

# TECHNICAL MEMORANDUM

## Utah Coal Regulatory Program

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December 17, 2009

TO: Internal File

THRU: James D. Smith, Permit Supervisor *JS 12/21/09*

FROM: Steve Christensen, Hydrologist *S/C*

RE: Mine Treatment Facility, Genwal Resources, Inc., Crandall Canyon Mine, C/015/0032, Task ID #3455, Outgoing File

### SUMMARY:

On December 09<sup>th</sup>, 2009, the Division of Oil, Gas and Mining (the Division) received an application to amend the Crandall Canyon mining and reclamation plan (MRP) from Genwal Resources, Inc., (the Permittee). The application calls for the construction of a mine-water treatment system at the Crandall Canyon Mine facility.

Following the Crandall Canyon Mine disaster on August 6<sup>th</sup>, 2007, the mine was deactivated and the portals were sealed. Mine water inflow built up to the extent that it is now discharging from the portals and discharging through a 12" pipe into Crandall Creek. In early 2009, the iron concentrations in the mine water began to increase.

Iron levels in the mine water discharge are currently out of compliance with the Permittee's Utah Pollution Discharge Elimination System permit (UPDES #UTU0024368). The Department of Water Quality has issued the Permittee a violation in association with the elevated iron levels. In addition, the Division issued Notice of Violation #10043 (NOV) on August 10<sup>th</sup>, 2009. The Division's NOV cited a failure to minimize disturbance to the hydrologic balance and diminution or degradation of the quality of surface water. The gravity discharge from the mine portals and its excessive amounts of iron are causing orange staining to occur in the receiving stream. In order to abate the NOV, the Permittee was directed to submit a plan to immediately address and mitigate the iron discharge currently reporting to the Crandall Canyon drainage.

On April 6<sup>th</sup>, 2009, the Permittee submitted an application to treat the mine water discharge (Task ID #3261). The application outlined the utilization of the 'old load out' area located directly below the north portals to treat the mine-water discharge with a series of baffles. The baffles were to supply oxygen to the mine-water discharge and thus facilitate the

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precipitation of the iron. The Division performed a technical analysis and identified several deficiencies.

The Permittee re-submitted the application for treatment of the mine-water discharge on October 15<sup>th</sup>, 2009 (Task ID #3415). The application outlined the installation and operation of a mechanical aeration device known as the Maelstrom Oxidizer Unit (the Maelstrom Unit). Mine water is fed into the Maelstrom Unit on one end where it then travels over and under baffles. As the water travels through the unit, a large volume of air is forced through the water. The high oxygen content then reacts chemically to change the dissolved iron from the ferrous state to the ferric state, which forms iron precipitates, which can then be settled out and ultimately removed. The application was reviewed and the Division determined that there were outstanding deficiencies that needed to be addressed prior to final approval. The December 9<sup>th</sup>, 2009 application again calls for the installation and operation of the Maelstrom Oxidizer Unit.

As with each of the aforementioned applications, the Permittee also requests the extension of the existing French drain system near the old north portals to collect additional mine seepage water, which is currently discharging to the sediment pond. The Permittee proposes re-routing undisturbed watershed WSUD-3 to the existing surface drainage system for the mine-site. The diversion/pipe system that was collecting the undisturbed drainage was damaged during the sealing and deactivation of the Crandall Canyon Mine after the mine collapse in August of 2007.

The following is a technical evaluation relative to the hydrology regulations of the State of Utah R645-Coal Mining Rules.

Upon review of the amendment, the Division has determined that additional information is necessary in order to comply with the State of Utah R645-Coal Mining Rules. The Permittee must address the following deficiencies prior to receiving final approval from the Division:

**DEFICIENCIES:**

**R645-301-742.220:** The Permittee must provide up to date survey information that demonstrates the sediment level of the pond.

**R645-301-742.220:** In addition, the Permittee must provide additional design and maintenance information for the proposed settling basin. The additional settling basin information should provide the following:

- The Permittee should revise the proposed clean out portion of the application. The Division finds that utilizing several staff gauges to determine when the 7,812' clean out level is reached is reasonable. However, due to the excessive staining that will be produced by the elevated iron levels in the mine water, it may be impossible to accurately read an elevation or tick mark on a standard staff gauge. As a result, the Permittee should install sediment markers (adjacent to the staff gauges) whose top elevation is 7,812'. With this method, it will be more apparent as to when the settling basin will require cleaning, as the sediment markers will no longer be visible at that point.
- The Permittee must commit to taking additional precautionary measures to minimize the amount of suspended iron particles that could potentially flow out of the pond during the vacuuming of the accumulated iron material. Such measures could include having sediment control devices on site prior to initiating clean up activities (excelsior logs etc.) in the event that suspended iron particles begin to discharge from the settling basin.
- The Permittee must revise the maintenance section of the application on page 5 of Appendix 7-65. When maintenance is required on the oxidizer unit or settling basin the bypassed mine water must be routed in a controlled manner to the disturbed drainage system. As such, the proposed temporary routing of the mine water down the main access road is unacceptable.
- The Permittee must demonstrate that all drainage components utilized in routing the mine water around the water treatment area can safely convey the design flow of 1,189 gallons per minute (gpm). The design flow of 1,189 gpm was derived from the October 14<sup>th</sup>, 2009 Blackhawk Engineering, Inc. memo that discussed the design criteria utilized in sizing the proposed mine water treatment area's spillway and discharge pipe. The Permittee must demonstrate that the conveyance system from the Maelstrom Unit to disturbed drainage ditch (DD-10), disturbed drainage ditch DD-10 as well as culvert C-4 can adequately convey the design flow of 1,189 gpm.
- The Permittee must provide a commitment to notify the Division 24 hours prior to initiating any clean up/maintenance activities on either the Maelstrom Oxidizer Unit or the settling basin.

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- The Permittee must provide a commitment that prior to initiating any clean up/maintenance activity on the Maelstrom Unit or settling basin that would require the re-routing of the mine water to the primary sediment pond, the sediment levels must be below the approved clean out level of 7,769'.
- During periods when the Maelstrom Oxidizer Unit or sedimentation basin must be taken off-line and mine water is discharged to the sediment pond, the water level in the sediment pond must be monitored to ensure that adequate storage is available in the pond to contain a 10-yr/24-hr storm event. The Permittee must provide a plan for monitoring the water level in the sediment pond and determining when the routing of mine water discharge to the sediment pond must stop.
- Based upon the Sedimentation and Drainage Control Plan in Appendix 7-4 of the MRP, a minimum volume of 2.172 acre-feet is required in order to contain the design storm event and associated sediment. The Permittee must commit to regularly monitor the discharge rate during treatment system bypass. The monitoring is necessary in order to calculate the time available for maintenance operations based on the available pond volume and mine water discharge rate.

**R645-301-751:** the Permittee must commit to establishing a back-up/contingency plan for the Maelstrom Oxidizer Unit once it's been demonstrated that the mine-water discharge levels of total iron are within UPDES limits for 3 consecutive months.

**TECHNICAL ANALYSIS:**

**GENERAL CONTENTS**

**PERMIT APPLICATION FORMAT AND CONTENTS**

Regulatory Reference: 30 CFR 777.11; R645-301-120.

**Analysis:**

The application meets the Permit Application Format and Contents requirements of the State of Utah R645-Coal Mining Rules.

The previous technical review (Task #3261) identified a deficiency on page 5-33. The application had referred to a Figure 7-14, which was not submitted with the package. The new application has an entirely different format and Figure 7-14 is not referred to and/or submitted under this task.

**Findings:**

The application meets the Permit Application Format and Contents requirements of the State of Utah R645-Coal Mining Rules.

**OPERATION PLAN**

**TOPSOIL AND SUBSOIL**

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-230.

**Analysis:**

**Topsoil Removal and Storage**

The application meets the Topsoil Removal and Storage requirements of the State of Utah R645-Coal Mining Rules.

No topsoil removal or storage will be required with the proposed surface facility alterations.

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**Findings:**

The application meets the Topsoil Removal and Storage requirements of the State of Utah R645-Coal Mining Rules.

**HYDROLOGIC INFORMATION**

Regulatory Reference: 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

**Analysis:**

**Groundwater Monitoring**

The application meets the Groundwater Monitoring requirements of the State of Utah R645-Coal Mining Rules.

The previous technical analysis (Task ID #3415) had identified a deficiency relative to groundwater monitoring. The deficiency called for the establishment of a monitoring point for collecting flow data from the sandstone seep discharge located directly below the north portals. The data is necessary in order for the Permittee to re-establish the approximate original contour (AOC) in the area of the 'old load out'/high wall area directly below the north portals.

On page 7 of Appendix 7-75 of the application, the Permittee commits to monitoring the sandstone seepage on a monthly basis and will provide the information to the Division via e-mail until such time as the revised final reclamation plan has been approved or is deemed no longer necessary by the Division.

**Water-Quality Standards And Effluent Limitations**

The application meets the Water-Quality Standards and Effluent Limitation requirements of the State of Utah R645-Coal Mining Rules.

The Permittee proposes the construction and utilization of a Maelstrom Oxidizer Unit (the Unit). Attachment 1 of the application provides information regarding the function and utilization of the Unit. The Unit facilitates a mass transfer of oxygen into a liquid to strip carbon dioxide and to oxidize and precipitate metals. Mine-water reports to one end of the Unit where it then travels through a series of baffles. As this is occurring, a large volume of air is forced through the water via a number of nozzles located at the bottom of the Unit. The Unit has been sized according to the anticipated flow rate.

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Attachment 2 provides bench test results obtained during the preparation of the application. Mine-water obtained at the Crandall Canyon mine-site was treated with the Unit. Prior to treatment, the mine-water had a total iron concentration of 2.16 milligrams/liter (mg/l) and a dissolved iron concentration of 0.79 mg/l. Following the treatment from the Unit, total iron levels were 0.52 mg/l with a corresponding value of 0.00 mg/l for dissolved iron.

As of now, it's unclear as to what is causing the elevated iron concentrations in the mine-water discharge. One possibility is that the iron concentrations are a result of dissolved pyrites in the coal. If that is the case, it's possible that as the pyrites are leached out, the iron levels will drop back to down to pre-existing compliance levels.

It is the hope that the construction and utilization of the aeration treatment facility under consideration with this permitting action will bring iron levels back into compliance with all federal and state water quality and effluent requirements. Monthly water monitoring (as required per UPDES requirements) of the aeration treatment facility's discharge will indicate whether it is effective. However, the data obtained through the bench tests and the effective utilization of the Unit in other locations is encouraging.

The previous technical analysis (Task ID #3415) had identified a deficiency regarding the proposed maintenance/clean-out plan for the proposed settling pond. The Permittee had proposed to route the in-mine water directly into Crandall Creek during periods when the settling pond required clean-out/maintenance. The previous analysis had requested that the Permittee provide the Division with documentation from the Department of Water Quality (DWQ) that such a practice would be acceptable per the terms of their UPDES permit and associated violations. DWQ representative Jeff Studenka informed Division staff that such re-routing of the discharge into Crandall Creek (even if only for a short period of time) would not be allowable under the Permittee's UPDES permit (UT0024368). As a result, the Permittee has revised the maintenance/clean-out plan.

Based upon input from Division staff and literature on treatment systems for mining sites, the Permittee submits that the solids content in the accumulated material in the settling basin will be approximately 5%. As a result, the Permittee proposes to utilize vacuum methods to remove the accumulated iron material from the settling basin. Vacuum tanker trucks will be positioned along the road directly adjacent to the settling basin in preparation for clean out. The mine-water will continue to be directed into the settling basin while vacuum operations are underway and not be routed directly into Crandall Creek. (See Below for additional discussion of the clean out/maintenance operations).

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The previous two technical reviews (Task ID #3261 and Task ID #3415) had identified a deficiency relative to the duration and characterization of the proposed treatment system. In previous applications, sections were noted where the Permittee had discussed the proposed treatment system as potentially 'permanent'. The Division requested that all references or language pertaining to the potential permanence of the water treatment system be removed. The utilization of the Maelstrom Oxidizer Unit in the old load out area of the Crandall Canyon Mine will be strictly operational. The most recent application has removed the 'permanent' references that were previously identified on page 7-47 and page 3 of Appendix 7-65 of the application.

In consultation with the Permittee and other regulatory agencies, the Division is in the process of developing a final reclamation plan for the Crandall Canyon Mine site that will take into account the mine water discharge. Two of the design considerations/assumptions that will frame the final reclamation plan of the north leases will be: 1) the mine-water currently discharging from the mine works will be permanent and 2) in light of the elevated total iron levels and potential for further water quality impacts, the mine-water discharge will require perpetual and permanent treatment prior to its ultimate discharge into Crandall Creek. As a result, the proposed water treatment system is considered to be short-term. At the time of final reclamation, the proposed water treatment system will be removed after the permanent (post-reclamation) passive facility is constructed.

#### **Diversions: General Undisturbed Drainage Discussion**

The application meets the Diversions: General requirements of the State of Utah R645-Coal Mining Rules.

Following the Crandall Canyon Mine disaster on August 6<sup>th</sup>, 2007, the mine was deactivated and the portals sealed. According to the Permittee, while constructing the portal seals, much of the UD-3 culvert diversion structure (See Plate 7-5, *Crandall Canyon Drainage Map*) was damaged beyond repair. The application proposes to route the undisturbed drainage from undisturbed watershed WSUD-3 (above the portals) into the existing disturbed drainage network rather than to try and re-establish the drainage back across the portals. The drainage from WSUD-3 will be routed to undisturbed drainage ditch UD-3, then to disturbed drainage ditch DD-8, then to culvert C-1, then to ditch DD-5, then to culvert C-12 and then into the primary sediment pond.

The application provides the updated routing and design calculations for disturbed drainage ditches DD-8 and DD-5 as well as culverts C-1 and C-12. The ditches and culverts are adequately sized to safely pass the 10-year/6-hour design storm event as required by R645-301-742.323.

Several deficiencies relative to the re-routing of undisturbed watershed WSUD-3 were identified during the two previous technical reviews (Task ID's #3261 and #3415) and the Permittee was directed to update the drainage calculations to account for the proposed change.

During technical review #3261, Table 4, *Runoff Summary Drainage to Sediment Pond* in Appendix 7-4, had identified undisturbed watershed WSUD-3 as reporting to the sediment pond. The application has revised Table 4 to account for the additional 0.23 cubic feet per second (cfs) of flow reporting from WSUD-3 to the sediment pond.

The Permittee was further directed to revise Table 5, *Runoff Control Structure Watershed Summary* in Appendix 7-4. The previous application (Task ID #3261) had not identified watershed WSUD-3 as reporting to the sediment pond or disturbed drainage ditch DD-8. The table has been revised to reflect the proposed alteration of the drainage control plan.

Additionally, the Permittee was asked to revise the flow depths and flow areas identified in Figure 3, *Undisturbed and Disturbed Ditch Typical Section*. The application has revised the figure to reflect the proposed alteration of the drainage control plan and additional storm water reporting to disturbed ditches DD-5 and DD-8.

Technical analysis (Task ID #3415) had identified a deficiency relative to the control/re-routing of the storm water runoff generated in undisturbed watershed 3 (WSUD-3). Based upon site inspections conducted at the mine site, the storm water runoff generated in undisturbed watershed WSUD-3 is not being controlled/diverted to the disturbed drainage system. The Permittee was directed to revise the application to identify how the storm water runoff generated in undisturbed watershed WSUD-3 will be diverted into the existing disturbed drainage system. Additionally, the Permittee was asked to provide detailed design drawings and a narrative.

On page 7-50 of the MRP, the Permittee describes how the storm water from WSUD-3 will be routed into the disturbed drainage network. The Permittee will utilize the existing inlet structure (concrete inlet box) and existing culvert. The existing culvert is an 18" PVC pipe, which is undamaged immediately above the portal. The 18" PVC will be cut off approximately 10' below the inlet structure and fitted with a PVC 90 degree elbow. A new segment of 12" HDPE pipe will be attached to the elbow and routed over and around the intake portal and allowed to discharge into existing disturbed drainage DD-8 (See Figure 7-5). The HDPE pipe will be supported by cables anchored into the concrete inlet box and by an existing steel lamppost located above the portal. The Permittee has provided the design drawings and schematics for the installation plans for the re-routing of WSUD-3 in Figures 13A and 13B of Appendix 7-4.

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**Diversions: Miscellaneous Flows**

The application meets the Diversions: Miscellaneous Flows requirements of the State of Utah R645-Coal Mining Rules

The previous technical review of the proposed water treatment system (Task ID #3261) identified a deficiency relative to the re-routing of the mine-water to the proposed water treatment system. On page 1 of Appendix 7-65, the Permittee describes how the mine-water discharge will be routed to the proposed treatment facility. A 12" HDPE pipeline will be tapped into the existing discharge line near the upper portals and extend to the proposed treatment facility. The pipeline will be equipped with shutoff valves, which will allow for the flow of the mine-water to be routed to the treatment facility, or bypassed directly to the existing UPDES outfall. Bolts drilled into the ledge rock and epoxied into place directly below the north portals support the pipeline.

The previous technical review also identified a deficiency relative to the collection and routing of the Star Point Sandstone seepage located directly above the proposed aeration treatment facility. The quantification of flow from the seeps is necessary in order to design a final reclamation plan of the old load out area and establish the approximate original contour. To that end, the Permittee has established a concrete trough behind the existing retaining wall between the ledge rock and the back of the wall. The trough will collect this seepage water and route it through the wall and into the settling basin. In doing so, the seepage water can be monitored. Engineered drawings in Attachment 6 of the application depict the location and flow path generated with the construction of the trough. The concrete trough is discussed on page 3 of Appendix 7-65.

**Sediment Control Measures**

The application meets the Sediment Control Measures of the State of Utah R645-Coal Mining Rules.

The previous technical analysis (Task ID #3415) had identified a deficiency relative to the characterization of the proposed water treatment area as an Alternative Sediment Control Area (ASCA). An ASCA is not defined in the State of Utah R645-Coal Mining Rules. However, the Division finds that the proposed water treatment facility and the scope of its design and operation are beyond the common application of the term 'ASCA'. The previous application had referred to the proposed water treatment system as 'ASCA 12'. Such references were found on page 7-46 of the approved MRP, the table of contents, page 2 and page 37 of Appendix 7-65. In addition, 'ASCA 12' is depicted on Plate 7-5, *Crandall Canyon Mine Drainage Map*. These references as well as the depiction on Plate 7-5 have been revised.

The previous hydrologic analysis (Task ID #3261) had identified deficiencies relative to the base material and barricade/embankment construction of the proposed water treatment facility and adjacent roadway. Division staff engineer Mr. James Owen reviewed the deficiencies. Mr. Owen had identified deficiencies relative to the construction of the embankment and base material. The Permittee has provided Mr. Owen with additional embankment and base material information. Mr. Owen's technical analysis performed under Task ID #3455 did not identify any deficiencies relative to the embankment/base material

Technical analysis Task ID #3261 had identified a deficiency relative to the construction of the proposed water treatment facility. At that time, the Permittee had proposed the utilization of "precast concrete parking curbs (wheel stops)" to facilitate the oxidation of the mine-water discharge. The current application under review proposes the utilization of a Maelstrom Oxidizer Unit. As such, the aforementioned deficiency is no longer applicable.

#### **Ponds, Impoundments, Banks, Dams, and Embankments**

The application does not meet the Ponds, Impoundments, Banks, Dams and Embankment requirements of the State of Utah R645-Coal Mining Rules.

During the sealing and deactivation of the Crandall Canyon Mine following the disaster in August of 2007, undisturbed drainage culvert UD-3 was damaged beyond repair. As a result, the Permittee proposes to route the undisturbed drainage from undisturbed watershed 3 (WSUD-3) into the surface drainage system for the mine facility. The undisturbed flow would flow from culvert UD-3 to culvert C-1 to disturbed drainage ditch DD-5 to culvert C-12 and on to the sediment pond. Based upon the approved sediment pond information contained within the MRP and from field observations and recent Division field inspections, the Permittee must provide more information.

The two previous technical analyses had identified a deficiency relative to the sediment level accumulation in the primary pond at the mine site. Up to date survey information was requested based upon field inspections by Division Staff and a review of the approved sediment pond design information. Division staff had reported the water level in the pond as less than 1 foot below the principal spillway. The updated survey information was thus requested to determine whether the pond required maintenance/cleaning.

The Permittee has demonstrated that the sediment pond had the capacity to accept the re-routed drainage from undisturbed watershed WSUD-3 and still contain the 10-year, 24-hour storm event. However, that was predicated on the sediment levels being maintained below their clean-out level. Annual reports submitted by the Permittee have provided estimated sediment accumulation elevations of 7,767' for 2006, 7,768' for 2007 and 7,768' for 2008 respectively. The sediment clean-out level for the pond is 7,769'.

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A further complication is the proposed maintenance plan for the Maelstrom Oxidizer Unit. On page 32 of Appendix 7-4 and page 5 of Appendix 7-65, the Permittee states, "There may be times during required maintenance that the oxidizer must be shut down for repair or cleaning, at which time the mine discharge water will need to bypass the treatment system". The application proposes to route the mine water around the treatment system area and onto the main access road where the flow will eventually enter into disturbed drainage ditch DD-10 before reporting to existing culvert C-4 and ultimately into the main sediment pond.

The Permittee makes the assumption that if the sediment level in the main sediment pond is below the approved clean-out level and assuming that the pond has been previously decanted, the sediment pond will retain enough capacity to store the re-routed mine water for approximately 8 hours while still maintaining the requisite free board to adequately store/retain the required 10-year, 24-hour design storm event.

Based on the previously discussed deficiency requesting up to date sediment levels in the primary pond, the Permittee initiated clean-out measures of the pond. At the time of this analysis, the clean out of the sediment pond has not been completed and the Division has not been supplied with updated sediment level information. As a result, the Permittee must provide up to date survey information that demonstrates the sediment level of the pond.

The technical analysis performed under Task ID #3415 identified several deficiencies relative to the design of the proposed settling basin. They are as follows:

- *A discussion as to how it will be determined when the settling basin is in need of clean-out/maintenance and a commitment to perform such maintenance at that time.*

On page 4 of Appendix 7-65, the Permittee discusses how it will be determined that the settling basin requires clean out. The Permittee commits to removing the accumulated material when it reaches an elevation of 7,812'. Figure 3 of 5 and Figure 4 of 5 depict the elevation of the settling basin berm to be 7,814.5'. In order to identify when the accumulated material reaches an elevation of 7,812', the Permittee proposes to install several staff gauges.

The Permittee should revise the proposed clean out portion of the application. The Division finds that utilizing several staff gauges to determine when the 7,812' clean out level is reached is reasonable. However, due to the excessive staining produced by elevated iron levels, it may be impossible to accurately read an elevation or tick mark on a standard staff gauge. As a result, the Permittee should install sediment markers (adjacent to the staff gauges) whose top elevation is 7,812'. With this method, it will be readily apparent as to when the settling basin will require cleaning, as the sediment markers will no longer be visible at that point.

- *A discussion of how the clean out/maintenance of the settling basin will be performed including the associated designs and calculations. (See Above R645-301-751 deficiency for additional discussion).*

### *Clean Out Measures*

On page 4 of Appendix 7-65, the Permittee discusses the proposed clean out plan for the settling basin. The Permittee proposes to remove the accumulated iron precipitate by utilizing vacuum methods. Based upon literature of similar treatment systems for mining sites and input from Division staff, the Permittee is assuming that the accumulated iron material will be approximately 5% solid. Such a consistency would allow the removal of the material via vacuum methods. The Permittee proposes to position vacuum tanker trucks directly adjacent to the settling basin on the main access road. A semi-flexible 4" suction inlet line will be lowered into the deepest part of the basin and suck the material into the waiting trucks.

The Permittee commits to being careful not to stir up the accumulations of iron material during the vacuuming and thus allowing suspended iron particles to flow out of the pond. However, the Permittee must commit to taking additional precautionary measures to minimize the amount of suspended iron particles that could potentially flow out of the pond during the vacuuming of the accumulated iron material. Such measures could include having sediment control devices on site prior to initiating clean up activities (excelsior logs etc.) in the event that suspended iron particles begin to discharge from the settling basin.

On page 4 of the application, the Permittee commits to sampling the iron material prior to initiating clean up activities. The material will be analyzed for RCRA hazardous constituents. The application states, "If the RCRA analysis shows the material to be hazardous, it will be disposed of at an approved, licensed hazardous waste disposal facility."

Additional sampling requirements and parameters for the mine-water discharge (both pre- and post- treatment) have been established in consultation with the Division. The Permittee commits to obtaining (in addition to the UPDES permit requirements) data to determine the effectiveness of the oxidation/settling methodology. The data will be collected monthly and will be provided to the Division via e-mail. The water samples will be collected from the 12" HDPE pipeline prior to entering the oxidizer unit and also at the UPDES sampling point at the outlet of the settling basin. The analytical parameters will include:

- Iron (total, dissolved and ferrous)
- Manganese (total and dissolved)
- Aluminum (total and dissolved)
- Alkalinity
- Sulfate
- pH

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- Dissolved Oxygen

*Maintenance Measures*

On page 5 of the application, the Permittee discusses the process to be implemented when the Maelstrom Unit requires maintenance. The Permittee proposes to open the by-pass valve located ahead of the oxidizer unit thus allowing the mine-water to be directed (temporarily) into the main access road. The water would then flow down the road and around the proposed treatment facility before entering into the disturbed drainage system. The mine-water (once routed down the road and around the water treatment facility) would flow into disturbed drainage ditch DD-10 before entering culvert C-4 and ultimately reporting to the primary sediment pond for the mine site.

The Permittee must revise the maintenance section of the application on page 5 of Appendix 7-65. When maintenance is required on the oxidizer unit, the bypassed mine water must be routed in a controlled manner to the disturbed drainage system. As such, the proposed routing of the mine water down the main access road must be revised.

The Permittee must demonstrate that all drainage components utilized in routing the mine water around the water treatment area can safely convey the design flow of 1,189 gallons per minute (gpm). The design flow of 1,189 gpm was derived from the October 14<sup>th</sup>, 2009 Blackhawk Engineering, Inc. memo that discussed the design criteria utilized in sizing the proposed mine water treatment area's spillway and discharge pipe. The Permittee must demonstrate that the conveyance system from the Maelstrom Unit to disturbed drainage ditch (DD-10), disturbed drainage ditch DD-10 as well as culvert C-4 can adequately convey the aforementioned flow.

On page 4 of Appendix 7-65, the Permittee discusses the sediment pond volume relative to the amount of discharge it will receive during instances when the Maelstrom Unit must be taken off-line. The Permittee assumes that if the sediment level in the pond is below the approved clean-out level and that the pond has been previously decanted, the remaining capacity in the sediment pond provides for approximately 8 hours of mine water discharge to be routed to the sediment pond. The aforementioned scenario is based upon an assumed mine water discharge of 500 gallons per minute. Historically, the mine water discharge has approached 1,000 gallons per minute, which would cut the amount of time allowed for maintenance in half.

The Permittee must provide a commitment to notify the Division 24 hours prior to initiating any clean up/maintenance activities on either the Maelstrom Oxidizer Unit or the settling basin.

The Permittee must provide a commitment to have the primary sediment pond decanted and the accumulated sediment below the approved clean out level prior to initiating any clean

up/maintenance that would require the Maelstrom Oxidizer Unit to be taken off-line and the mine water routed to the primary sediment pond.

During instances when the Maelstrom Oxidizer Unit must be taken off-line, the Permittee must provide a means of identifying (in the field) the point at which the routing of mine water discharge to the sediment pond must stop. Based upon the Sedimentation and Drainage Control Plan in Appendix 7-4 of the MRP, a minimum volume of 2.172 acre-feet is required in order to contain the design storm event and associated sediment.

- *A discussion and demonstration as to how the retention time of the settling basin was determined. Page 1 of Appendix 7-65 states, "The unit has been sized according to the anticipated flow rate..." and "The basin has been designed with twice the volume (i.e., retention time) recommended from the bench testing in order to maximize the potential for meeting UPDES compliance levels." Upon review of the application, it's not clear what design assumptions and calculations were utilized in designing the settling basin and it's function.*

In Attachment 5 of Appendix 7-65, the Permittee provides the design considerations and basis for calculating the settling basin's volume. The Permittee assumes a removal rate of 7 milligrams/liter of iron from an assumed flow rate of 500 gallons/minute. Assuming the accumulated material is a semi-liquid (slurry) form composed of approximately 5% solids and 95% water; the yearly volume of accumulated sludge material would be approximately 8,200 cubic feet. The Permittee provides the stage/storage relationships for the proposed settling basin.

The Permittee has proposed a clean out level for the basin at 7,812'. At this level, the Permittee estimates that the settling basin will require cleaning approximately once a year.

- *Figure 1 of 5 in Attachment 7 of Appendix 7-65 must be revised to accurately depict the location of the precast concrete drop inlet box. Based upon field visits with the Permittee, the structure had to be constructed further down gradient from the spillway.*

The Permittee has revised Figure 1 of 5 in Attachment 7 of Appendix 7-65 to accurately depict the location of the precast concrete drop inlet box.

- *Figure 1 of 5 and Figure 2 of 5 in Attachment 7 of Appendix 7-65 must be revised to depict how the seeps from the Star Point Sandstone ledge will be collected. Based upon a recent field visit by Division staff, the Permittee indicated that the seep collection area would be in a different location as is depicted on the aforementioned figures.*

The Permittee has revised Figures 1 of 5 and 2 of 5 of Appendix 7-65 to depict the location of the Star Point Sandstone seep collection system.

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The previous technical deficiency (Task ID #3415) identified a deficiency relative to the proposed utilization of an open channel spillway. The Permittee was advised to demonstrate that the proposed utilization of a single open channel spillway meets the criteria established in R645-301-742.223.1.

In Attachment 6 of Appendix 7-65, the Permittee provides the design calculations for the proposed single, open-channel spillway to be utilized with the settling basin. Based upon calculations provided from Blackhawk Engineering, Inc., the expected maximum flow of 2.65 cubic feet per second (cfs), produces a flow depth of approximately 0.26' which is less than 20% of the 16" total depth of the spillway. In addition, the receiving culvert has been designed to carry the flow at a full flow diameter of 0.80', which is approximately 55% of the full flow capacity of 4.79 cfs. Per R645-301-742.223.1 the Permittee can utilize a single open channel spillway if there is a demonstration that the spillway is of 'non-erodible construction and designed to carry sustained flows'. The Permittee proposes the utilization of an 18" culvert with a 4" concrete apron at the inlet. As a result of utilizing these materials, the proposed spillway design provides for 'non-erodible' construction.

At this time, it's not a certainty that the proposed water treatment facility will be effective in reducing the total iron levels to below UPDES limits. As a result, the Division is not requiring a back-up system be in place at the time the system comes on-line. However, once the water treatment system comes on-line and three months of consecutive water samples demonstrate levels within UPDES requirements, the Permittee must commit to establishing a back-up/contingency plan for the Maelstrom Oxidizer Unit once it's been demonstrated that the mine-water discharge levels of total iron are within UPDES limits for 3 consecutive months.

**Findings:**

The application does not meet the Hydrologic Information requirements of the State of Utah R645-Coal Mining Rules. The following deficiencies must be addressed prior to Division approval:

**R645-301-742.220:** The Permittee must provide up to date survey information that demonstrates the sediment level of the pond.

**R645-301-742.220:** In addition, the Permittee must provide additional design and maintenance information for the proposed settling basin. The additional settling basin information should provide the following:

- The Permittee should revise the proposed clean out portion of the application. The Division finds that utilizing several staff gauges to determine when the 7,812' clean out level is reached is reasonable. However, due to the excessive staining that will be

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produced by the elevated iron levels in the mine water, it may be impossible to accurately read an elevation or tick mark on a standard staff gauge. As a result, the Permittee should install sediment markers (adjacent to the staff gauges) whose top elevation is 7,812'. With this method, it will be more apparent as to when the settling basin will require cleaning, as the sediment markers will no longer be visible at that point.

- The Permittee must commit to taking additional precautionary measures to minimize the amount of suspended iron particles that could potentially flow out of the pond during the vacuuming of the accumulated iron material. Such measures could include having sediment control devices on site prior to initiating clean up activities (excelsior logs etc.) in the event that suspended iron particles begin to discharge from the settling basin.
- The Permittee must revise the maintenance section of the application on page 5 of Appendix 7-65. When maintenance is required on the oxidizer unit or settling basin the bypassed mine water must be routed in a controlled manner to the disturbed drainage system. As such, the proposed temporary routing of the mine water down the main access road is unacceptable.
- The Permittee must demonstrate that all drainage components utilized in routing the mine water around the water treatment area can safely convey the design flow of 1,189 gallons per minute (gpm). The design flow of 1,189 gpm was derived from the October 14<sup>th</sup>, 2009 Blackhawk Engineering, Inc. memo that discussed the design criteria utilized in sizing the proposed mine water treatment area's spillway and discharge pipe. The Permittee must demonstrate that the conveyance system from the Maelstrom Unit to disturbed drainage ditch (DD-10), disturbed drainage ditch DD-10 as well as culvert C-4 can adequately convey the design flow of 1,189 gpm.
- The Permittee must provide a commitment to notify the Division 24 hours prior to initiating any clean up/maintenance activities on either the Maelstrom Oxidizer Unit or the settling basin.
- The Permittee must provide a commitment that prior to initiating any clean up/maintenance activity on the Maelstrom Unit or settling basin that would require the re-routing of the mine water to the primary sediment pond, the sediment levels must be below the approved clean out level of 7,769'.
- During periods when the Maelstrom Oxidizer Unit or sedimentation basin must be taken off-line and mine water is discharged to the sediment pond, the water level in the sediment pond must be monitored to ensure that adequate storage is available in the pond to contain a 10-yr/24-hr storm event. The Permittee must provide a plan for monitoring

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the water level in the sediment pond and determining when the routing of mine water discharge to the sediment pond must stop.

- Based upon the Sedimentation and Drainage Control Plan in Appendix 7-4 of the MRP, a minimum volume of 2.172 acre-feet is required in order to contain the design storm event and associated sediment. The Permittee must commit to regularly monitor the discharge rate during treatment system bypass. The monitoring is necessary in order to calculate the time available for maintenance operations based on the available pond volume and mine water discharge rate.

**R645-301-751:** the Permittee must commit to establishing a back-up/contingency plan for the Maelstrom Oxidizer Unit once it's been demonstrated that the mine-water discharge levels of total iron are within UPDES limits for 3 consecutive months.

## MAPS, PLANS, AND CROSS SECTIONS OF MINING OPERATIONS

Regulatory Reference: 30 CFR Sec. 784.23; R645-301-512, -301-521, -301-542, -301-632, -301-731, -302-323.

### Analysis:

#### Mining Facilities Maps

The application meets the Mining Facilities Maps requirements of the State of Utah R645-Coal Mining Rules.

Plate 5-3, Crandall Canyon Mine Surface Facilities and Plate 7-5, Crandall Canyon Mine Drainage Map have been revised to reflect the proposed aeration treatment facility as well as the re-routing of the undisturbed drainage from watershed WSUD-3.

#### Certification Requirements

The application meets the Certification Requirements of the State of Utah R645-Coal Mining Rules.

Revisions to Plates 5-3, Crandall Canyon Mine Surface Facilities and Plate 7-5, *Crandall Canyon Mine Drainage Map* were signed and stamped by Mr. David Hibbs (Utah registered professional engineer). In addition, Figures 7-13a thru 7-13d, *Mine-Water Discharge Treatment Facility*, were signed and stamped by Mr. Hibbs.

### Findings:

The application meets the Maps, Plans and Cross Sections of Mining Operations requirements of the State of Utah R645-Coal Mining Rules.

## RECLAMATION PLAN

### HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 784.14, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-301-512, -301-513, -301-514, -301-515, -301-532, -301-533, -301-542, -301-723, -301-724, -301-725, -301-726, -301-728, -301-729, -301-731, -301-733, -301-742, -301-743, -301-750, -301-751, -301-760, -301-761.

### Analysis:

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**Hydrologic Reclamation Plan**

The application meets the Hydrologic Reclamation Plan requirements of the State of Utah R645-Coal Mining Rules.

On page 4 of Appendix 7-65, the Permittee discusses the reclamation of the proposed water treatment facility. Due to the relatively amount of material utilized in the construction of the treatment facility (i.e. less than 500 cubic yards of material for the embankment, small pre-fabricated Maelstrom unit that's easily transported etc.) and the relatively small size of the entire treatment facility, the effort to reclaim the site will be minor.

**Findings:**

The application meets the Hydrologic Reclamation Plan requirements of the State of Utah R645-Coal Mining Rules.

**RECOMMENDATIONS:**

The application does not meet the requirements of the State of Utah R645-Coal Mining Rules. The Permittee must address the aforementioned deficiencies prior to obtaining Division approval.