SUPPLEMENTARY GEOTECHNICAL AND SALINITY INVESTIGATION

FLOOD STORAGE BASINS AT ALSPEC INDUSTRIAL PARK 221-227 AND 289-311 LUDDENHAM ROAD, ORCHARD HILLS NSW

Prepared for **HBB Property Pty Ltd**

19 December 2024

Ref: DRM P23.1039-R07r1.D1

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Site	Flood Storage Basins At Alspec Industrial Park 221-227 And 289-311 Luddenham Road, Orchard Hills NSW
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LIMITATIONS AND GENERAL NOTES

LIMITATIONS

The report was prepared in accordance with the scope agreed between **Development Risk Management Pty Ltd (DRM)** and the client. The scope of services was agreed to with due consideration of a range of factors including time, budget, access and site constraints. The report is provided for the specific purpose as described in the report. The report may not contain sufficient information for purposes other than that described in the report.

The information in this report is considered accurate at the date of issue.

In preparing the report, DRM has relied upon information provided by the Client and/or their Agents. Such data may include surveys, analyses, designs, maps and plans. DRM has not verified the accuracy or completeness of the data except as stated in this report.

 Where information from this report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimise the likelihood of misinterpretation.

Unless otherwise stated, the report, or sections of the report, should not be used as part of a specification for a project, without review and agreement by DRM.

The report must be read in its entirety and should be kept in its entirety without separation of individual pages or section or attachments.

DRM cannot be held responsible for interpretations or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

GENERAL NOTES

Geotechnical and environmental reporting relies on the interpretation of factual information based on judgment and opinion and is far less exact than other engineering or design disciplines due to a range of uncertainties and variabilities. Geotechnical and environmental reports are for a specific purpose, development and site as described in the report and may not contain sufficient information for other purposes, developments or sites (including adjacent sites) other than that described in the report.

Subsurface conditions can change with time and can vary between test locations. Therefore, actual conditions in areas not sampled may differ from those predicted since no subsurface investigation, no matter how comprehensive, can reveal all subsurface details and anomalies. Anthropogenic impact and natural causes can also affect subsurface conditions and thus the continuing adequacy of these reports. Seasonal variations can also affect subsurface conditions. DRM should be kept informed of any such events and should be retained to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Data obtained from nominated discrete locations, subsequent laboratory testing and empirical or external sources are interpreted by trained professionals in order to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions in accordance with any relevant industry standards, guidelines or procedures.

DRM P23.1039-R07r1

Thursday, 19 December 2024

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Supplementary Geotechnical and Salinity Investigation
Flood Storage Basins At Alspec Industrial Park
221-227 And 289-311 Luddenham Road, Orchard Hills NSW

Development Risk Management Pty Ltd (DRM) is pleased to present the revised Supplementary Geotechnical and Salinity Investigation for site located at Flood Storage Basins At Alspec Industrial Park 221-227 And 289-311 Luddenham Road, Orchard Hills NSW (the site) prepared by our subcontractor Core Geotech.

I trust this report meets your current requirements. Please do not hesitate to contact me on 0450 715 562 or nalin_desilva@drm.ltd if you have any queries.

For and on behalf of Development Risk Management Pty Ltd,

NALIN DE SILVA

Principal Environmental Engineer

This report must be read in conjunction with the ***Limitation and General Notes*** page at the front of this report.

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Document Delivery

CG provides this document in either printed format, electronic format or both. The electronic format is provided for the client's convenience and CG requests that the client ensures the integrity of this electronic information is maintained.

Where an electronic only version is provided to the client, a signed hard copy of this document is held on file by CG and a copy will be provided if requested.

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Appendix A: Information About this Report

1 Introduction

Core Geotech Pty Ltd (CG) report CG24-0297-A of April 2024 (Ref 1) included the results of a geotechnical investigation of a part of the site located at 221-227 & 289-311 Luddenham Road, Orchard Hills NSW which is being considered for the construction of three flood storage basins as a part of the proposed future Alspec Industrial Business Park. The scope of the investigation included assessment of geotechnical conditions affecting the design and construction of the basins and assessment of excavated materials for use in bulk earthworks proposed for the industrial park.

Subsequently, the client requested an assessment of geotechnical conditions and salinity within the proposed basins in the context of the proposed construction of Outer Sydney Orbital (OSO), a major road infrastructure associated with Western Sydney Airport.

The geotechnical investigation covered in CG Report CG24-0297-A comprised site inspection, non-intrusive and intrusive site investigations followed by laboratory testing of selected samples, engineering analysis and reporting for the proposed basins.

This supplementary report considered the aspects of Integrated water cycle management report (Henry& Hymas -Ref 3) and Groundwater Impact Assessment (Eco Logical – Ref 2)

2 Scope of Works

The scope of work included a review of salinity management guidelines for Hawkesbury Nepean catchment (Ref 3), review of subsurface conditions and test results including textural classification and salinity included in CG24-0297-A and preparing this supplementary report outlining salinity management aspects for the OSO and detention basin area within the Alspec Industrial Park.

3 Project Description

Based on the supplied information, it is understood that the proposed project involves excavation of three (3) flood storage basins (1, 2 and 3) near the north west boundary of the site. The depth of excavation ranges from 2m to 4m below the existing surface grade. It is understood that proposed OSO where the road would be mostly overhead would be in this area and may include ancillary structures associated with the OSO. The proposed location of three (3) flood storage basins is shown in Figure 1 below.

It is understood that the OSO would be located within the western portion of the site excluding the environmental conservation zone located northwest of the site.

Figure 1: A Master plan showing the flood storage basins

4 Site Description

The proposed site is irregular in shape and located on the west of Luddenham Road. The site is bounded to the north by Patons lane, to the south by rural residential properties, to the east by Luddenham Road and to the west by an under construction north south rail track. The site includes an electrical easement on the northwest side. The area within the proposed basins was generally vacant and the vegetation comprises naturally occurring grass and shrubs. Two dams were observed within and near the footprints of the basins. One Dam covers only a small northern area of basin 1 and the second dam covers a small portion of basin 2 near the southeastern area.

Based on the Six map NSW topographic map the general direction of the slope facing northeast. However, the site has an undulating terrain throughout, with a part of the site trending slope of 1° to 2º to toward the northwest boundary. Based on Henry & Hymas report, the site comprised three catchment areas, the largest one being the western catchment (49.59ha) flowing towards the west. The northeast catchment (2.68ha) and south eastern catchment 11.35ha) both flow towards the east to Luddenham Road.

It is understood that the proposed earthworks have been designed to maintain the pre-development catchment pattern.

5 Stormwater and Groundwater Management

The storm water network has been designed to safely convey minor storm events (1:20yr ARI storm) via a pit and pipe stormwater system and major storms (1:100yr ARI Storm) via overland flow route (Henry & Hymas Ref 3). The objective of the stormwater system is to ensure no negative impact on downstream ecosystems and waterways through the implementation of water quality systems, detention basins and sediment control. The stormwater from the developed area will be managed using rainwater tanks, storage basins, and irrigation areas. Henry &Hymas stormwater model is based on the development of warehouses and associated infrastructure. It has been assumed that the effect of structures on OSO would be negligible for the overall water balance.

The total storage basin volume allowed in the stormwater management plan for the three catchments amounts to 15,800m3 and the total irrigation area of 13.29ha. In addition, each warehouse will have rainwater tanks to provide storage during minor storms.

The groundwater impact assessment (Eco Logical Ref2) has been prepared to comply with Secretary's environmental assessment requirements to reduce or eliminate impact on groundwater and groundwater dependent eco systems. The Groundwater Impact Assessment report has considered the site water balance including rainfall, evapotranspiration and infiltration.

It is noted that the potential evapotranspiration is 1209mm/year and the actual evapotranspiration of 700mm/year. The report recommended planting deep rooted perennial grasses to maximize the evaporation and reduce recharge to groundwater and to reduce excess overland flow outside the catchment.

Irrigation rates of 0.4kL/m2/year (600mm/year) and rainfall of 782.8mm/year have been assumed in the water balance modelling.

Infiltration rate of 0.635mm/hour has been assumed which is the mid-range for the type of soils encountered.

6 Ground Model

6.1 Soil Landscape and Geology

The NSW Environment & Heritage eSPADE web application identifies the soil landscape of basin 1 and 3 is underlain by South Creek (sc) alluvial soils and of basin 2 is Blacktown (bt) residual.

In reference to Penrith 1:100,000 Geological Series Sheet 9030 (Edition 1) 1991 by Geological Survey of NSW Department of Mineral Resources the site to the northwest is underlain by Quaternary Alluvial soils and to the east is underlain by Triassic Middle-aged geology Wianamatta Group Rw (undifferentiated) Bringelly Shale (Rwb) which comprises shale, carbonaceous claystone, claystone, laminate, fine to medium grained lithic sandstone, rare coal and tuff.

Borehole and test pit investigation included in DRM (April 2024- Ref 1) showed the subsurface in the alluvial area to comprise mostly Silty Clay and Sandy Clay to the termination depth in the range 2m to 3m. The subsoil in Blacktown residual landscape area comprised high plasticity clay. None of the boreholes encountered rock.

6.2 Groundwater

No free groundwater was encountered during the geotechnical investigation. However, it is pointed out that standing groundwater and seepages may fluctuate with variations in rainfall, temperature and other factors. No longer term groundwater monitoring has been carried out.

7 Soil Classification and Salinity

7.1 Soil Classification

Soils within the alluvial landscape (basins 1 and 3) were assessed to be mostly medium plasticity Silty Clay or clay loam with a typical permeability of 0.06m/d to 0.12m/d. The clay content was seen to increase with depth in this area,

The soils within Blacktown landscape (basin 2) typically high plasticity clay typically identified as medium clay or loamy clay with typical permeability in the range 0.01m/day to 0.02m/day.

Permeability of soils depend upon the soil structure, void ratio(compaction) and salinity (dispersion).

It is noted that the irrigation models used and average infiltration rate of 0.015m/day (0.635mm/hour) which falls somewhere in between the typical values for the site soils.

7.2 Soil Salinity

Soil salinity has been measured in 46 samples selected across the basins from 12 boreholes and 22 test pits. Soil is considered to be saline if the Electrical Conductivity in saturated pore space (Ece) is more than 4dS/m (moderately saline or higher salinity). 21 samples were assessed to be moderately saline (46%). It was noted that in all three basins the upper 1m depth of soil to be mostly non-saline or slightly saline and the risk of salt leaching to the environment is low. Moderately saline soils will be exposed if the depth of excavation exceeds 1m.

It is noted that the maximum depth of excavation for the proposed basins 1, 2 and 3 to be 2.0m, 4.2m and 1.3m respectively.

The saline soils to be excavated for the basins are generally susceptible to erosion and it could be a main concern for the area where such soils to be placed. About 46% of tested samples were moderately saline soils. Soils excavated from the basins are proposed to be used in

earthworks in the subdivision. Measures to reduce the impact of soil salinity during earthworks have been included in DRM April 2024 (Ref1) report.

Measures for salinity management in the context of stormwater and groundwater management in the project including OSO are included in the following section.

8 Water Balance and Irrigation

As described briefly above in *section 5 Stormwater and Groundwater Management* of this report, excess stormwater generated by the proposed development is managed by a combination of storage and irrigation. An infiltration rate of 0.635mm/hour (15.2mm/day) has been assumed based on type D soils assuming a mid-value for type D soils recommended in the US Department of Agriculture.

It is noted that AS 1547-2012 recommended a maximum design loading rate of 16mm/day for clay loams (soils typically found in South Creek Landscape). The design loading rate (DLR) for effluent irrigation is usually much less than the irrigation rate for fresh water.

For medium to heavy clays, typically found at lower depth in Blacktown landscape area the maximum irrigation rate recommended in AS1547 was 5mm/day.

The infiltration rate depends on the soil type, soil compaction, the depth of water accumulated, depth of soil cover with the assumed permeability and the presence of lower or higher permeability soils underneath the surface layer.

CG considers the use of a single infiltration for the whole site is acceptable in the absence of site-specific infiltration tests. A large portion of the irrigation area is within the alluvial landscape where soils are more permeable, and the depth of permeable soils extends at least 1m or deeper. For preliminary modelling CG considers the infiltration rate of 15mm/day to be reasonable.

In order to achieve the correct water-balance, CG recommends additional investigation to be undertaken during detailed design stage (i.e. post development consent) to provide greater certainty regarding the assumed parameters.

9 Salinity Management in OSO and Detention Ponds

The guiding principle of salinity management within the irrigation area for the project and OSO is to minimise salt mobilisation outside the project boundary which may impact the creek system and associated eco systems. The following management strategies are proposed:

1. Prior to commencement of construction, identified salinity areas which may be exposed during construction should be identified by sampling at a smaller grid.
2. Where possible, minimise use of infiltration and detention in hazard areas. Consider lining of detention systems if they intercept saline soils.
3. Maximise the size of impervious areas, if possible, if the additional water generated can be safely disposed or retained.
4. Identify and manage sodic soils which are vulnerable for erosion. Sodic soils are generally those with exchangeable sodium percentage is more than 15% and is more than the percentage of calcium and magnesium. Such soils where present may be remediated by adding gypsum or similar products. Sodic soils if present within the irrigation areas could also reduce the permeability and cause water logging.
5. Establish deep rooted salt tolerant native vegetation to increase evapotranspiration and reduce the quantity available for recharge.
6. Where possible, install subsurface drains or channels to direct interflow away from saline areas and not infiltrate through salt rich soils which may cause accumulation of salt at lower levels and eventually leach out to the environment.

7. Consider the use of salt protected materials for services, such as salt resistant pipes.
8. If feasible, establish a riparian zone with salt tolerant vegetation to further reduce the effect of migration of salt to the environment.

10 Salinity Management Plan

A project salinity management plan should be established, and various sub plans should be prepared for each aspect of work such as earthworks management, construction of detention basins etc.

The plan should include periodic monitoring of salinity levels in open water bodies and shallow groundwater.

11 Reference

1. Development Risk Management (April 2024) Geotechnical Investigation. Flood Storage Basins Alspec Industrial Park, Luddenham Road Orchard Hills
2. Eco Logical (November 2024) Orchard Hills Alspec Industrial Business Park, Groundwater Impact Assessment.
3. Henry & Hymas (March 2024) Integrated Water Cycle Management Report, Alspec Industrial Business Park Orchard Hills NSW 2748
4. Environment Climate Change and Water, (2010) Hydrological Landscape for the Hawkesbury -Nepean Catchment management Authority, Western Sydney Study Area- Volume 4- Guidelines for Salinity in the Landscape

12 Closure

This report has been prepared for Development Risk Management Pty Ltd in accordance with the email request dated 29 November 2024 by the client under CG's Terms of Engagement.

The report is provided for the exclusive use of Development Risk Management Pty Ltd for the specific development and purpose as described in the report. The report may not contain sufficient information for developments or purposes other than that described in the report.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. The conclusions drawn in the report are based on interpolation between boreholes and test pits. Conditions can vary between test locations that cannot be explicitly defined or inferred by investigation.

The report, or sections of the report, should not be used as part of a specification for a project, without review and agreement by CG, as the report has been written as advice and opinion rather than instructions for construction.

The report must be read in conjunction with the attached Information Sheets and any other explanatory notes and should be kept in its entirety without separation of individual pages or sections. CG cannot be held responsible for interpretations or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report. In preparing the report CG has necessarily relied upon information provided by the client and/or their agents.

This report must be read in conjunction with the attached Information Sheets and any other explanatory notes.

We trust these comments are sufficient to meet your present requirements. Please do not hesitate to contact CG should you have any queries.

Appendix A
Information About this Report

Information About This Report

Limitations

Scope of Services: The report has been prepared in accordance with the scope of services set out in CG's Proposal under CG's Terms of Engagement, or as otherwise agreed with the client. The scope of services may have been limited and/or amended by a range of factors including time, budget, access and site constraints.

Specific Purpose: The report is provided for the specific development and purpose as described in the report. The report may not contain sufficient information for developments or purposes other than that described in the report.

Currency of Information: The information in this report is considered accurate at the date of issue with regard to the current conditions of the site.

Reliance on Information: In preparing the report CG has necessarily relied upon information provided by the Client and/or their Agents. Such data may include surveys, analyses, designs, maps and plans. CG has not verified the accuracy or completeness of the data except as stated in this report.

Copyright and Reproductions: The contents of this documents are and remain the intellectual property of CG. This document should only be used for the purpose for which it was commissioned and should not be used for other projects or by a third party. This report shall not be reproduced either totally or in part without the permission of CG. Where information from this report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimise the likelihood of misinterpretation.

Construction Specifications: Unless otherwise stated, the report, or sections of the report, should not be used as part of a specification for a project, without review and agreement by CG.

Report Should Not be Separated: The report must be read in conjunction with the attached information Sheets and any other explanatory notes and should be kept in its entirely without separation of individual pages or sections.

Review by Others: CG cannot be held responsible for interpretation or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

GENERAL NOTES

Geotechnical Reporting: Geotechnical reporting relies on the interpretation of factual information based on judgment and opinion and is far less exact than other engineering or design disciplines. Geotechnical reports are for a specific purpose, development and site as described in the report and may not contain sufficient information for other purposes, developments or sites (including adjacent sites) other than that described in the report.

Subsurface Conditions: Subsurface conditions can change with time and can vary between test locations. For example, the actual interface between the materials may be far more gradual or abrupt than indicated and contaminant presence may be affected by spatial and temporal patterns. Therefore, actual conditions in areas not sampled may differ from those predicted since no subsurface investigation, no matter how comprehensive, can reveal all subsurface details and anomalies. Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions and thus the continuing adequacy of a geotechnical report. CG should be kept informed of any such events and should be retained to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Groundwater: Groundwater levels indicated on borehole and test pit logs are recorded at specific times. Depending on ground permeability, measured levels may or may not reflect actual levels if measured over a longer time period. Also, groundwater levels and seepage inflows may fluctuate with seasonal and environmental variations and construction activities.

Interpretation of Data: Data obtained from nominated discrete locations, subsequent laboratory testing and empirical or external sources are interpreted by trained professionals in order to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions in accordance with any relevant industry standards, guidelines or procedures.

Soil and Rock Descriptions: Soil and rock descriptions are based on AS 1726 – 2017, using visual and tactile assessment except at discrete locations where field and / or laboratory tests have been carried out. Refer to the accompanying soil and rock terms sheet for further information.

Further Advice: CG would be pleased to further discuss how any of the above issues could affect a specific project. We would also be pleased to provide further advice or assistance including:

- Assessment of suitability of designs and construction techniques;
- Contract documentation and specification;
- Construction control testing (earthworks, pavement materials, concrete);
- Construction advice (foundation assessments, excavation support).

DEVELOPMENT RISK MANAGEMENT

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