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23 January 2009

Brian Wesley
Mine Manager
Ashton Underground Mine
PO Box 699
SINGLETON NSW 2330

Dear Brian,

**SUBSIDENCE IMPACTS ON NARAMA DAM AND RAVENSWORTH VOID 5 DAM**

As requested, please find herein our assessment of the subsidence impacts from mining at Ashton Coal Mine on the existing Narama Dam and the proposed Ravensworth Void 5 Dam and our recommendations for monitoring.

Our assessment indicates that mining at Ashton Coal Mine is not expected to cause any perceptible impacts on either the existing Narama Dam or the proposed Void 5 Dam at Ravensworth Open Cut Mine. Although mining at Ashton comes within the Dams Safety Notification Area for both dams, they are both sufficiently remote from longwall and miniwall mining activity at Ashton to be unaffected by normal mining subsidence. Far-field horizontal movements may occur, but these are likely to occur on such a broad scale and be of such low magnitude that they have no perceptible impact on the dams.

## 1. SITE DESCRIPTION

Figure 1 shows a plan of the two dams relative to the proposed longwall and miniwall panels at Ashton Coal Mine.

Narama Dam is an earth fill dam with a capacity of 1,000ML, but we understand that storage is maintained at less than 700ML to avoid excess flow through the dam wall. Figure 2 shows photographs of the crest of Narama Dam and from near the edge of Miniwall 9. The nearest point on the toe of Narama Dam to the proposed mining is approximately 280m from the goaf edge of Miniwall 9. The overburden depth is approximately 195m in this area. The surface topography is essentially flat.

The construction detail of the proposed Ravensworth Void 5 Dam has not been provided for this assessment, but it is understood that the dam wall will be constructed as a bridge across an existing open cut void using overburden spoil. The nearest point on the toe of the Ravensworth Void 5 Dam to the proposed mining is approximately 250m from the goaf edge of Longwall 9. The overburden depth is approximately 160m. The surface topography is gently rolling as a result of being built up as an out-of-pit spoil dump for Ravensworth Open Cut.

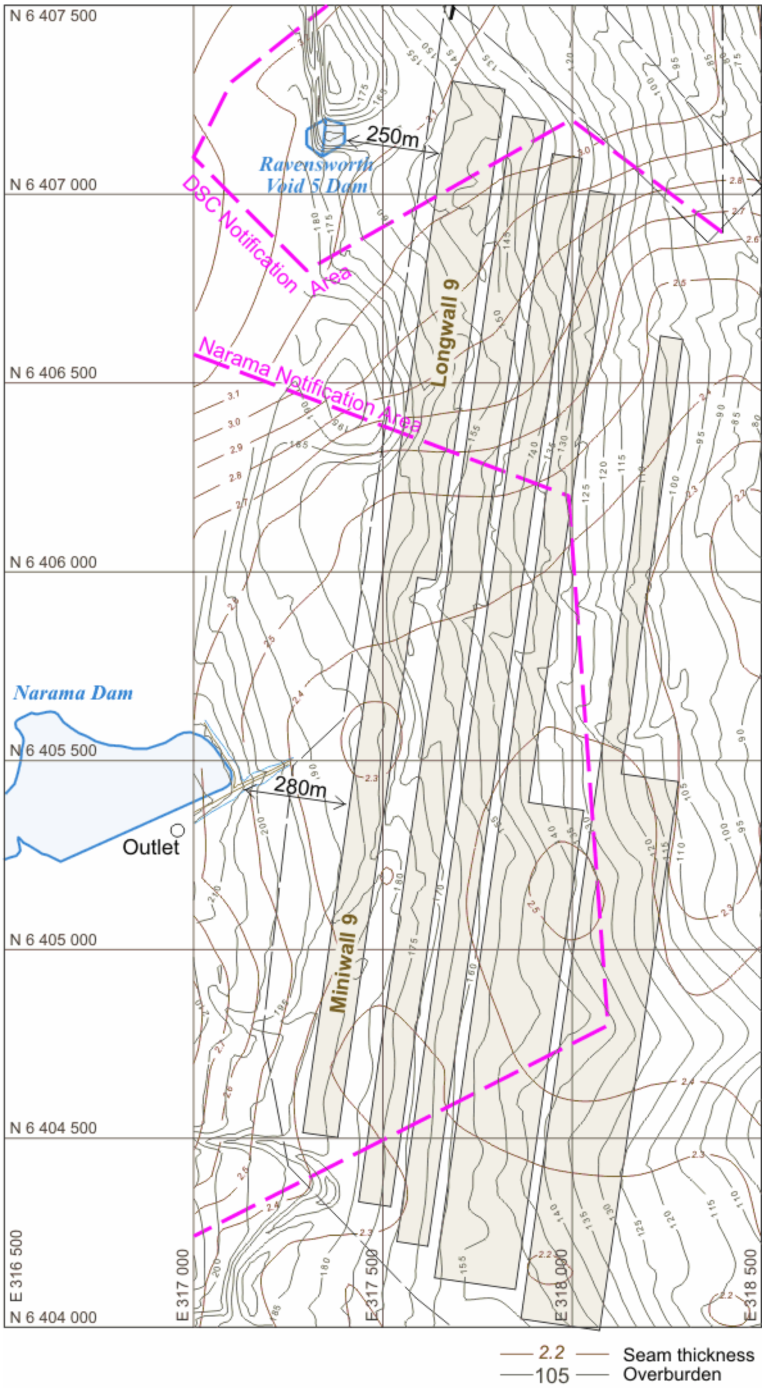


**Figure 1 Site plan showing location of Narama Dam and Ravensworth Void 5 Dam.**

a)

b)

**Figure 2 Narama Dam.**

## 2. PREDICTED SUBSIDENCE AND SUBSIDENCE IMPACTS

### 2.1 Narama Dam

Maximum subsidence above Miniwall 9 is expected to be approximately 200mm in the centre of the panel. Vertical subsidence is expected to become imperceptible at a distance from the goaf edge of much less than 26.5° angle of draw given the low level of maximum subsidence over the miniwall panel. An angle of draw of 26.5° is equivalent to a distance of approximately 90m. No vertical subsidence is expected to occur at any point on Narama Dam.

Previous subsidence monitoring from Ashton over longwall panels at shallower overburden depths and at other sites at greater overburden depths indicates that perceptible far-field horizontal subsidence movements may extend to a distance of up to between two and five times overburden depth from the goaf edge as shown in Figure 3. This data is based on conventional longwall panels where maximum vertical subsidence is typically 1-2m. Monitoring data is not available for maximum vertical subsidence over the panel of less than 200mm. Although far-field horizontal movements are expected to decrease with the magnitude of vertical subsidence, it is conservative to use far-field monitoring data from conventional longwall mining for assessment purposes.

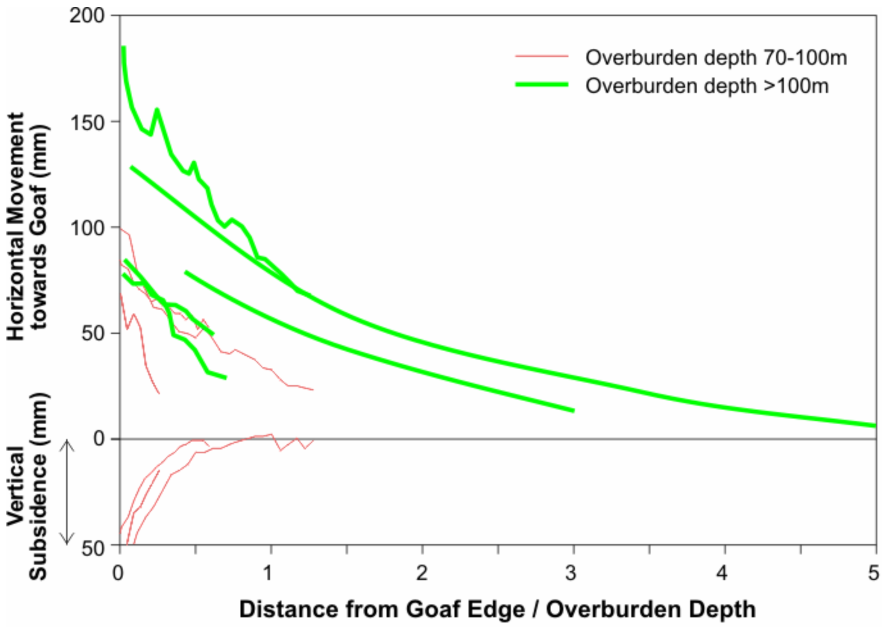


**Figure 3 Examples of vertical and horizontal subsidence movements measured at Ashton and elsewhere.**

The differential horizontal movements caused by far-field effects are small. The distance between the nearest point to Miniwall 9 on the toe of Narama Dam and the furthest point from Miniwall 9 is approximately 300m. The differential movement over a distance of 300m starting 280m from the goaf edge is approximately 30mm. The horizontal strain associated with this level of differential movement is approximately 0.1mm/m and the actual strains are expected to be lower by a factor of approximately seven given the lower magnitude of vertical subsidence over the mined panel.

A horizontal strain of 0.1mm/m is too small to be detectable by conventional survey techniques used for subsidence monitoring and is of no practical significance for the dam or dam wall of an earth dam. There is not expected to be any perceptible impact on the dam wall of Narama Dam from the proposed mining at Ashton Coal Mine.

There is a remote chance that differential horizontal movements may be concentrated on some of the concrete take-off infrastructure located on the downstream face of the dam if the buried pipeline moves relative to the rest of the structure, but these differential movements are expected to be less than thermal stresses generated by natural seasonal and diurnal temperature variations.

### 2.2 Proposed Ravensworth Void 5 Dam

Maximum subsidence above Longwall 9 is expected to be approximately 1200mm in the centre of the panel. Vertical subsidence is expected to become imperceptible at a distance from the goaf edge of much less than 26.5° angle of draw. No vertical subsidence is expected to occur at any point on the Void 5 Dam.

The dam is approximately 100m from toe to toe, so differential horizontal subsidence movements of up to approximately 15mm are considered possible based on previous monitoring of far-field subsidence movements. The horizontal strain of 0.15mm/m is expected to be imperceptible for all practical purposes. The material used to construct the dam wall is expected to be able to accommodate this level of movement without impact. Horizontal movements associated with natural consolidation of the spoil material are expected to be much larger than differential subsidence movements caused by the proposed mining at Ashton.

## 3. Recommendations for Subsidence Monitoring

Subsidence monitoring of Narama Dam is aimed primarily at confirming that there are either no perceptible subsidence movements at the dam or that any movements that are measured are within the expected range.

A subsidence monitoring line perpendicular to Miniwall 9 that extends toward the closest point of Narama Dam is recommended to confirm the extent of vertical and horizontal subsidence movements away from Miniwall 9. A survey monitoring and control strategy that allows measurement of horizontal movements in three dimensions to a repeatability of 10mm is recommended.

Subsidence monitoring of the existing survey marks on the embankment of Narama Dam is recommended to confirm that there are no significant changes. Several base surveys prior to the commencement of Miniwall 9 are recommended to confirm the repeatability of the survey technique.

A subsidence monitoring line perpendicular to Longwall 9 that extends toward the closest point of the Void 5 Dam is recommended to confirm the extent of vertical and horizontal subsidence movements away from Longwall 9. The detail of a monitoring strategy for the Void 5 Dam should be determined once the dam has been constructed.

If you have any queries or would like further clarification of any of these issues, please do not hesitate to contact me directly.

Regards

Ken Mills
Senior Geotechnical Engineer