershed at the monitoring site, 4) the anticipated discharge quality of the sediment basins, and 5) the amount of previous disturbance within the watershed. During the development of "During Mining" surface water quality projections it was assumed that surface water leaving the mine site will meet EPA and ADEM effluent limitations but will be of the lowest quality, ie, will have a pH of 6 s.u., a FeT of 3 mg/l, a MnT of 2 mg/l, a TSS of 70 mg/l, and a SpC of 2000. As shown in the attached 'Water Quality & Quantity Projections' page, no parameter exceeded EPA effluent limitations at any flowrate calculated. These changes in surface water quality are not expected to be permanent and are not significant based on baseline water quality in this watershed and should not have a profound affect on the use-classification of the receiving stream if the operator complies with state and federal water quality guidelines.

Sediment delivered to the receiving stream from the mine site, as estimated by a computer program developed at PERC Engineering Co., Inc. utilizing the Universal Soil Loss Equation (USLE), and modified using conservative values for

sediment basin trapping efficiencies and sediment delivery ratios for the receiving streams, should average 23.8 tons per year before mining begins, 234 tons per year during the first year of mining, 289 tons per year during the second year of mining, 302 tons per year during the third year of mining, 302 tons per year during the forth year of mining, 302 tons per year during the fifth year of mining, 91.3 tons per year in the first year after active mining, 35.6 tons per year in the second year after active mining, 21.7 tons per year in the third year after active mining but before 100% release of bonds, and 20.7 tons per year after release of the performance bonds. It may seem unusual that post mining sediment delivered to the receiving stream was less than the pre-mine values, however, this is due to the reclamation of unreclaimed previous disturbance that will be reclaimed during the mining of the proposed permit area and the fact that the ponds are proposed as permanent water impoundments, which will continue to treat surface water runoff after the permit is released. See attached **results of estimated sediment delivered to the receiving stream.**

Sediment levels in surface runoff will be controlled by sediment basins as designed in Part III-B of this application. Timely regrading and liming of revegetation as outlined in Part IV of this application will minimize exposure of unweathered overburden and result in conditions which could result in low quality surface water or groundwater discharge.

The long term effects of mining by Global Met Coal Corp. on surface water quality in the receiving stream is also shown in **the attached 'Water Quality & Quantity Projections' page.** Post mining estimates are based on: 1) baseline surface water quality, 2) estimated impact during mining, 3) the size of the permit area, 4) the size of the watershed, and 5) the amount of previous disturbance within the watershed. Post mining surface water quality will be of generally lower quality as compared to baseline values but this difference will be minimal due mainly to the existing previous disturbance in the BCJMSW-4 (P3546SW1) watershed.

Changes in water quantity within the permit area due to the affects of mining have been estimated using "Procedures For Predictive Analysis Of Selected Hydrologic Impacts Of Surface Mining" by David B. McWhorter. Values for precipitation, temperature, and solar radiation were obtained from the National Weather Service and NOAA. Runoff curve numbers were taken from "Applied Hydrology and Sedimentology for Disturbed Areas" by Barfield, Warner, and Haan. Water use coefficients were taken from "Water Requirements for Stabilization of Spent Shale" by Wymore. Effective rooting depth values were taken from "Agronomy Journal, Volume 52". Available Water Capacity values for soils and B Horizon mined areas were taken from the Soil Conservation Service's Soil Survey. Available Water Capacity values for A Horizon mined areas were taken from an average of over 40 site-specific studies conducted in

Jefferson, Tuscaloosa, Walker, and Winston counties by Tim Thomas of PERC Engineering Co., Inc. utilizing "A Method of Comparing Soil Materials for Plant Available Water" by Sam Lyle. It is estimated that there will be a 51.4 percent increase in base flows, a 10.50 percent increase in average flows, and a 27.7 percent decrease in peak flowrates relative to baseline conditions within the permit area as a result of mining by Global Met Coal Corp.. Changes in flowrates are shown in the attached 'Water Quality & Quantity Projections' page.

In general, the aquifers overlying the Black Creek Seam within the proposed permit area will be significantly affected during the mining process. Due to the fracturing of low permeability shale strata, groundwater availability within the permit area will increase. Also, due to the fact that this fracturing will eliminate shale intervals which, prior to mining, served as a 'perch' for the small, water holding intervals, only one post mine spoil aquifer will exist within the permit area instead of several small perched aquifers. Also, voids created in the overburden by mining will increase the gravitational affects on the groundwater while decreasing capillary affects on the groundwater, resulting in a much lower groundwater elevation. Groundwater quality within this interval within the proposed permit area should decrease in the form of increased conductivities, mineralization, sulfate levels, and decreased pH's, due to the fact that the post mine spoil aquifer will 'sit' upon the uppermost consolidated post mine interval

(the interval just below the recovered Black Creek Seam... in other words the pit bottom), and will be in contact with any unweathered spoil material and any unrecovered coal in the spoil that lies on the pit bottom and in the spoil within the saturated thickness of the post mine spoil aquifer. Aquifers discussed in Part II-F whose elevations underlie the bottom of the adjacent Locust Fork of the Black Warrior River will be affected the same as the overlying intervals discussed above, however, groundwater from up-dip areas in these aquifers will still migrate into and contribute to the average groundwater level in the post mine spoil aquifer. Migration into the post mine spoil aquifer from up-dip areas will be dictated by the lateral hydraulic conductivity of the undisturbed strata and not the spoil therefore no increase in infiltration into the proposed mine site is anticipated.

Off-site impact above the Black Creek Seam is anticipated due to the fact that this interval will be hydraulically connected to unmined strata on the southeast side of the permit and the predominant dip of the strata within the proposed permit area is toward the south. This means that contaminant transport (in groundwater) from the proposed permit area to off-site areas after mining occurs will be aided by groundwater migration. Also, only the unmined strata on the south side of the proposed permit which lies below the saturated thickness of the post mine spoil aquifer will come into contact with affected groundwater. As stated above, the decrease in groundwater quality will most

likely be in the form of increased conductivities, mineralization, sulfate levels, and decreased pH's. For the small, shallow aquifers that are down dip of the proposed permit area, and are high enough that they are above the saturated thickness of the post mine spoil aquifer, no changes in groundwater quality are anticipated, however, the only affect to these shallow aquifers are a small decrease in recharge area and as a result a small decrease in groundwater quantity. Off-site aquifers whose elevations underlie the bottom of the adjacent Locust Fork of the Black Warrior River will be affected to a lesser extent due to the fact that prior to mining by Global Met they also received groundwater that migrated from up-dip areas and a significant portion of these areas have already been disturbed. Groundwater resources overlying the Black Creek Seam which receive groundwater from the post mine spoil aquifer should be affected, however that affect will decrease as the distance from the proposed permit increases due to diffusion.

As stated in Part II-F, the sandstone strata underlying the Black Creek Coal Seam has either very small grain size which would result in low porosity, a cementing agent which restricts or interrupts groundwater flow, or the sandstone intervals contain a significant amount of shale interbedding such that groundwater flow is restricted. In any event, based on groundwater levels, this interval transmits only a small amount of groundwater. It also indicates that if groundwater quality is affected by mining, this interval would restrict its

movement into other underlying intervals. In addition, groundwater quality in GMCBCMW5 reveals moderate to high mineralization and conductivity but low sulfate values in a well which is down-dip from, and hydraulically connected to, intervals which underlie prior and existing surface mining operations. Because sulfate concentrations are the most reliable evidence of coal related impact, it must be assumed that no significant amount of groundwater in this interval has migrated into Groundwater Monitoring Site GMCBCMW5 from the up-dip areas. This information indicates that no great amount of impact is anticipated with respect to on or off-site groundwater quality for the aquifer located below the Black Creek Coal Seam as a result of mining at this facility. No changes to on or off-site groundwater quantity in this interval are expected as a result of this proposed mining operation due to the evidence stated above.

As stated in Part II-F, a well inventory initiated by PERC Engineering Co., Inc. in August of 2012 revealed that there are 219 residences within a ½ mile radius of the Black Creek Mine. The locations of all inventoried residences within a ½ mile radius of the proposed facility are shown on the attached Well Inventory Map. Pertinent information of the well inventory is attached (See Well Inventory Summary and Well Inventory Maps). The well inventory is on-going and will be completed and estimates of impact to local groundwater resources and well owners as a result of this operation will assessed during the technical review. In the event that it is shown that mining by Global Met Coal Corp. has

diminished the quality or quantity of surrounding well(s), one of the following methods of replacing the resident's domestic supply will be implemented: 1) an alternative source of groundwater for either shallow groundwater wells or wells with inadequate casing would involve drilling a new well in which the casing would penetrate an aquitard, such as shale below the lowest target coal seam, and the well would also terminate below the aquitard in water-producing strata, such as sandstone, or 2) connect the residence to an existing municipal water supply, or 3) other methods which replace the groundwater users supply and is agreeable to both the user and the operator will be considered an alternative.

No alteration of the drainage area of the receiving streams are anticipated as a result of this operation.

PHC FINDINGS:

The findings of the preceding Determination of the Probable Hydrologic Consequences for Global Met Coal Corp. at their Black Creek Mine is as follows:

A) Acid or toxic-forming materials: On-site geochemical analysis shown in Part II-E revealed two acid forming layers in the overburden at the Black Creek Mine. These layers were from 109.3 - 110.1 ft and 112.5 - 115.0 ft. in Geochemical Analysis Site GMCBCOB4. The interval from 109.3 - 110.1 ft. was found to be contaminated with coal. The interval from 112.5 - 115 ft. is adjacent to the coal seam and is probably contaminated by the above coal seam. Due to the fact that all overburden at this site does not occupy similar areas, intervals shown in the overburden analysis which are located in the upper portions of the drill log occupy a smaller volume than intervals which are located closer to the bottom, consequently, their acid-base accounts do not contribute as substantially to the overall chemistry of the overburden. In an attempt to more accurately describe the acid-base potential of the overburden at the Black Creek Mine site, a spreadsheet which was 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 into the spoil. The results of this method from overburden geochemical analysis site GMCBCOB4 (as shown in the attached Volumetric Overburden Calculation Sheets) are favorable: overburden at the Black Creek Mine contains an average of +11.70 (tons CaCO3/1000 tons overburden) excess neutralization potential. This excess neutralization potential will neutralize the acid found in the acid forming layers discussed above and no acid drainage is anticipated at this site.

B) Adverse impacts to the hydrologic balance:

As stated in the PHC, changes in water quantity within the permit area due to the affects of mining have been estimated using "Procedures For Predictive Analysis Of Selected Hydrologic Impacts Of Surface Mining" by David B. McWhorter. Values for precipitation, temperature, and solar radiation were obtained from the National Weather Service and NOAA. Runoff curve numbers were taken from "Applied Hydrology and Sedimentology for Disturbed Areas" by Barfield, Warner, and Haan. Water use coefficients were taken from "Water Requirements for Stabilization of Spent Shale" by Wymore. Effective rooting depth values were taken from "Agronomy Journal, Volume 52". Available Water Capacity values for soils and B Horizon mined areas were taken from the

Soil Conservation Service's Soil Survey. Available Water Capacity values for A Horizon mined areas were taken from an average of over 40 site-specific studies conducted in Jefferson, Tuscaloosa, Walker, and Winston counties by Tim Thomas of PERC Engineering Co., Inc. utilizing "A Method of Comparing Soil Materials for Plant Available Water" by Sam Lyle. It is estimated that there will be a 51.4 percent increase in base flows, a 10.50 percent increase in average flows, and a 27.7 percent decrease in peak flowrates relative to baseline conditions within the permit area as a result of mining by Global Met Coal Corp.. Changes in flowrates are shown in the attached 'Water Quality & Quantity Projections' page. This change in storage should not be adverse to the hydrologic balance. No other adverse impacts are anticipated as a result of this operation.

C) Contamination, diminution, and interruption of underground or surface source of water used for legitimate purpose on site and adjacent areas: Surface Water:'During Mining' water quality estimates for the receiving stream is also given in the attached 'Water Quality & Quantity Projections' page. All estimates for quality and quantity of the receiving stream during the mining of the proposed permit area is based on: 1) baseline surface water quality, 2) the size of the proposed permit area within the watershed, 3) the drainage area of the watershed at the

monitoring site, 4) the anticipated discharge quality of the sediment basins, and 5) the amount of previous disturbance within the watershed. During the development of "During Mining" surface water quality projections it was assumed that surface water leaving the mine site will meet EPA and ADEM effluent limitations but will be of the lowest quality, ie, will have a pH of 6 s.u., a FeT of 3 mg/l, a MnT of 2 mg/l, a TSS of 70 mg/l, and a SpC of 2000. As shown in the attached 'Water Quality & Quantity Projections' page, no parameter exceeded EPA effluent limitations at any flowrate calculated. These changes in surface water quality are not expected to be permanent and are not significant based on baseline water quality in this watershed and should not have a profound affect on the use-classification of the receiving stream if the operator complies with state and federal water quality guidelines.

Groundwater:In general, the aquifers overlying the Black Creek Seam within the proposed permit area will be significantly affected during the mining process. Due to the fracturing of low permeability shale strata, groundwater availability within the permit area will increase. Also, due to the fact that this fracturing will eliminate shale intervals which, prior to mining, served as a 'perch' for the small, water holding intervals, only one post mine spoil aquifer will exist within the permit area instead of several small perched aquifers. Also, voids created in the overburden by mining will increase the gravitational affects on the groundwater while

decreasing capillary affects on the groundwater, resulting in a much lower groundwater elevation. Groundwater quality within this interval within the proposed permit area should decrease in the form of increased conductivities, mineralization, sulfate levels, and decreased pH's, due to the fact that the post mine spoil aquifer will 'sit' upon the uppermost consolidated post mine interval (the interval just below the recovered Black Creek Seam... in other words the pit bottom), and will be in contact with any unweathered spoil material and any unrecovered coal in the spoil that lies on the pit bottom and in the spoil within the saturated thickness of the post mine spoil aquifer. Aquifers discussed in Part II-F whose elevations underlie the bottom of the adjacent Locust Fork of the Black Warrior River will be affected the same as the overlying intervals discussed above, however, groundwater from up-dip areas in these aquifers will still migrate into and contribute to the average groundwater level in the post mine spoil aquifer. Migration into the post mine spoil aquifer from up-dip areas will be dictated by the lateral hydraulic conductivity of the undisturbed strata and not the spoil therefore no increase in infiltration into the proposed mine site is anticipated. Off-site impact above the Black Creek Seam is anticipated due to the fact that this interval will be hydraulically connected to unmined strata on the southeast side of the permit and the predominant dip of the strata within the proposed permit area is toward the south.

This means that contaminant transport (in groundwater) from the proposed permit area to off-site areas after mining occurs will be aided by groundwater migration. Also, only the unmined strata on the south side of the proposed permit which lies below the saturated thickness of the post mine spoil aquifer will come into contact with affected groundwater. As stated above, the decrease in groundwater quality will most likely be in the form of increased conductivities, mineralization, sulfate levels, and decreased pH's. For the small, shallow aquifers that are down dip of the proposed permit area, and are high enough that they are above the saturated thickness of the post mine spoil aquifer, no changes in groundwater quality are anticipated, however, the only affect to these shallow aquifers are a small decrease in recharge area and as a result a small decrease in groundwater quantity. Off-site aquifers whose elevations underlie the bottom of the adjacent Locust Fork of the Black Warrior River will be affected to a lesser extent due to the fact that prior to mining by Global Met they also received groundwater that migrated from up-dip areas and a significant portion of these areas have already been disturbed. Groundwater resources overlying the Black Creek Seam which receive groundwater from the post mine spoil aquifer should be affected, however that affect will decrease as the distance from the proposed permit increases due to diffusion. As stated in Part II-F, the sandstone strata underlying the Black Creek Coal Seam has either very

small grain size which would result in low porosity, a cementing agent which restricts or interrupts groundwater flow, or the sandstone intervals contain a significant amount of shale interbedding such that groundwater flow is restricted. In any event, based on groundwater levels, this interval transmits only a small amount of groundwater. It also indicates that if groundwater quality is affected by mining, this interval would restrict its movement into other underlying intervals. In addition, groundwater quality in GMCBCMW5 reveals moderate to high mineralization and conductivity but low sulfate values in a well which is down-dip from, and hydraulically connected to, intervals which underlie prior and existing surface mining operations. Because sulfate concentrations are the most reliable evidence of coal related impact, it must be assumed that no significant amount of groundwater in this interval has migrated into Groundwater Monitoring Site GMCBCMW5 from the up-dip areas. This information indicates that no great amount of impact is anticipated with respect to on or off-site groundwater quality for the aquifer located below the Black Creek Coal Seam as a result of mining at this facility. No changes to on or off-site groundwater quantity in this interval are expected as a result of this proposed mining operation due to the evidence stated above.

D) Sediment yield from disturbed areas:

As stated in the PHC, sediment delivered to the receiving stream from the mine site, as estimated by a computer program developed at PERC Engineering Co., Inc. utilizing the Universal Soil Loss Equation (USLE), and modified using conservative values for sediment basin trapping efficiencies and sediment delivery ratios for the receiving streams, should average 23.8 tons per year before mining begins, 234 tons per year during the first year of mining, 289 tons per year during the second year of mining, 302 tons per year during the third year of mining, 302 tons per year during the forth year of mining, 302 tons per year during the fifth year of mining, 91.3 tons per year in the first year after active mining, 35.6 tons per year in the second year after active mining, 21.7 tons per year in the third year after active mining but before 100% release of bonds, and 20.7 tons per year after release of the performance bonds. It may seem unusual that post mining sediment delivered to the receiving stream was less than the pre-mine values, however, this is due to the reclamation of unreclaimed previous disturbance that will be reclaimed during the mining of the proposed permit area and the fact that the ponds are proposed as permanent water impoundments, which will continue to treat surface water runoff after the permit is released. See attached results of this program for the receiving stream.

E) Acidity, TSS, TDS, Fe, Mn, pH, other:

See the attached 'Water Quality & Quantity Projections' page.

F) Flooding or Streamflow Alterations:

None anticipated at this site.

G) Groundwater and Surface Water Availability:

Due to the unconsolidated nature of the post mine strata and the voids present after mining, gravitational forces (as opposed to capillary forces) will play a larger role in influencing infiltrated groundwater movement, therefore groundwater levels in the post mine aquifer will be lower on average than an unaffected aquifer of identical thickness and extent, and lateral groundwater movement in the post mine aquifer will be much greater than prior to mining therefore, as stated previously, baseflow to surrounding streams will increase.

H) Other:

No other impacts are anticipated at this site.

I) Supplemental Information:

None required for this mine site.