

Tyrone Operations  
P.O. Drawer 571  
Tyrone, NM 88065



September 5, 2012

**Certified Mail #70100780000225012159**  
**Return Receipt Requested**

Mr. Keith Ehlert  
New Mexico Environment Dept.  
Ground Water Quality Bureau  
Mining Environmental Compliance Section  
P.O. Box 5469  
Santa Fe, New Mexico 87502

**Certified Mail #70100780000225012142**  
**Return Receipt Requested**

Mr. David R. Ohori  
Energy, Minerals & Natural Resources Dept.  
Mining and Minerals Division  
Mining Act Reclamation Program  
1220 South St. Frances Drive  
Santa Fe, New Mexico 87505

Dear Messrs Ehlert and Ohori:

**Re: Reclamation Cost Estimate Update,**  
**GR010RE, DP-1341 Operator Factor and Swell Factor**

In a meeting held on June 11, 2012 Freeport-McMoRan Tyrone Mines Inc. (Tyrone) presented updates to several of the earthwork productions factors to be used in the 2012 Earthwork Reclamation Cost Estimate. In particular, Tyrone proposed differentiating the values for the Operator Experience Factor by changing the value used for coarse grading operations from 0.75 to 1.0. Tyrone also proposed differentiating the values for the Material Swell Factor by changing the values used for material originating in loose stockpiles from 15% to 0%. In a follow-up conference call on July 17, 2012, NMED and MMD requested information to support the values proposed by Tyrone for these two factors. This letter presents Tyrone's reasoning for the proposed changes.

**Operator Factor**

The operator factor is a relative factor that is used to represent the skill of the equipment operator. Values in the Caterpillar Performance Handbook for the operator factor include 0.6 for a poor operator, 0.75 for an average operator and 1.0 for an excellent operator. In previous estimates a uniform value of 0.75 was used throughout the estimate. Currently, Tyrone is proposing to differentiate the Operator Experience Factor based on the type of grading activity.

Generally, there are two types of grading activities required for reclamation. First, there is the highly repetitive coarse grading of the stockpiles. Coarse grading means the bulk pushdown to a design slope of material originally stockpiled at angle of repose. Given the relatively low skill level required, the repetitive nature of the work, and the long time frames required, operators will quickly acquire an excellent level of experience regardless of their initial skill level. Therefore, Tyrone proposes to use an Operator Experience Factor of 1.0 ("excellent") for coarse grading operations. The proposed value for coarse grading is consistent with our reclamation experience at Tyrone.

The second type of grading is the fine grading associated with channel construction, cover material placement and cover subgrade preparation. Fine grading operations require a higher skill level and it is more difficult to reach an excellent level of experience due to the detailed nature of the work. Thus, Tyrone proposes to use an Operator Experience Factor of 0.75 (average) for fine grading operations.

### **Swell Factor**

Swell is the percentage of bank volume that increases when a material is removed from the natural state. When excavated, the material breaks up into different size particles that do not fit together, causing air pockets or voids to reduce the weight per volume. For example, if the bank material has a swell of 20%, it will take 20% more volume (1.20 times) to hold the same weight of bank material after excavation.

Stockpile material initially starts as pit wall bank material. After blasting it becomes loose material that is then transported to a stockpile. In the transition from bank to blasted loose material, the volume of material increases as it swells. During reclamation, the loose stockpile material is graded, moved or used as cover material on other stockpiles. Other reclamation cost estimation tools do not consider swell factors for material that has already been mined. However, the Nevada Standardized Reclamation Cost Estimator (Nevada Department of Environment Protection, 2009) applies a 20% swell factor to the cut volume for road recontouring but does not apply a swell factor to slope grading volumes calculated for waste rock dumps, heap leach pads and tailing impoundments.

Data provided by M3 Engineering Inc. (M3), a reclamation design engineering firm, for two stages of the 7A Far West Stockpile reclamation demonstrate near zero material cut-fill balances. Figure 1 shows the data for grading from the pre-construction topography to the rough graded stockpiles with 3H:1V outslopes. For this intermediate configuration the fill exceeded the cut by 9,435 cu yards resulting in a calculated swell of approximately 2.6%. This calculated swell of 2.6% is not considered significant given the overall accuracy of the calculation.

Figure 2 shows the data for grading from the pre-construction topography to the final ridge and valley grading. For this final configuration there was a calculated shrink of approximately 1.3%. This value is also not considered significant given the overall accuracy of the calculation. Both Figures 1 and 2 are based on field data rather than design surfaces. These data demonstrate that there is no significant swell of the stockpile material when it is regraded. The swell (+2.6%) and the shrink (-1.3%) are considered small and within the error range of the computations. Further supporting this conclusion is the fact that M3 did not use a swell factor for the stockpile reclamation design, and there was no excess material left over when the regrading was complete. This same observation applies to other reclaimed features at Tyrone but the intermediate construction data needed to enable a similar calculation is not available.

### **Summary**

Tyrone proposes to differentiate the values used for Operator Experience Factor based on the relative difficulty of the operation being performed. First, Tyrone proposes to use an operator factor of 1.0 for highly repetitive coarse grading and cover subgrade preparation. Second, Tyrone proposes to use an operator factor or 0.75 for the fine grading operations associated with cover grading and channel construction.

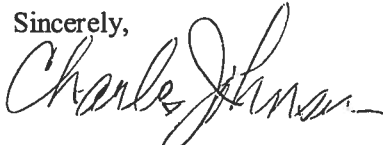
Dear Messrs Ehlert and Ohori  
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Tyrone also proposes to differentiate the values used for the Material Swell Factor. Tyrone's proposal is based on the following arguments which support not using a swell factor when grading mined materials:

- The Nevada Standardized Reclamation Cost Estimator does not use a swell factor for mined materials
- M3 does not use a swell factor when estimating grading cut and fill volumes
- Actual construction data from two stages of the 7A west stockpile reclamation project demonstrate that the measured swell and shrink are essentially zero
- The lack of excess material following grading is a tangible demonstration that the swell factor is zero.

Therefore, Tyrone proposes to use a swell factor of 0% when working with loose stockpile materials. However, Tyrone acknowledges that materials will exhibit swell when removed from their natural state. Tyrone proposes using a swell factor of 15% for materials mined from their natural state.

Sincerely,

  
for Thomas L. Shelley, Manager  
Reclamation

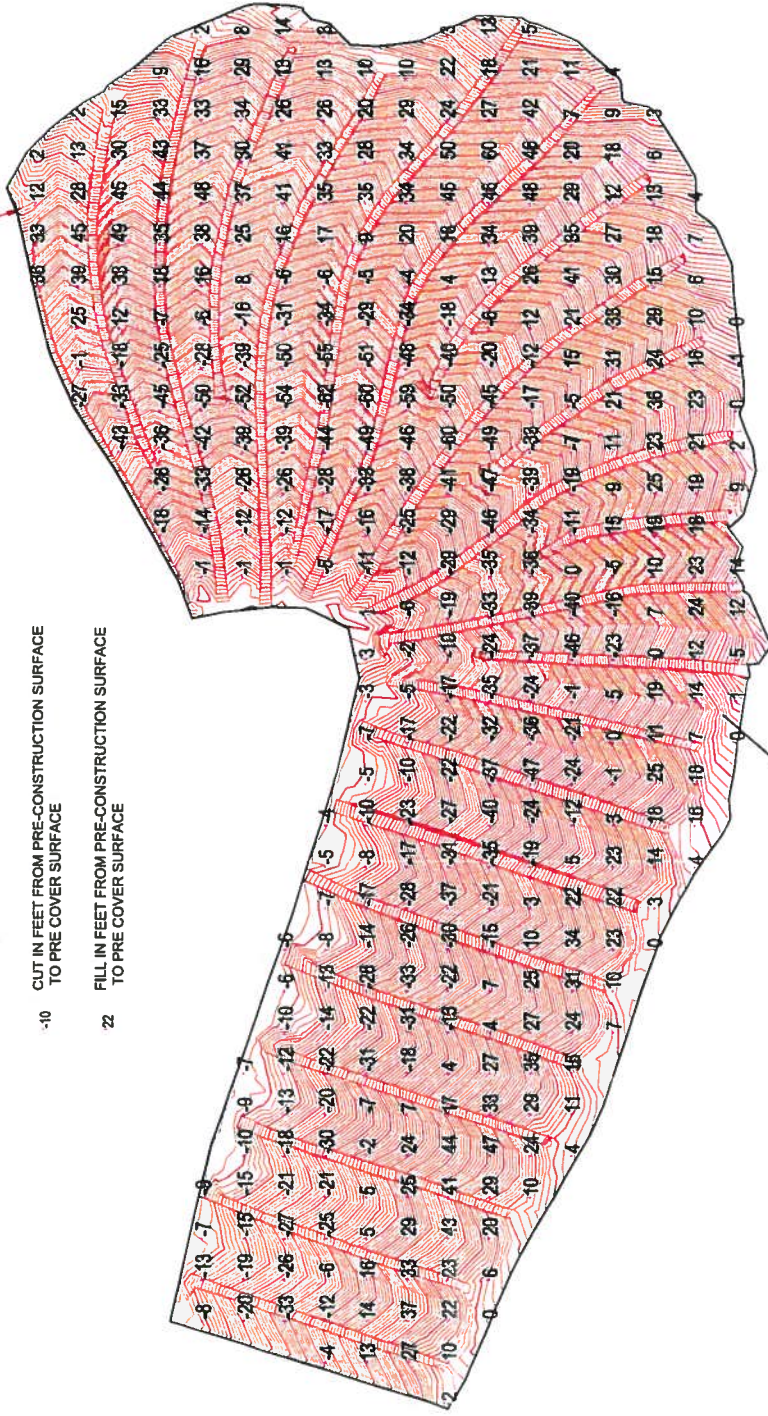
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Attachments  
20120905-100

c: Terry Fairbanks  
April Tischer



1' Contours from  
7A FAR WEST PRE COVER SURFACE

- 10 CUT IN FEET FROM PRE-CONSTRUCTION SURFACE TO PRE COVER SURFACE
- 22 FILL IN FEET FROM PRE-CONSTRUCTION SURFACE TO PRE COVER SURFACE



**SURFACE : \*7A FAR WEST SWELL SOUTH AND EAST OUTSLOPE\***  
 Base Surface 2004 Aerial Pre Construction  
 Comparison Surface 7A FAR WEST PRE COVER COMBINED 12-10-09  
 Cut 386,239 Cu. Yd.  
 Fill 380,977 Cu. Yd.  
 Net 5,262 Cu. Yd.<Cut>

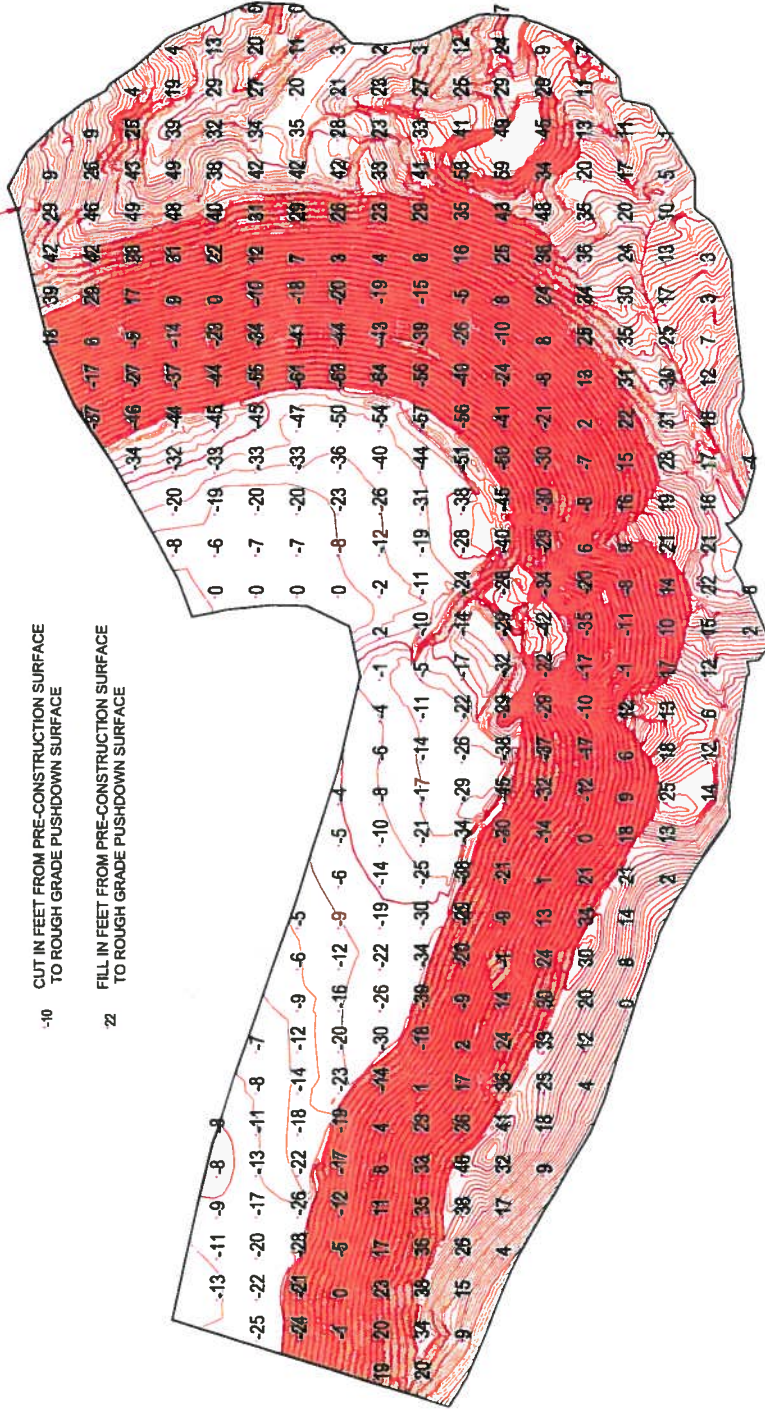
**7A FAR WEST**  
 Pre-Construction to Pre-Cover Cut to Fill Figure  
 July 31, 2012



1' Contours from 2004 Aerial Pre Construction Topo

-10 CUT IN FEET FROM PRE-CONSTRUCTION SURFACE  
TO ROUGH GRADE PUSHDOWN SURFACE

22 FILL IN FEET FROM PRE-CONSTRUCTION SURFACE  
TO ROUGH GRADE PUSHDOWN SURFACE



SURFACE : \*7A FAR WEST SOUTH AND EAST ROUGH GRADE AS BUILT\*

Base Surface  
2004 Aerial Pre Construction  
Comparison Surface  
Rough Grading Topo As Built  
Cut  
371,837 Cu. Yd.  
Fill  
381,272 Cu. Yd.  
Net  
9,435 Cu. Yd. <Fill>

**7A FAR WEST**  
Pre-Construction to Rough Grade Pushdown Cut to Fill  
Figure July 31, 2012