Memorandum

To:

CC:

From: Robert Ellison

Date: 6/10/2010

Re:

Construction of the sludge lagoons commenced on 28 June 2010. Initial activities included clearing and grubbing and sludge removal. Up to the 1st payment certificate – there were minor problems to do with smoke, a diversion channel, excessive clearing, etc. Minor issues typical of a construction project which were solved as they arose. Sludge stockpiling posed problems of storage – with excess volumes – that were not identified in design. This problem was resolved using a 25 tonne excavator to increase the height of the pile – as an extra to the contract. Associated problems with excess sludge necessitated extending the area of the storage with additional clearing – again at an additional cost.

During sludge excavation – a deep, dark coloured silt and clay alluvium was identified in areas that were not included in geotechnical logging on the site. It was very difficult to distinguish this material from sludge at first – and this probably added to the stockpiling problems. The situation only became clear after exploratory excavation to depth. The material – while having acceptable physical properties for inclusion in the works - is saturated clay that provides very poor foundation material and is very difficult to work effectively.

On commencement of wall construction – it quickly became apparent that the existing walls had nowhere near the volume required to construct the works. The reason was initially unclear. Until the real extent of the problem became clear – it was thought that the excess sludge volume as well as a 'clearing and grubbing' stockpile contributed. These are contributing factors but not sufficient to explain the total discrepancy. The figures suggest that the total discrepancy is up to 20,000 m^3 of additional cut to fill. The cost and time implications for the Contractor must be significant.

The material in the existing walls was exhausted and borrow pits were opened relatively early to enable the works to continue. The borrow pits were necessarily limited in size and relatively deep as suitable material was only available in select locations. Other areas across the lagoon floors contained far too much rock, and very large rock, to be practical. This again was not identified in the original geotechnical report.

The alluvium identified following removal of sludge posed additional construction difficulties. Notwithstanding the poor foundation properties – and on advice from GHD – it was decided to 'bridge' the alluvium with better quality material for wall construction.

Test results for wall compaction and moisture content were provided for the 2nd payment certificate. These showed either passing results, a number of locations that had passed, results that had passed on retest and some failures. On that basis it appeared that sufficient testing was occurring and that the testing regime was systematically addressing compaction failures on the basis of a Level 1 test regime to AS3798. A 75% progress payment was made for the cut to fill on the walls. No payment was made in respect of the clay core as no results had been provided for physical properties – permeability, Emerson Class and Atterberg limits.

Little attention was paid to optimum moisture content. It is first of all an impractical undertaking on the site. Nuclear gauge testing provides both a moisture content and a field density. Field density provides a qualitative guide to compaction – although the range of MDD from approximately 1.12 to 1.93 tonnes/m^3 makes a strict quantitative assessment difficult. OMC for materials on the site ranges from 11% to 50%. It is impossible to say whether field moisture measurements are above or below OMC until such time as the laboratory tests are complete. With multiple tests and limited lab facilities – one day at a minimum and most likely 2 for results to be available. A day further on and the test location is buried under another metre of wall. I can see no practical way around this problem. The only solution would be to stop construction for 2 days after every layer.

Secondly, there is minimal theoretical justification for specifying both MDD and OMC. Section 2(r) of AS3798 states:

'The optimum moisture content determined by laboratory methods is only a guide for field construction, as the optimum moisture content for compaction under field conditions will depend on the material type, equipment used, the layer thickness and the nature of the foundation. In general, the heavier the compaction effort or the thinner the layer, the lower the optimum moisture content. Increased compaction effort may cause the soil to approach saturation and higher densities may not result.' AS3798 specifically excludes water retaining structures. However, it is the standard for earthworks and the principles of compaction are universal.

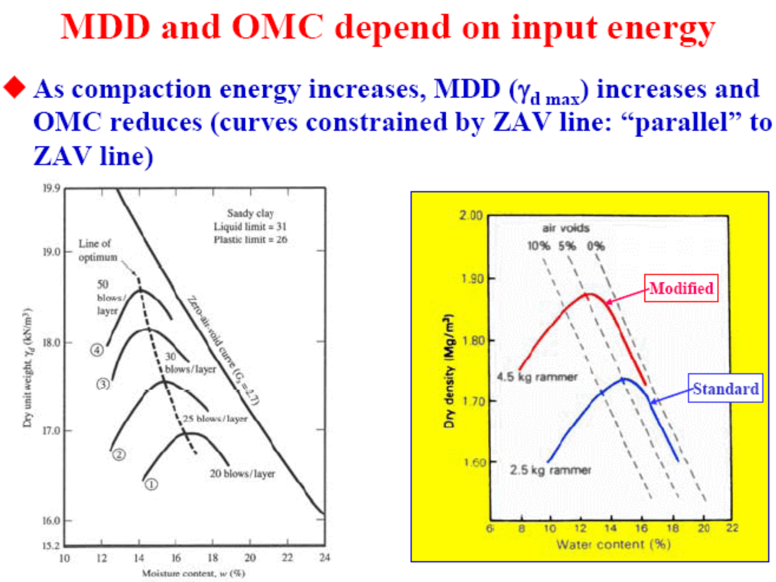

Figure 1: MDD and OMC vs. Energy Input

Figure 1 shows the shows the changes in MDD and OMC with energy input. Compaction reduces the air content of a material. The zero air voids line is a limit on compaction as pore water pressure changes from negative to positive when air voids are reduced to zero.

Soils across the site were moist to wet clay. There were occasional additons of water – but most effort was put into drying soil – particularly the black alluvium – through repeated working with the sheetsfoot rollers. Soils routinely passed a field moulding test.

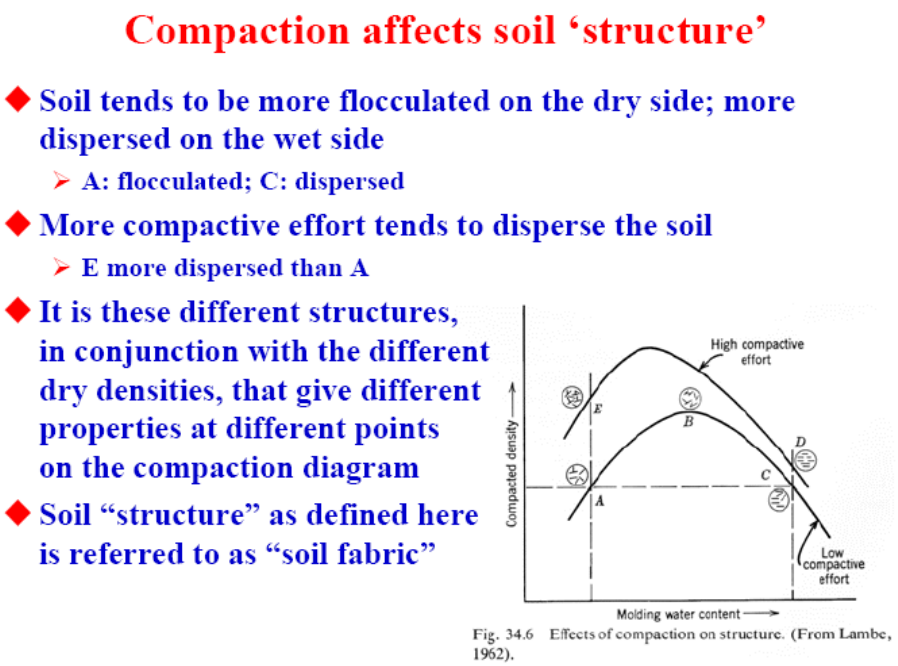

Figure 2: Effect of compactive effort on soil structure

The structure of soils change with high compactive effort and/or high water content. Each layer was approximately 100mm thick after compaction by sheepsfoot rollers – one of 12 tonne and one of 20 tonne. The methodology was suitable for the material and the compactive effort was high.

Soil dispersion has implications for permeabilities in particles disperse and block voids. Reduced permeabilities result from compaction at higher compactive effort or moisture content. It should be noted that permeabilities (at 98% compaction) for all materials used in the walls exceed that specified for the clay core by 2 to 3 orders of magnitude.

Camco submitted 43 compaction tests for the 3rd claim. Of these 20 passed and 23 failed. 17 of the failures had dates and samples that suggest that they were available at the time of the 2nd claim indicating that they may have been deliberately withheld. After discussion with Camco they were given a further week to submit additional information that supported their Claim. Their total information on compaction and moisture content – as analysed by GHD - is included in an enclosed spreadsheet. Compaction results were sorted by pass or fail in the spreadsheet and imported into Civil3D. These were than manually sorted for repeat tests at or near the same location and level. The remainder showing fails that had not been retested is shown in Attachment 1.

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In general the results show 2 spots at 95% compaction in the outer wall, one anomalous result outside the wall and several more in internal walls. Although I might add that 3 of the lowest results previously supplied have dropped off the list. The results for compaction suggest minimal risk – although I am reluctant to make a call until it is certain that all results have been supplied. To this end we have asked Cardno Bowler – as the geotechnical testing authority for Camco - for a Level 1 inspection report to AS3798 and will review this information when available. We have also suggested that Cardno Bowler specifically review moisture content and the implications of this and as well to suggest ways forward in relation to soft spots in the wall.

The initial analysis by GHD was compromised by a double correction for field moisture content. This produced unrealistic densities (less than a SG of 1 in some cases – i.e. floating walls) and impossibly large voids ratios. Once this was corrected – the materials graphed in a much better way.

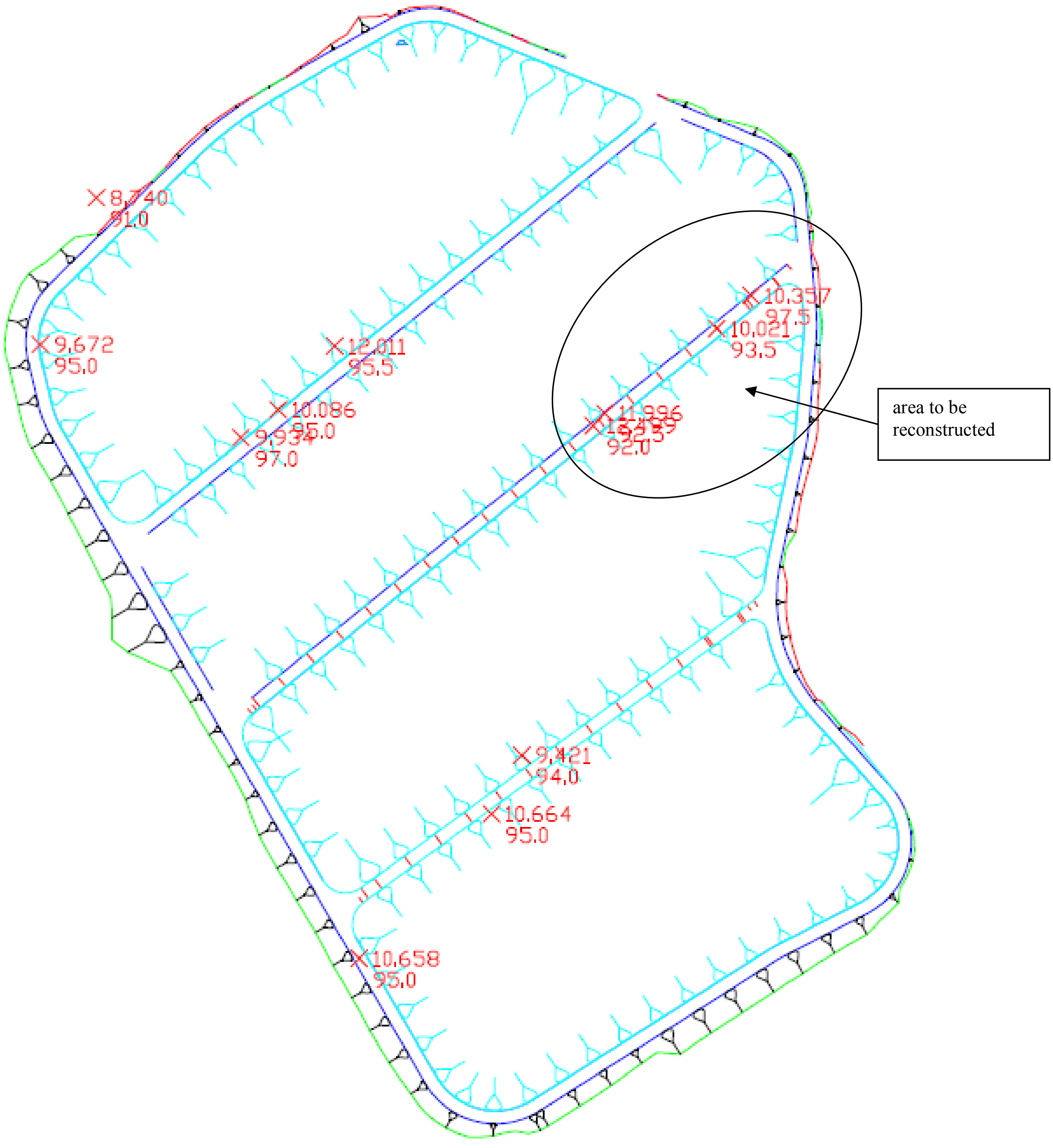
GHD were concerned with moisture content in relation to permeability – and suggested that as most tests were outside of specified moisture content ranges this was a problem we had not considered. I think this is an over reaction. A typical soil with 10% water content (by weight) has 25% voids. The same material with the same dry density (tonnes/m^3) with 5% moisture has 25% voids – 12.5% water and 12.5% air. It is both the voids (total for air and water) and soil structure (flocculation and dispersal) that determine permeability. Soil moisture (according to As3798) is specified as a guide to achieving compaction with minimal effort. I think GHD have very much the wrong end of the stick on this – but it is something we may now need to deal with. As such – we have asked Cardno Bowler to address this issue and provide their take on this issue.

The results for field moisture results that are out of specification are shown in attachment 2. This includes most of the testing across most of the walls.

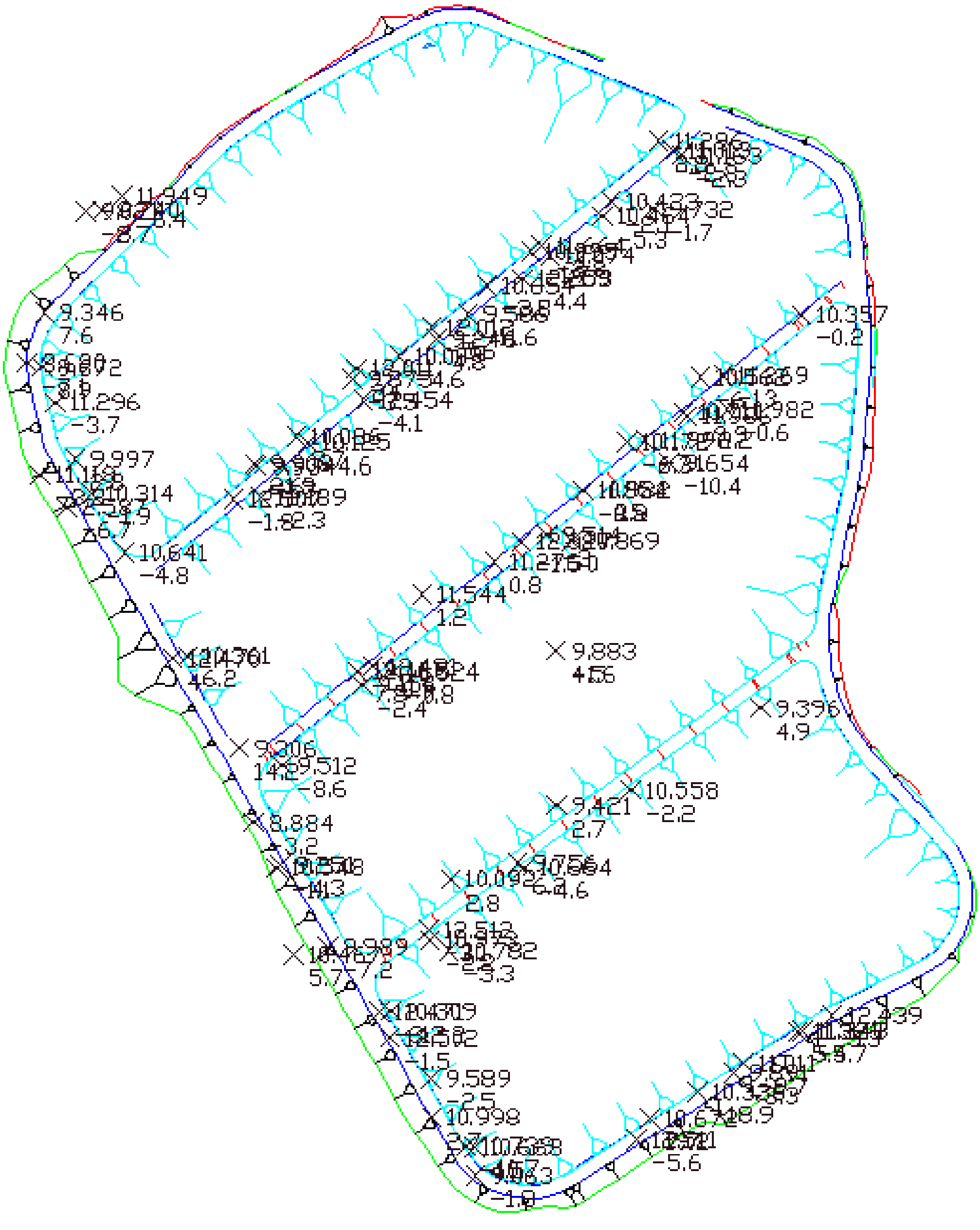
Separately, GHD have been asked to provide a report by mid this week to discuss the current situation as determined by testing, to provide options for moving forward that ideally didn't involve reconstruction and to assess the level of risk to the Principal and best means of managing risk.

We are intending to review and compare options to arrive at the best way forward. My inclination is to reconstruct in the area shown in Attachment 1.

R I Ellison BE(Hons), MEnSc, CPEng, RPEQ



Attachment 1: Locations and levels of compaction results that are less than 98% standard



Attachment 2: Locations and levels of moisture results out of spec