

Calga Sand Quarry  
Southern Extension

Surface Water Assessment

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Specialist Consultant Studies Compendium  
Part 2



# Calga Sand Quarry Southern Extension

## Surface Water Assessment

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## EXECUTIVE SUMMARY

This report presents the results of an assessment of the existing surface water conditions within the catchments surrounding the proposed Southern Extension (Stages 4 and 5) of the Calga Sand Quarry located on the Somersby Plateaux about 2 km north of the Sydney - Newcastle Freeway. The report provides a compendium of local climate, stream flow and water quality data and describes the existing drainage patterns of the Project Site and the hydrologic characteristics of the catchments.

Water quality monitoring from the local creeks, the existing quarry operations and groundwater indicates that the existing quarry operations have negligible impact on suspended solids and oil & grease in the overflow from the site. All water sources have pH that is lower than the ANZECC default trigger criteria, indicating that this is a characteristic of the locality and that the existing quarry has minimal impact.

In the absence of any flow data from the local creeks, a rainfall/runoff model has been developed using the AWBM computer model from the *Rainfall Runoff Library* published by the CRC for catchment hydrology. The model parameters have been derived from historic flow data from two rivers that drain from the Somersby Plateau. Estimates of the flow regime in the creeks that drain from the catchments surrounding the Southern Extension have been made by applying 38 years of daily rainfall and evaporation data to the AWBM model. The model data indicates that the average annual runoff from the affected catchments is of the order of 395 ML/year in an average year, or 19% of rainfall.

The water management system proposed for the Southern Extension involves the capture and reuse of runoff for sand processing and dust suppression. The majority of water required for processing is recycled within the site and an estimated 208 L of “top-up” water is required per tonne of product to account for evaporation losses, water needs for dust suppression and the water that remains “locked up” within the waste silt that is generated by the washing process. Four water storages will be constructed along the down-slope side of Stage 4 into which all runoff from that stage will drain. Stage 5 will be developed as a “closed” drainage system in which all runoff from the pit will be retained within the pit during extraction operations and following rehabilitation. The water within the pit will establish its own level depending on the balance between runoff, rainfall, evaporation and seepage loss.

This report provides details of the design requirements for various minor water storage and diversion structures that will be required to manage water and control sediment runoff from the site. The design requirements for all these structures have been developed to be compliant with the requirements of the draft document by the Department of Environment and Climate Change and the Sydney Metropolitan CMA (2007) “*Managing Urban Stormwater: Soils and Construction: Volume 2E - Mines and Quarries*”.

A detailed site water balance model has been developed that characterises all the gains and losses from the water cycle system within the quarry and the effect of the water retained by the quarry on the flow regime of the creeks. The water balance model takes account of the profound changes in the hydrologic processes that occur during quarrying, including processes that lead to an increase in the proportion of rainfall that becomes runoff:

- removal of vegetation which leads to a significant reduction in the loss of water by evapotranspiration,
- temporary stockpiling of overburden material to create an additional depth of soil profile;

- removal of friable sandstone to create a surface with negligible moisture storage capacity and low permeability;
- placement of waste silt from sand washing into silt cells in which the surface remains covered in water; and
- placement overburden on top of silt cells to create a surface which has limited deep drainage because of the low permeability of the underlying silt.

The progressive changes in the areas of various surfaces over the life of the quarry lead to changes in the runoff characteristics and the water balance of the Project Site. In essence, Stages 4 and 5 (31 ha and 12 ha respectively) receive 534 ML of direct rainfall in an average year, of which about 100 ML currently drains to the creeks by way of surface runoff and groundwater base flow.

The water balance analysis indicates that the proposed operations will be capable of relying on runoff harvesting from within the operating area to sustain the proposed level of production with some potential minor requirement for transfer of water from Stage 3 to Stage 4 between Years 4 and 12. Thereafter, it is assumed that rehabilitation of Stage 3 will be complete and water held in the dams within Stage 3 will not be accessible for supplementing supply for sand processing within Stage 4. Notwithstanding the requirement for top-up water of about 208 L per tonne of product (208 ML/year once the quarry reaches full production of 1,000,000 tpa), the water balance analysis indicates that the impact on creek flow will vary from an increase of up to 20 ML/year in Year 2 to a reduction of 71 ML/year in Year 22. Over the life of the quarry the average reduction in stream flow as a result of quarry activities is expected to be about 31 ML/year.

Once quarry activity and site rehabilitation is complete, runoff from Stage 4 will be allowed to drain into the water storage dams (that will remain) and overflow into the Creek C. Notwithstanding the fact that Stage 5 will remain a “closed” valley, and not contribute to surface runoff, the analysis indicates that the increased runoff from Stage 4 (as a result of relatively shallow “soil” placement over low permeability silt) will lead to an average increase of flow of about 90 ML/year.