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January 7, 1994

Mr. Daron R. Haddock
State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

SUBJECT: Riprap Design Procedures, Sowbelly Canyon, Castle Gate Coal Mine, Carbon County, Utah. Permit No. 007/004

Dear Daron:

We have reviewed your letter of December 29, 1993, and the attached memo from Steven M. Johnson dated December 28, 1993, regarding the design of the reclamation diversions in Sowbelly Canyon. This letter offers clarification to address the concerns documented in Mr. Johnson's memo, and is not intended to alter the permit documents.

Mr. Johnson has correctly characterized some of the limitations associated with the two different riprap sizing methods utilized in recent revisions to the Castle Gate Coal Mine reclamation plan. Those methods are referred to as the Searcy method, developed for the U.S. Department of Transportation, and the Simons, Li and Associates method, developed for the Office of Surface Mining. Unfortunately, there are numerous riprap design methodologies available, each one yielding a different result, and each with its own limitations. Clearly, if the forces that riprap experience were easily quantifiable, there would only be one widely accepted design methodology with few limitations. Since this is not the case, professional judgement must be employed to select a method appropriate for the application and one that yields reasonable results.

The Simons/OSM method has been used to design riprap for the Castle Gate reclamation diversions with longitudinal channel slopes in excess of 10%, and whose flows exceed those covered by design curves on the Simons/OSM graphs (the lower flow limit ranges from approximately 10 cfs on diversions with a bottom width of 6 feet to 30 cfs on diversions with a bottom width of 10 feet). Riprap for all the other diversions was designed using the Searcy/DOT method. The classification of the diversions into these two groups, and the use of the two design methodologies results in reasonable average riprap sizes for the reclamation diversions. Further engineering analyses could be performed to determine a more accurate riprap size, but given the variables inherent in the design and the methods of constructing the diversions, additional effort is not warranted.

Mr. Johnson's concerns associated with the riprap sizing within transition zones is valid. Based on recommendations presented by Simons, Li and Associates, the larger riprap designed for the steeper reaches will extend 15 feet beyond the transition to a milder-slope reach.

Mr. Daron R. Haddock
Castle Gate Coal Mine
Sowbelly Canyon Riprap Design
January 7, 1994

Riprap for transition zones is discussed in the reclamation hydrology portion of each permit section of Chapter 3. Section 3.2-5(2) addresses this issue for Sowbelly Canyon.

Sedimentation at the base of the steep reaches along the main diversion in Sowbelly Canyon (SBRD-1) is not expected to accumulate in quantities that will interfere with the flow capacity of the diversion. Riprap lining the diversion will minimize erosion along the diversion downstream of the disturbed area boundary. Consequently, sources of the sediment load will be from overland flow across undisturbed and reclaimed ares that do not report to a pond, and from the bedload of the natural stream upstream of the disturbed area. Since the upstream reach of SBRD-1, i.e. SBRD-1D, is relatively flat, the bedload of the natural stream will probably be released along SBRD-1D before it is transported to the steeper reaches. Furthermore, the majority of the sediment generated from the reclaimed areas will be trapped before reaching SBRD-1 by silt fences and sediment ponds. For these reasons, sediment pools at the upstream end of the mild slope reaches do not appear necessary. If monitoring during the bond period proves that some of the design assumptions are not valid, then modifications to the runoff and sediment control plans can be made at that time.

In regard to the steep grade of diversion SBRD-3, a closer evaluation of the topography for that area indicates that the diversion will be constructed with a fairly uniform longitudinal slope of 12% to 15%, instead of varying from 4% to 53%. Consequently, both the flow capacity and riprap design for diversion SBRD-3 are currently adequate.

If we can offer further clarification, please do not hesitate to call.

Sincerely,

William S. Hendrickson

William S. Hendrickson, P.E.
Civil Engineer

Enclosures

cc: Richard Allison, P.E., Amax Coal West