Central Victorian Livestock Exchange

RLX Operating Company Pty Ltd

Expert Witness Statement

IS110800-001 | FINAL

12 June 2015

Matter 21406061

Central Victorian Livestock Exchange

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Document history and status

Revision	Date	Description	By	Review	Approved
Final	12/6/15	Issued for distribution	GH	LL	GH

Contents

Summary of Opinion

The site of the proposed Central Victorian Livestock Exchange (CVLX) lies north west of Ballarat near to the junction of the Sunraysia highway and the Western Highway. At this site it is proposed to develop a cattle and sheep livestock sale yard and associated handling facilities. Water and effluent from the site will be treated on site and disposed of by irrigation over pasture across the site. My opinion relates to the potential groundwater effects of operation of the site.

The site is located at the southern edge of the Loddon Highlands Water Supply Protection Area (WSPA). The site is also just to the north of the Cardigan Groundwater Management Unit (GMU). The Loddon Highlands WSPA was declared to enable management control of the groundwater use from the deep lead and basalt aquifers in the Loddon Valley. Cardigan GMU as established to enable the management take and use of groundwater from the basalt aquifers west of Ballarat.

At the surface of the site three different rock types have been identified. The majority of the site has mudstones and siltstones of Paleozoic age present at the surface. These rocks are hydrogeological basement rocks for the aquifers of the region and are generally considered to be poor aquifers. The eastern portion of the site has basalt at the surface. This is the western edge of a basalt flow that is present to the north and in the vicinity of Miners Rest. This basalt is interpreted to lie directly on basement rocks. In the west of the site the surface materials are colluvial and alluvial sediments associated with hill wash and occasional flooding. Underlying the alluvial material at a depth of about 8 metres is hard basalt, which in turn lies directly on basement rocks at a depth of approximately 22 metres.

Groundwater level at the site has been determined by the installation of four groundwater monitoring wells. From these wells groundwater flow potential has been determined to be to the north and west. Groundwater quality varies across the site from segment B to segment D of the classification of the State Environment Protection Policy - Groundwaters of Victoria. Groundwater in the watertable across the site contains trace nitrogen and phosphorus.

The following conclusions have been reached:

- Operations at the site are likely to result in a small reduction in recharge due to the construction of impervious areas;
- Operations at the site are likely to result in a small increase in recharge from irrigation of treated effluent. This is unlikely to materially alter groundwater quality and will preserve the beneficial uses of the watertable aquifer at the site;
- Operation of holding ponds and storm water retention is expected to have no noticeable impact on groundwater;
- The operations at the site as proposed have no effect on the availability of groundwater and are not subject to any requirements of the Loddon Highlands WSPA.

The net effect of the change in recharge is likely to be a near balance in overall recharge.

No changes to offsite groundwater are expected from the proposed livestock exchange.

1. Compliance with guide to expert evidence note G2

1.1 General Matters

Expert Witness: Gregory Peter Hoxley, 452 Flinders Street, Melbourne VIC 3000

Qualifications: Bachelor of Science (Degree with Honours) - Geology

Area of Expertise: Hydrogeology, irrigation, irrigation drainage, salinity, salinization

Please see professional CV in Appendix A

Relationship: Jacobs Group Australia Pty Ltd was engaged by RLX Operating Company Pty Ltd to provide this opinion.

Instructions: A copy of the instructions is in Appendix B

Assumptions: This report has been prepared on the basis of a desk study and by review of on-site data and investigations undertaken for the application. As detailed design and specification of a range of operating equipment has not been prepared (consistent with the planning stage that the proposal is at) the nature of operations has been assumed to be consistent with general industry practice for irrigation and groundwater management.

Assistance: I have relied on measurements and field observations from the site provided by Douglas Partners which were collected (in part) at my direction.

2. Introduction

A new regional livestock exchange and saleyard is proposed to be constructed west of Ballarat. The proposed site is near the junction of the Western Highway and the Sunraysia Highway. This document presents a review of the available groundwater and hydrogeological conditions at and around the site for the purposes of assisting with the assessment of proposed planning amendments.

In preparing this review a range of existing data and information has been collated and this has been supplemented with site specific data collected by Douglas Partners Pty Ltd on behalf of the proponent and with my review.

3. Site Geology and Hydrogeology

3.1 Regional groundwater mapping

The site geology and hydrogeology has been collated from a variety of government provided and sponsored on-line sources. Figure one shows the general location of the site in relation to Ballarat. This figure shows key groundwater aspects as well. Specifically the locations of:

- Loddon Highlands Water Supply Protection Area (WSPA) shown in light green fill;
- Cardigan Groundwater Management Unit (GMU) shown in light purple fil;)
- Locations of nearby registered bores (shown as red triangles);

In this figure the location of the proposed site is highlighted in red.

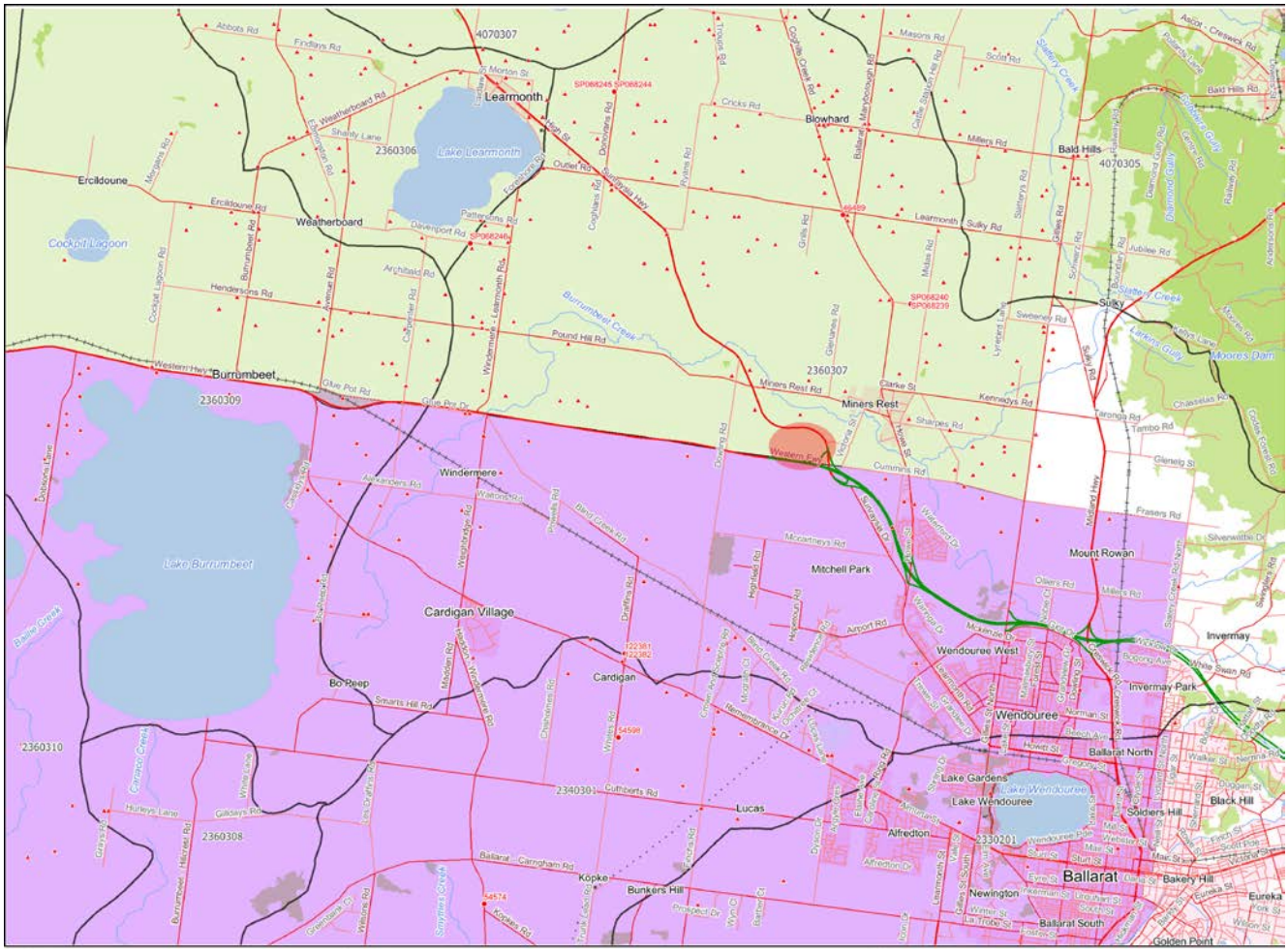

Figure 1 : General site location map with groundwater features (Loddon Highlands WSPA in green, Cardigan GMU in purple and registered bores with red triangles). Source: DELWP mapshare website

Geological and hydrogeological information for the general vicinity of the site is provided from datasets provided by the Victorian Government through the Visualising Victorian Groundwater (VVG) project. The local geology for the site is shown in figure 2, as provided by VVG.

Figure 2 : surface Geology mapped in the vicinity of the site (see table below for unit descriptions). Source: Visualising Victorian Groundwater on-line atlas. Groundwater bores identified in the water measurement information system are shown with blue crosses

The majority of the site is mapped as mixed shale, sandstone and mudstone of Ordovician age (Ocl). This unit is considered to be geological basement for the aquifers in this area. The three geological units mapped are:

- Ordovician mudstone, sandstone and shale (Ocl);
- Alluvial sediments, comprising silt and sand (Qa1);
- Colluvial sediments comprising gravel and sand (Nc1).

The detailed descriptions of the mapped units are given in the tables below.

Table 1 : Description of Ocl

Unit	Castlemaine Group - Lancefieldian(Ocl): generic
History	Lancefieldian to Lancefieldian (water [process] - hemipelagic; turbidity current - submarine fan)

Lithology	shale (significant); sandstone (significant); mudstone (significant); conglomerate (minor [proportion])

Table 2 : Description of Qa1

Unit	alluvium(Qa1): generic
History	Pleistocene to Holocene (channelled stream flow-fluvial [environment])
Lithology	silt [material] (significant); sand (significant); gravel [material] (significant)

Table 3 : Description of Nc1

Unit	incised colluvium (Nc1): generic
History	Pliocene to Holocene (channelled stream flow - fluvial [environment]; sheet flow - colluvial; earth flow [process] - colluvial)
Lithology	silt [material] (significant); gravel [material] (significant); sand (significant)

Within the vicinity of the site the depth to groundwater has been mapped (at a regional scale) as being less than ten metres below the surface with the majority of the site having watertable less than five metres below the surface. Figure three shows the regional depth to watertable mapping.

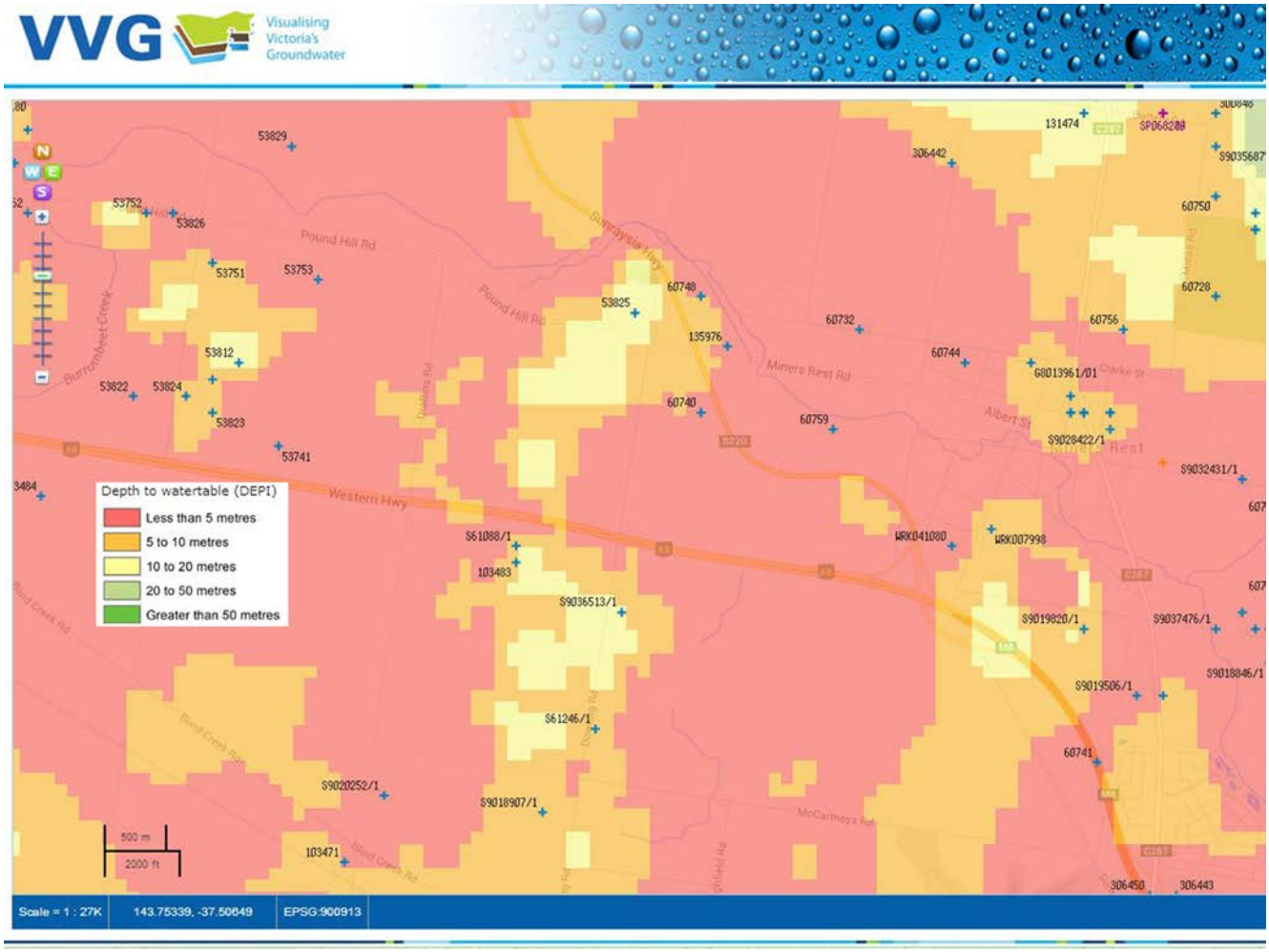

Figure 3 : Mapped depth to watertable (at a regional scale) for the site and surrounding area. Source: Visualising Victorian Groundwater

Groundwater salinity mapping is also available at a regional scale and figure 4 shows the mapped (regional) groundwater salinity.

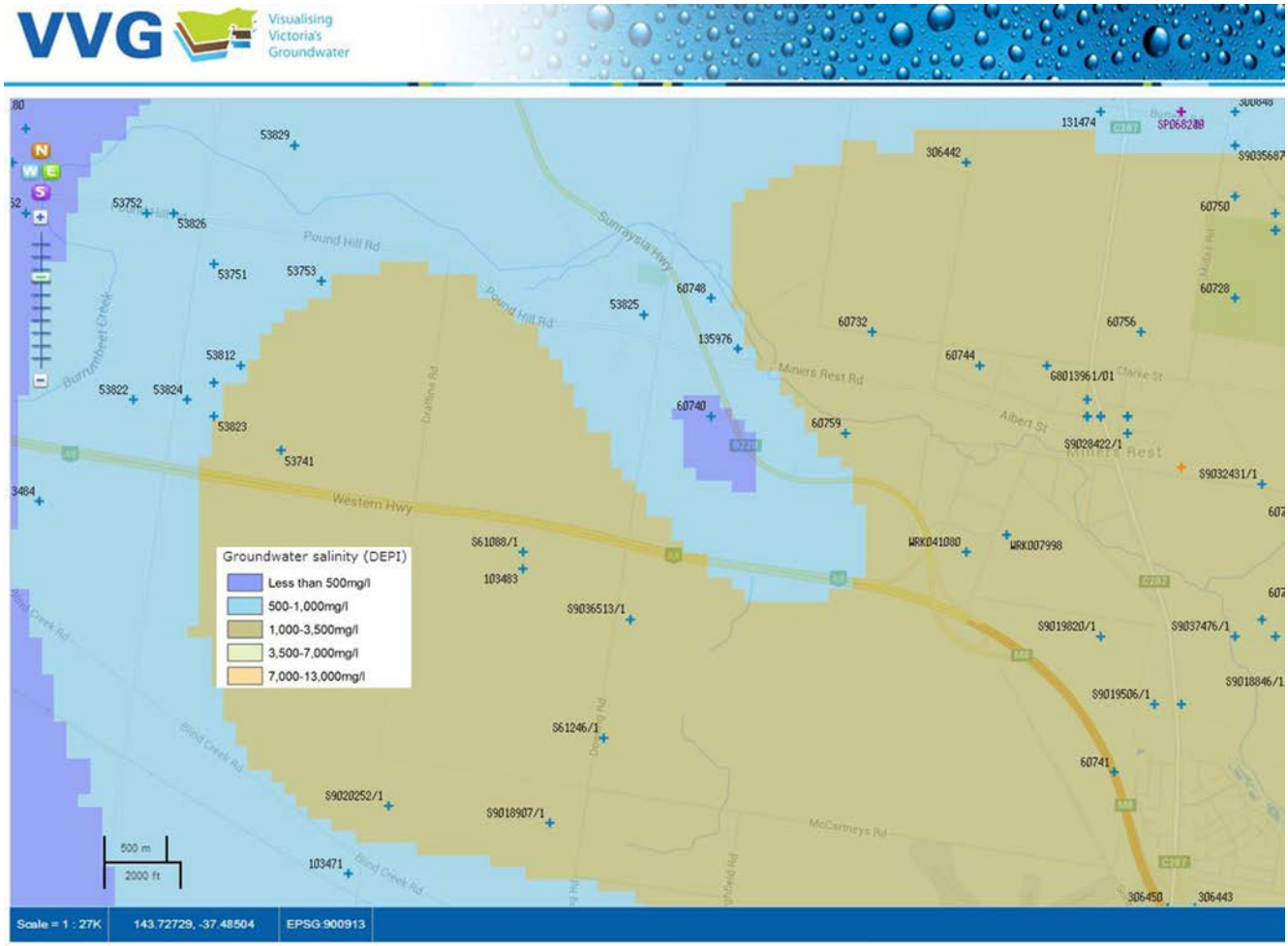

Figure 4 : Mapped groundwater salinity (at a regional scale) for the watertable. Source: Visualising Victorian Groundwater.

Groundwater salinity across the site is expected to be between 500 mg/L TDS and 3,500 mg/L TDS. Thus in terms of the beneficial uses to be preserved (State Environment Protection Policy Groundwaters of Victoria) the groundwater is identified as to be protected for irrigation uses and potentially for potable uses depending on other background water quality parameters.

3.2 Site Specific Geology and Hydrogeology

Site specific studies have been undertaken for the application. Douglas Partners undertook drilling, test pit construction and water analysis of the groundwater at the site. The Douglas Partners report is included in Appendix C. From this report the actual groundwater conditions at the site are confirmed as broadly consistent with the regional mapping presented above. Four groundwater wells were drilled and constructed across the site at three locations to confirm groundwater conditions. Figure five shows the general outline of the site with the three groundwater monitoring locations identified

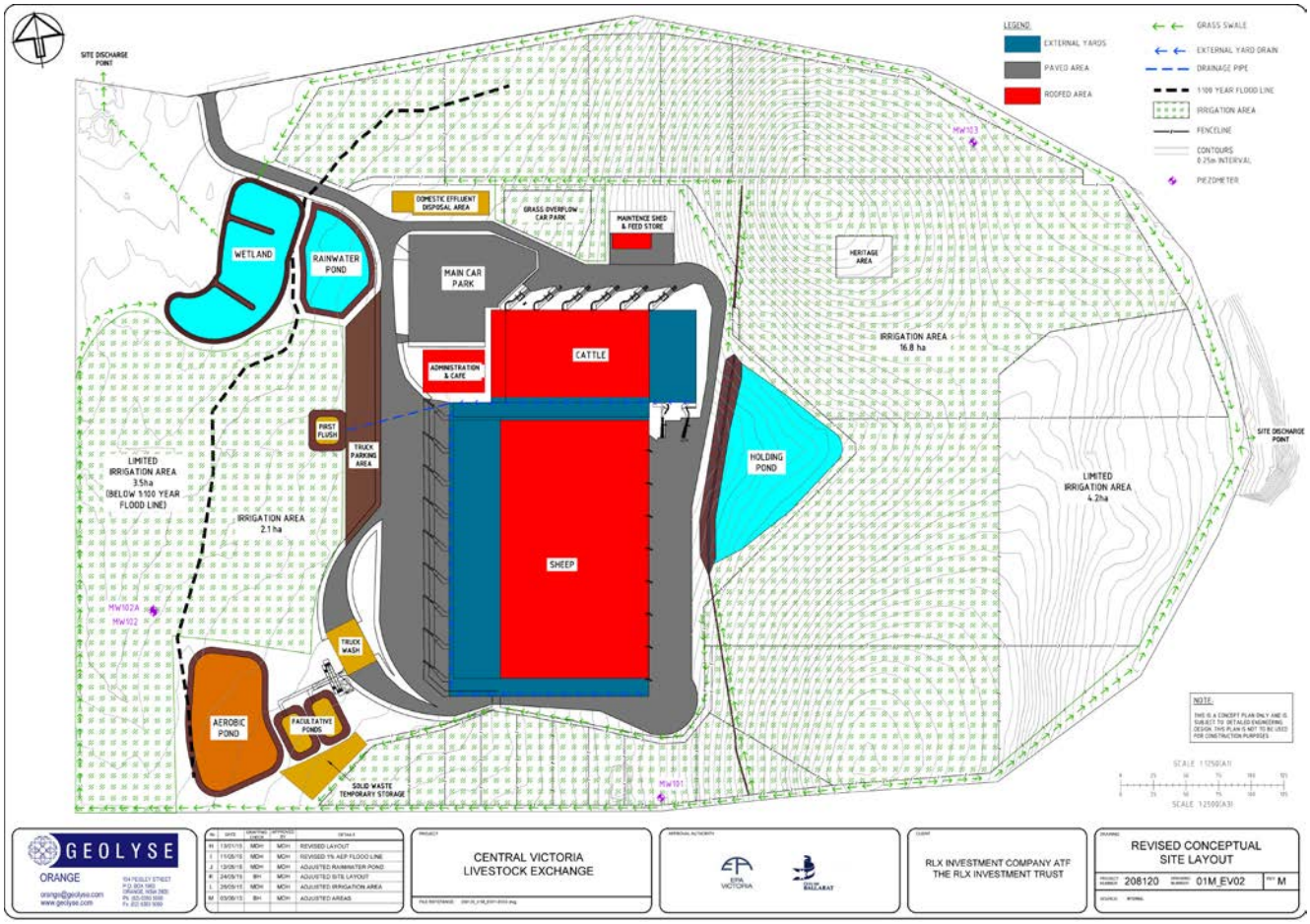

Figure 5 : General site layout showing location of groundwater wells in purple. Source: CVLX

For simplicity a simplified figure has been prepared from this plan that shows groundwater surface contours and the groundwater monitoring sites only (Figure 6).

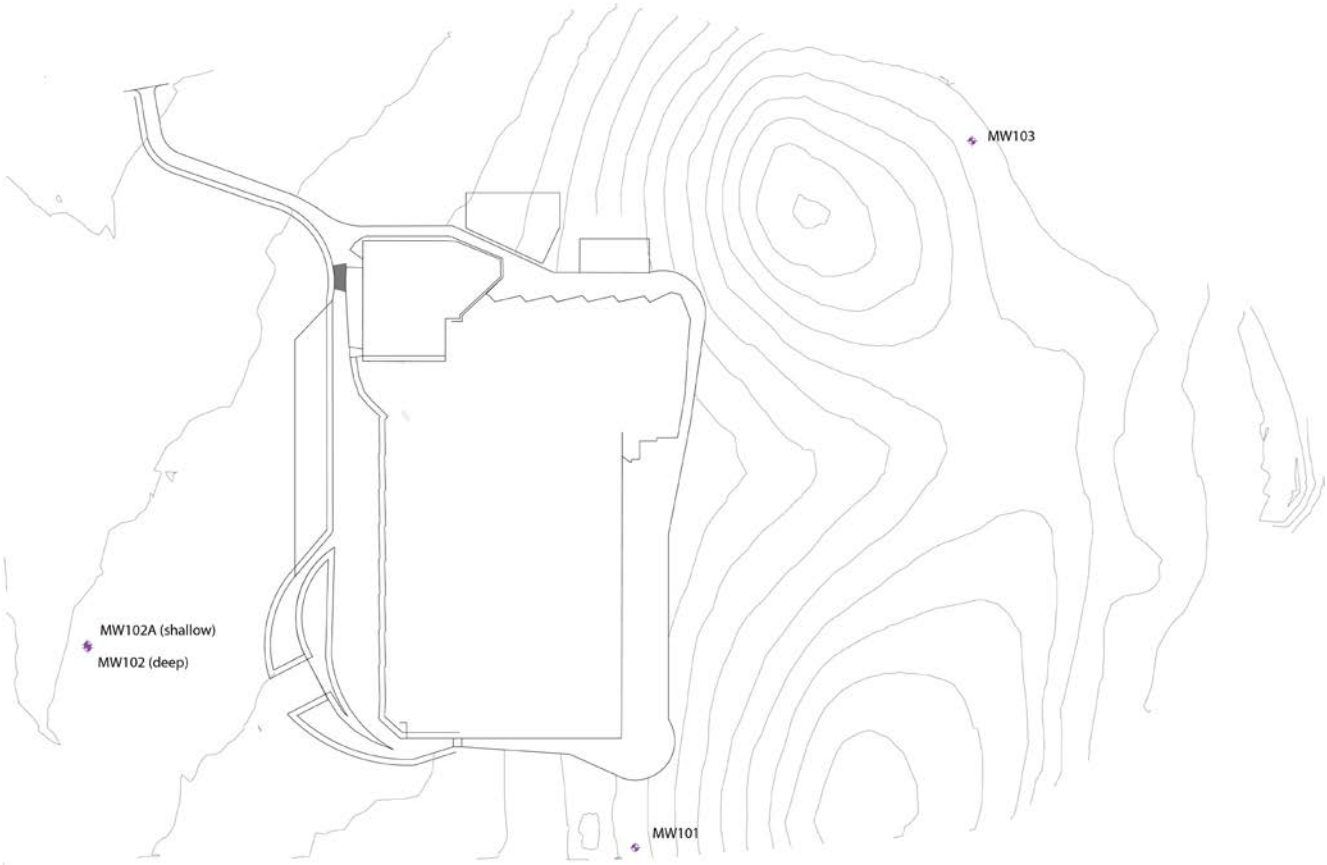

Figure 6 : Location of four groundwater monitoring wells across the site.

Appendix C provides the Douglas Partners report with the full details of the construction and geology at these locations. A summary of the groundwater conditions is provided in table four.

Table 4 : Summary of groundwater monitoring wells constructed at site

Groundwater Well	Hydrogeological Summary
MW101	Starts and finishes in the bedrock aquifer. Drilled to 25.1m depth. The well samples and monitors bedrock
MW102	Starts in colluvial/alluvial sediments, intersects hard basalt at 8 metres below surface and then passes into bedrock at 22.3 metres below surface. This bore monitors groundwater in the bedrock aquifer. Basalt encountered in drilling this bore was firm and had sections with little fracturing. No water inflow was noticed from the basalt.
MW102A	Located adjacent to MW102. This bore monitors the colluvium and alluvium above basalt.
MW103	Starts and finishes in bedrock. The bore was stopped at 25 metres. This bore monitors the bedrock aquifer.

Information on groundwater level and salinity and chemistry has been collected from the monitoring wells. Figure seven shows the groundwater level in the wells after cleaning and recovery.

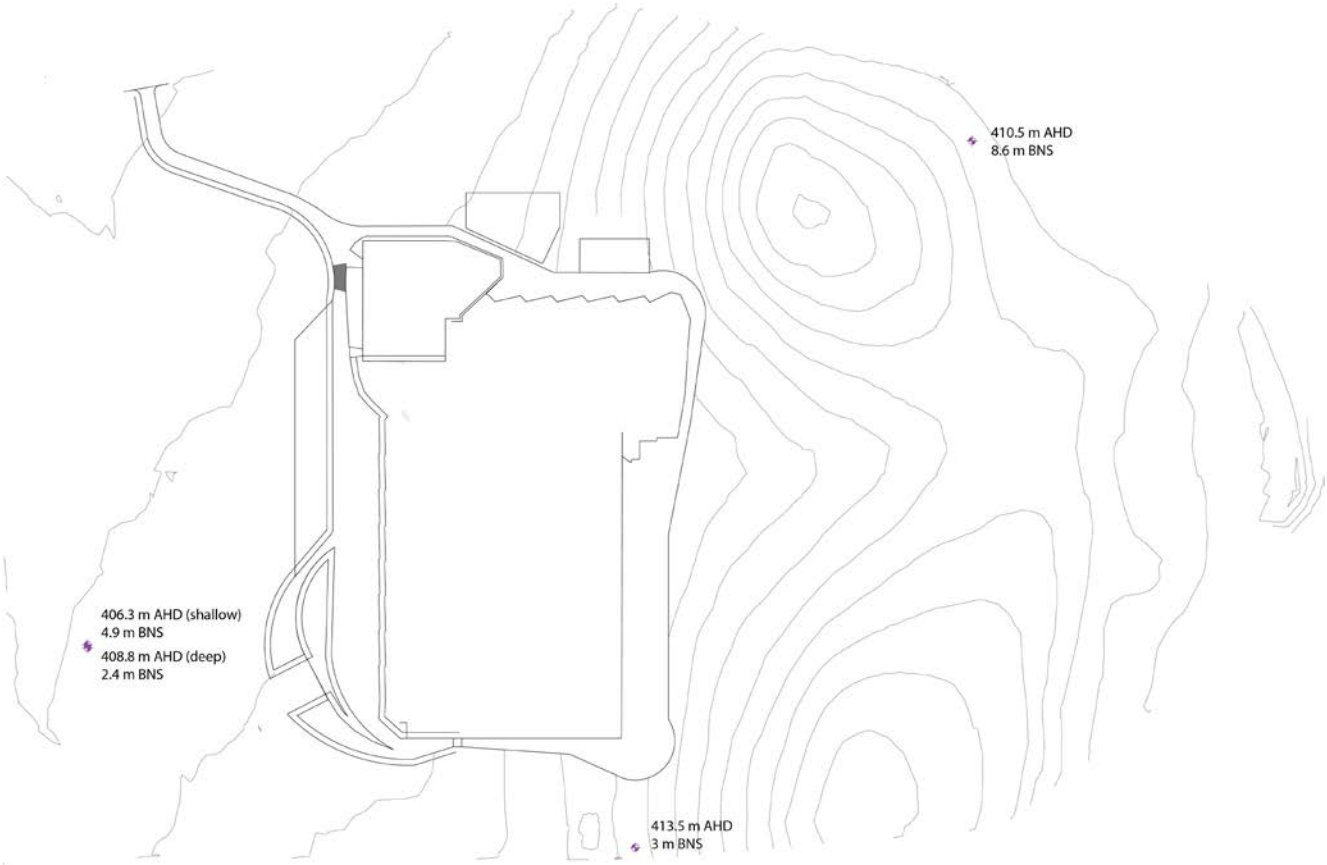

Figure 7 : Groundwater levels measured across the site

From these groundwater levels the following can be concluded:

- Groundwater levels are consistent with the regional depth to watertable mapping and as such are consistent with the general regional understanding of groundwater
- Groundwater flow potential across the site is in a north easterly direction in the bedrock aquifer
- The basalt layer in the east of the site is a barrier to groundwater flow as the groundwater level in the deep bore is higher than in the shallow bore at the same site and this difference in head could not be preserved if the basalt was not a barrier to flow at this location

Groundwater salinity has been measured at the monitoring wells and is shown in figure eight.

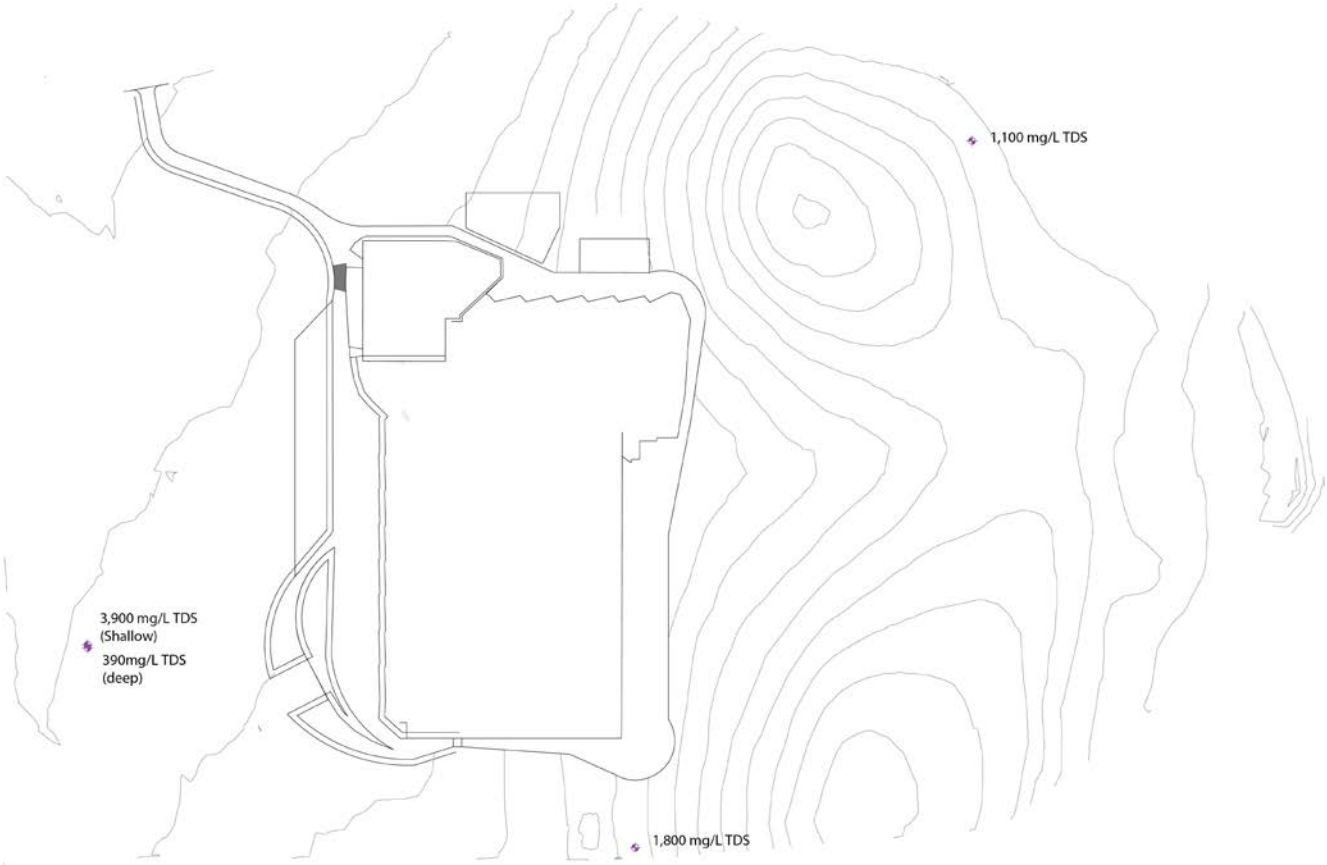

Figure 8 : Groundwater salinity across the site

Groundwater salinity of the shallow aquifer is broadly consistent with the mapped regional salinity in that it ranges from 1,100 mg/L TDS to 3,900 mg/L. The highest salinity measured at the site is slightly higher than the regional mapping and is just above segment B of the SEPP, and into segment C. Thus the groundwater is in part of the site above irrigation salinity segment.

Of note is the low salinity of the deep bore at site MW102A. This is considerably fresher than the shallow groundwater at this site. It is slightly fresher than the other bedrock sites. This difference is not unusual or concerning for the proposed use of the site. The difference in salinity at site MW102 and MW102A is taken as further evidence that the basalt at that location is a barrier to flow. The salinity contrast could not be preserved is there was a significant rate of mixing between aquifers at this location.

From test pits across the site an area of shallow basalt has been identified at the east of the site. From the groundwater testing on site it is expected that groundwater level will be lower to the east and that the basalt is likely to have only low hydraulic connection to the bedrock aquifer.

Groundwater chemistry has been tested in the monitoring wells. Nutrients have been identified already present in the watertable across the site. Dissolved phosphorus has been found in the watertable at MW101 and MW102A. Nitrogen was identified in all wells, Ammonia was identified in all wells and Nitrite was identified in all wells. Thus is it concluded that the watertable at the site currently contains trace nutrients.

3.3 Groundwater Management

The site is located in the Ascot sub-zone of the Loddon Highlands WSPA. A groundwater management plan for the WSPA was approved in 2012 and provides for the management of groundwater in the area to provide security of access to authorised users of groundwater. An overall goal is to avoid over-extraction to protect users and the environment. The management plan provides for levels of restriction on allocation based on trigger levels of the key aquifers. In the plan the two key aquifers are the Basalt Aquifer and the underlying Deep Lead Aquifer. Basement rocks are not the focus of the plan and it is noted in the plan document that "yields are low" in bedrock outcrop.

The majority of the subject site is bedrock outcrop. Areas of basalt aquifer are found in the east and west of the site. These aquifers are poorly developed at the site. As there is no proposed groundwater extraction as part of the proposed development the groundwater management plan does not have any specific requirements for this site.

A search of the DELWP on-line groundwater database was undertaken to identify licenced groundwater bores in the vicinity of the site. Figure nine shows the location of licenced bores. Licenced bores are relevant as significant groundwater extraction is licenced. Other bores are located in the vicinity, however they will only have modest groundwater take for stock and/or domestic uses.

The closest licenced bore is located at the site of the Basalt Quarry in Miners Rest. It is listed as being licenced for "industrial" purposes. This bore is recorded as being constructed to X metres depth. I interpret this bore to be accessing the Basalt aquifer. The salinity of this bore is recorded as 3,170 EC in 2012. This is approximately 2,000 mg/L TDS. No water level records are available.

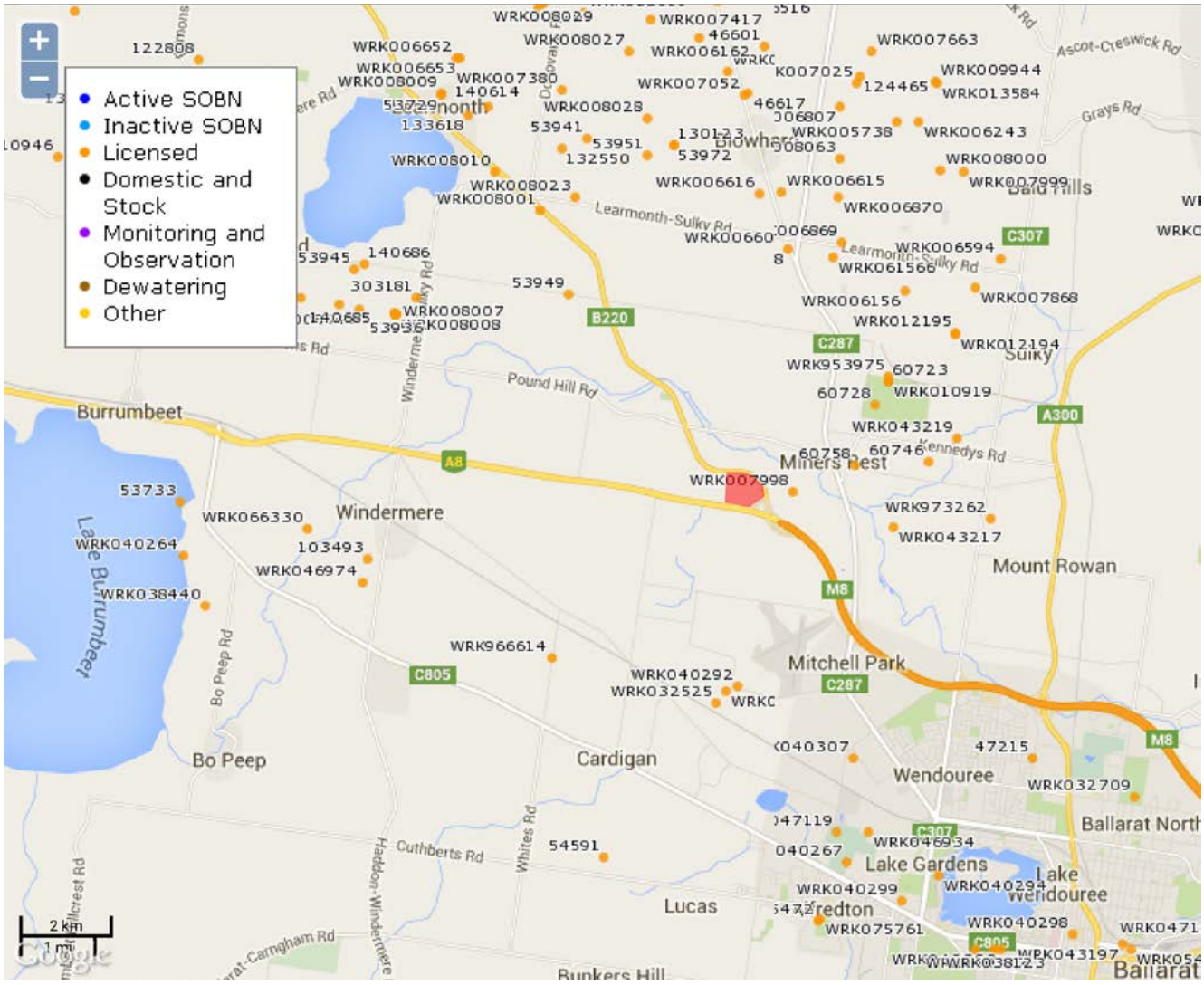

Figure 9 : Locations of nearby licenced groundwater bores. Source: Victorian Water Measurement Information System

4. Potential effects of development on groundwater

4.1 Introduction

From a groundwater perspective the development of the site may have an effect on groundwater through changed water conditions on the site. Details of the development were provided as part of the instructions and in summary the relevant aspects are:

- Construction of roads and buildings across the site;
- Irrigation of pasture/crops with treated effluent;
- Storage of effluent in holding ponds;
- Storage of runoff in holding ponds;
- Irrigation of treated effluent from domestic waste

My review of the proposed development the following potential groundwater effects have been identified:

4.2 Construction of roads and buildings

The effect of constructing impervious areas is to reduce the recharge to the watertable across the site. The footprint of the proposed area is shown in figure five. This will result in marginally reduced recharge to the bedrock aquifer. The recharge rate across the site is expected to be in the range of 5% to 15% of rainfall (Leaney, 2011). Rainfall at the site is an annual average of 689 mm (Ballarat Aerodrome). The approximate impervious area is 4.8 ha. This results in an estimated recharge reduction of between 1,682 m^3 per year and 5,048 m^3 per year;

4.3 Irrigation of land

Irrigation of treated effluent is proposed over 18.9 ha of primary irrigation land at a rate of up to 144 mm per annum on average. This will be done by rotational irrigation. Irrigation is planned to be applied at a rate that will retain a soil moisture deficit. As such there is unlikely to be any deep drainage resulting directly from irrigation events. However, it is expected that natural rainfall will provide a level of leaching of salt into the deeper profile. Irrigation will provide higher moisture content in the soil which will allow rainfall to percolate more readily. As such an increase in recharge across the site can be expected. At worst the rate of increased recharge would be at the same rate as the expected recharge from rainfall. This is an upper figure given that the irrigation is planned to maintain a soil moisture deficit The mechanism of additional recharge is that rainfall falling on a freshly irrigated site would percolate to groundwater more easily as a result of the wetting of the soil profile by irrigation. To estimate the additional recharge I have assumed that the irrigation rate is considered to be extra rainfall and the overall recharge rate is not altered. Allowing between 5% and 15% of additional recharge from the effects of irrigation - over the irrigated area - provides an additional 1,360 to 4,082 m^3 of recharge to the watertable. Assessment by Geolyse (2015) has identified that a nitrogen deficit is likely to develop based on the irrigation rates. A small phosphorus excess was identified. The watertable aquifer has been shown to have nitrogen and phosphorus present in dissolved form.

Irrigation with treated effluent is expected to have negligible impact on groundwater availability and negligible impact on groundwater quality.

The small volume of treated effluent from the domestic waste water is also considered to be likely to have negligible impact on groundwater level or quality.

4.4 Holding ponds and wetland

Holding ponds and a wetland for management of run-off are proposed for the site. These are to be constructed using a compacted clay base. Soil tests from the site indicate that the soils have high clay content and are likely to be suitable for the formation of a liner. As such the leakage from the holding ponds is expected to be small. The observation wells installed at the site should be monitored during operation to confirm that no significant leakage occurs.

5. Conclusions

The following conclusions have been reached:

- Operations at the site are likely to result in a small reduction in recharge due to the construction of impervious areas;
- Operations at the site are likely to result in a small increase in recharge from irrigation of treated effluent. This is unlikely to materially alter groundwater quality and will preserve the beneficial uses of the watertable aquifer at the site;
- Operation of holding ponds and storm water retention is expected to have no noticeable impact on groundwater;
- The operations at the site as proposed have no effect on the availability of groundwater and are not subject to any requirements of the Loddon Highlands WSPA.

The net effect of the change in recharge is likely to be a near balance in overall recharge.

No changes to offsite groundwater are expected from the proposed livestock exchange.

5.1 Declaration

“I have made all the enquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel”

_____

Greg Hoxley

12 June 2015

6. References

Geolyse (2015) Central Victorian Livestock Exchange – Response to Central Highlands Water Dated 3 June 2015, reference: 208120_LEO_004C.docx

Leaney F, Crosbie R, O'Grady A, Jolly I, Gow L, Davies P, Wilford J and Kilgour P. 2011. Recharge and discharge estimation in data poor areas: Scientific reference guide. CSIRO: Water for a Healthy Country National Research Flagship. 61 pp.

State Environment Protection Policy "Groundwaters of Victoria" Victorian Government Gazette No S 160, 17 December 1997.

Appendix A. Curriculum Vitae

Greg Hoxley

PRINCIPAL HYDROGEOLOGIST

CURRENT POSITION

Principal Hydrogeologist

QUALIFICATIONS

Bachelor of Science (Honours)

EXPERTISE

- Groundwater Modelling
- Salinity (Dryland and Irrigation)
- Landfill
- Mine Dewatering and Water Supply
- Environmental Effects Statements / EIS
- Groundwater Resources and Management
- Waste Water Disposal
- Groundwater Quality and Contamination

Summary of Competencies

In Greg Hoxley is an experienced and senior hydrogeologist with over 25 years experience in groundwater and hydrogeology. He has undertaken a wide range of groundwater and salinity related projects for a wide range of public and private sector clients.

He has worked within government and the private sector during this period

Employment Synopsis:

Rural Water Corporation of Victoria: 1987 to 1995 - Senior Hydrogeologist

Sinclair Knight Merz: 1995 to 2013 - Principal Hydrogeologist

Jacobs 2013 - Present Principal Hydrogeologist

Experience

Groundwater Modelling

Greg Hoxley is a highly experienced groundwater modeller. He has developed and used groundwater models for a wide variety of situations and used a number of different modelling programs and software. He is proficient in writing programs in FORTRAN and has written models as well as made significant enhancements to existing models. He has been involved in modelling for over 25 years and has worked with most of the widely available and recognised groundwater and sub-surface models in use in the industry. He has both developed models and supervised large and complex modelling projects. He is proficient in the use of the following modelling programs:

– MODFLOW

– MIKE-SHE (includes MIKE-11)

– SUTRA

– FEFLOW

– HELP

– VLEACH

– AQUIFEM-N

He has also written a large body of special programs to pre and post process model data for a variety of models. He has been a member of the Groundwater Modelling Sub-committee of the Groundwater Group for the (then) Murray Darling Basin Commission and he was part of the expert panel that helped to develop the Guidelines for Groundwater Modelling published by the Murray Darling Basin Commission.

He has developed many models for a wide range of clients and purposes. Significant modelling projects include the following:

Nyah to the SA Border Hydrogeological Models

This project involved developing a suite of nine models to determine the impact of irrigation on groundwater level and then on groundwater discharge to the Murray River. The project was significant as it was the first large scale application of models to a natural resource issue in the Murray Basin and helped developed the rules for a salinity offset scheme involving irrigation.

Greg Hoxley

PRINCIPAL HYDROGEOLOGIST

Barwon Downs Aquifer

The Barwon Downs aquifer provides a major source of water for Geelong City. It is particularly important in drought periods. This project developed a 5 layer model of the whole aquifer system that included scenario simulation for 100 years. This model has been used as the basis for setting license conditions for the use of the resource.

Riverine Plain and Mallee Groundwater Models

These models were developed as part of a series of models that covered the whole of the Murray Basin. Whilst the models were initially developed by a number of different organisations, the finalisation of the models and production of final reports were management by Greg Hoxley. These models provided predictive options for groundwater management purposes across large parts of the Murray Basin.

Koo Wee Rup Groundwater Supply Protection Area

This model simulates the impact of extended groundwater pumping from aquifers in the declared Koo Wee Rup Groundwater Supply Protection Area. The model has been used to define the impacts of extraction and also to evaluate the potential for injection of treated effluent into the aquifer to reduce the impacts of pumping.

Ord River Irrigation Areas - Stage 1 and Stage 2

Irrigation of the Ord River region was studied by the major project. The existing and proposed irrigation areas were modelled to determine the likely groundwater response to irrigation and potential environmental effects resulting from expanded irrigation. The models developed formed a key part of the PER/CER assessment of potential impacts.

South Goulburn Plain Model

The south Goulburn Plain area was studied using a model that evaluated the potential for pumping of groundwater from deep confined sediments to reduce the rate of rise of the watertable in the area. Increasing pressure is being placed on groundwater in the area and the model provided information on likely benefits for shallow groundwater systems resulting from increased deep groundwater use.

Wool Scour Site, Perth

Modelling of the progress of a plume of contaminated groundwater from an industrial site in Jandakot, Perth

Leachate Modelling, Thailand

Modelling of the movement of leachate through the unsaturated zone from two proposed landfills in northern Thailand.

Salinity (Dryland and Irrigation)

Greg Hoxley has over 25 years experience in salinity and water quality issues. He has comprehensive experience in all aspects of salinity in Australia. His experience ranges from detailed technical studies of soil water movement and solute behaviour, through to strategic advice relating to State and Federal policy on salinity management and plans. He has experience in all aspects of salinity, both dryland and irrigation. He has been involved in detailed technical assessments of salinity development, such as modelling of groundwater and solute movement. He has provided advice on salinity and water quality issues to all regions in Victoria and many others across

Greg Hoxley

PRINCIPAL HYDROGEOLOGIST

Australia. He was a key note speaker at the Local Government Salinity Summit in 2001. He has written and contributed to a number of papers on salinity and salinity management. Governments frequently seek his advice on salinity technical aspects, as well as for policy development. He has been closely involved in the development of salinity trading regimes and is fully aware of the challenges and issues associated with the use of market based techniques to manage salinity.

Key projects that demonstrate his experience are:

Goulburn Broken Plains Study

This study was a benchmark study for an area of northern Victoria that has predicted high salt loads in the next 30 years. The study provided estimates of groundwater trends and the patterns of future salt load for the next 50 to 100 years. A key development of this study was a modification to the MODFLOW groundwater model and coupling of a soil water salt model. This modelling development enabled the predicted salt impacts on vegetation growth to be incorporated into salinity planning for the first time.

Lexton Salinity Study

The Lexton Salinity model was developed to assess the impacts changed vegetation on groundwater recharge and then of the potential discharge to streams in the Lexton area of northern Victoria. This project evaluated the likely impacts of a range of vegetation management options and was one of the first models to look at the whole water balance for a dryland salinity area. The model identified the potential advantages of break of slope tree plantations and highlighted the relative effectiveness of perennial pasture.

Nyah to the SA Border Salinity Management Plan Support

This project developed the salinity accounting mechanism that enables the impact of salinity caused by irrigation in the Murray Mallee to be accounted. This project set a national benchmark for the innovative use of polluter pays principles combined with natural resource management objectives. Restrictions were established and market mechanisms used to minimise the environmental impacts of irrigation expansion.

Lake Toolibin Recovery Project

This project involved the assessment and planning for pumping of groundwater to protect and recover Lake Toolibin (in WA) from saline discharge. Lake Toolibin has been identified as a key environmental asset for the region, which was threatened by salt. Engineering options were required to rescue the lake. This study identified the potential for groundwater pumping to protect the lake and environs and provided data for design of a disposal system.

Kerang Lakes Area Salinity Management Plan

The Kerang Lakes area contains many important wetlands threatened by salt. This project involved providing hydrogeological advice and support for the development of a community management plan for the area. This involves working closely with the community to educate and assist the development of an effective salinity management plan.

Review of the Salinity and Drainage Register

This project involved the review of all of the items listed on the Murray Darling Basin Commission Salinity and Drainage Register that contribute or reduce salt in the Murray River. The MDBC required a review of all of the items and priority actions developed from the review. This review set the technical basis for policy development of a new register under the Basin

Greg Hoxley

PRINCIPAL HYDROGEOLOGIST

Salinity Management Plan

Murray Darling Basin Salinity Audit

As part of a regular review of salinity, the MDBC commissioned an audit of salinity in the basin. This project developed the audit data for Victoria. In addition, it set the primary method by which other regions would audit potential future salinity in the Basin. The method developed for this project was then used as the basis for the Salinity Theme of the National Land and Water Audit.

Other key projects include:

- Broken and North Goulburn Plains Project
- Salinity Management Options for the Glenthompson Area
- Salinity Risk Assessment in the Loddon-Campaspe
- Salinity Management Options in the Gerangemete Area
- Lake Tutchewop Options Study
- Salinity Investigation and Assessment, Riverine Plain
- SunRISE 21 Land Capability Assessment
- Implementation of Salinity Mitigation Works
- Tragowel Plains Irrigation Impacts (Mike SHE)
- Shepparton Irrigation Region Salinity Audit
- Lindsay River Groundwater Interception Scheme
- Feasibility of Artificial Recharge at Barwon Downs
- Murray Basin Hydrogeological Map Series
- Managing Victoria's Growing Salinity Problem
- Wimmera Hill Country management
- Review of Dryland LWMP for NC Vic
- Lower Avon Richardson Salinity Study
- Hydrogeological Support for Avoca Dryland
- Environmental Assessment of Bullock Swamp
- Avon Richardson Salt and Water Balance
- Action Plan for Kooloonong- Natya Landcare Group
- Stream Salinity Monitoring, Gelnelg
- Kerang Lakes REALM Model Update
- Upper Loddon REALM model update
- Campapspe REALM Model Update
- Goulburn Broken REALM Model Update
- Wimmera RCS Review and Renewal
- Integrated NRM plan of the Lower Murray Region
- Development of Catchment Indicators for Victoria
- Catchment Categorisation
- Guidelines for Disposal Basins
- Salinity Risk Assessment in the Loddon Campaspe
- Coordination of Second generation SMP for Mallee
- Capacity of Local Government in Dryland Salinity
- Wimmera Salinity Trial Catchment Study
- Land Use Suitability & Capability
- Hydrogeological Investigations for Wimmera SMP

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> Local Govt Planning Support Tool

Landfill

Greg Hoxley has considerable experience in landfill leachate impacts and management. He regularly is called as an expert witness in hearings related to landfill leachate effects. He is experienced in many aspects of leachate generation and management for landfills, including modelling of leachate migration and impacts. He provided the groundwater component of the only EPA approved landfill operators course in Victoria.

Relevant Experience includes:

Ondit Quarry Landfill Assessment

This project involved providing advice and opinions to the Victorian EPA on the likely impacts of a landfill proposed for a quarry in western Victoria. The EPA opposed the landfill and the matter was subject to a hearing. This involved appearing as an expert witness on behalf of the EPA.

Torquay Landfill

This project involved undertaking the technical assessment of groundwater conditions and potential for leachate impacts for a landfill near Torquay, Victoria. Site investigation and characterisation was undertaken and a review of potential leachate migration and possible impacts was undertaken.

Margate Landfill

The Margate landfill in southern Tasmania serves a significant population south of Hobart. The site required expansion to cope with future needs. The study involved a wide range of services, from assessing groundwater conditions at the site, defining clay and soil permeability, negotiation with the regulator about performance standards and ongoing monitoring and assessment of the impacts of past landfill activity. The site is geologically complex and has a long history of landfill activity that complicated the study.

Bairnsdale Landfill

This project involved providing specialist review services for a proposed landfill at Bairnsdale. The site was of special interest as it was located in an area of high quality groundwater and near sensitive environmental features.

Kerang Regional Landfill

Providing expert witness testimony for the Kerang Shire (Victoria) in successfully dismissing and appeal against a proposed regional landfill site.

Launceston Landfill

Assessment of leachate generation rates at an existing and proposed extension of a landfill for Launceston (Remount Rd site).

Corangamite Regional Landfill

Hydrogeological investigations for the proposed Corangamite Regional Landfill at Cobden. This work involved the assessment of alternative sites and a full hydrogeological and hydrological assessment of the preferred site. Included in this assessment was numerical modelling of leachate migration through the unsaturated zone and an estimate of the time delay in any impact being seen at the water table.

Lorne Landfill Leachate Study

The existing landfill at Lorne required a review of operations as part of an

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overall analysis of the landfill operations for Surf Coast Shire. This investigation into the leachate generation and flow analysis of the Lorne Landfill included prediction of leachate generations rates and rates of escape to the environment.

Proposed Werribee Proscribed Waste Landfill

Provided specialist advice to Southern Rural Water regarding the potential groundwater impacts of the proposed proscribed waste landfill at Werribee. I attended the hearing regarding this landfill and was asked to provide expert opinion on the groundwater impacts by the panel.

Scottsdale Landfill

Provided advice relating to the Scottsdale Shire (Tasmania) on leachate generation, containment and migration for the proposed new landfill for the Shire. This site was technically difficult due to the very high rainfall at the site.

Mine Dewatering and Water Supply

Greg Hoxley has significant experience in assessing groundwater requirements from mining purposes and providing de-watering assessment and advice. He has particular experience in the Mineral Sands industry where he is familiar with the process requirements of mineral sands mines and how these interact with groundwater. He has been involved in water balance assessments for mines, design and installation of groundwater pumping systems, environmental assessment of mine water management, and statutory reporting requirements and exploration assessment. This has included the supervision of groundwater testing systems for pumping and injection of groundwater. He has been involved in the assessment of acid drainage issues and management tailings pond leakage.

Relevant project experience includes:

Wemen Mine Water Supply

Conceptual and detailed design of a groundwater pumping system for water supply for a Mineral Sands Mine in NW Victoria. This included field testing of aquifer capacity, numerical modelling of groundwater response and design of a wellfield and headworks system to provide water for a dredge mining operation.

Prungle Mine Environmental Assessment and Pre-feasibility Assessment

This project involved the pre-feasibility and environmental effects assessment for a proposed mineral sand mine in Western NSW. This project involved field-testing of aquifer parameters, numerical modelling, environmental impact assessment, water balance modelling and liaison with regulatory agencies. The project involves significant dewatering of an orebody to enable mining, combined with disposal of water.

Cobar Water Infiltration Study

As part of the proposed expansion of a block fall mine near Cobar, A study was undertaken to estimate the peak inflow rate to underground workings from rain events. This involved sophisticated numerical modelling to evaluate the likely peak infiltration and flow rate through a fractured rock system under a high Annual Return Interval rain event. This work was used to assist the design of a pit pumping system for the mine.

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Marong Open Cut Groundwater Study

As part of the Environmental Impact Study of the proposed Marong open cut coal mine in SW Queensland a groundwater model was developed. My role in the project was to provide review and sign-off on the model development and predictions. The model conceptualisation was complex as a result of nearby groundwater users and the need for significant dewatering.

Fiji Gold Mine Water Infiltration Study

This project involved estimating the infiltration of surface water and rainfall into a hard rock gold mine in Fiji. The project was a desk study based on field data collected by the client and involved analytical analysis of inflow response to rainfall events to assess the need for mine dewatering.

12 Mile Mineral Sands Mine

This project involved identifying a high volume water supply for a proposed mine in western NSW. The project included field studies and drilling in an attempt to find a groundwater supply and environmental impact assessment of the proposed water management system.

Environmental Effects Statements / EIS

Greg Hoxley has had considerable experience in the development of EES/EIS documentation and in undertaking studies as part of EES/EIS. He has been involved in all aspects of such studies, from detailed technical assessment of potential environmental effects of proposed developments, through to overall management of the preparation of statements, and on to representing developments at hearings and providing expert testimony. He is familiar with the statutory process for environmental effects statement in many States.

Relevant project experience includes:

Mildura Marina EES

This project involved developing the EES documentation for a proposed Marina Development in northern Victoria and then presenting the project to a Panel Hearing. This project involved many specialist studies, including salinity studies.

Ord Irrigation Project PER/CER

This project involved the development of documentation for environmental review for the proposed Ord River Stage 2 Irrigation Development. It involved technical assessment of the nature of environmental impact and preparation of reports for public review of the proposed development.

Marong Power Station EIS

This project involved providing assistance with the groundwater aspects of a proposed expansion to a power station and coal mine in southern Queensland. The project was highly controversial and required careful consideration of potential effects.

12 Mile Mineral Sand Mine EIS

This project involve the assessment of a range of water related impacts for a proposed mineral sands mine in western NSW. The project is near a protected area and the project tasks involved ensuring that the design and development of the mine did not disturb adjacent sensitive areas.

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Groundwater Resources and Management

Greg Hoxley has considerable experience in groundwater resource identification and management. He has been involved in groundwater management issues for over 25 years. He has contributed to many of the key technical aspects of groundwater policy in Victoria over the years. He has represented Victoria on the National Groundwater Committee. He has undertaken many projects in groundwater resources and management. These range from field data collection and resource evaluation, through to basin scale resource assessments. He has provided a number of key technical documents for the assessment and management of groundwater resources in Victoria. He developed the method by which groundwater basin Permissible Annual Volume is determined and led the project that developed the first estimate of over-committed groundwater basins in Victoria. He is familiar with groundwater legislation and how this relates to groundwater management. He has provided technical advice to regulating agencies on groundwater issues.

Relevant Project Experience includes:

PAV Determinations

This project involved developing a method that could be applied across a range of groundwater basins with different data availability to assess the likely long term yield from the basin. The project provided the underlying methodology that has been used to determine a first pass estimate of the yield of all Victorian Groundwater Management Areas.

Risk Mapping

This project developed a series of maps for the whole of Victoria that define the risk of groundwater contamination from different land uses. The project provided the first comprehensive assessment of contamination risk for the State. The maps provide resource managers with key information on the nature and threats to the groundwater resource. The project has provided very important information for the management of groundwater quality. This project involved the development of a customised method for defining risk and mapping it across the entire State. It included numerical modelling of contamination movement and collation of a large number of spatial data layers.

Beneficial Use Maps

Beneficial Use maps were prepared to assist the implementation of the State Environment Protection Policy “Groundwaters of Victoria”. These maps provide a ready indication of the groundwater Beneficial Use category, which can then be used to set policy requirements for an area. These maps are a key part of managing groundwater resources

Koo Wee Rup Water Supply Protection Area

This project involves the assessment of the likely yield from the aquifers of the Koo Wee Rup Water Supply Protection Area in southern Victoria. The aquifer system is potentially under threat from multiple degrading sources. This study has included numerical modelling, groundwater chemistry sampling and assessment and technical advice on allocation and trading policy

Barwon Downs Aquifer Evaluation

This project involved the assessment of the long term yield from the Barwon

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Downs Aquifer. This aquifer is a key water supply for the city of Geelong. The project included modelling, field studies, and assessment of environmental impact - especially the potential impact on streams and wetlands. This information was used to support a licence application.

Septic Tank Impact Assessments

Many small townships in coastal areas of Victoria rely on septic tanks for effluent disposal. This study looked at the groundwater contamination risks and likelihood for a number of small towns in sandy coastal areas of Victoria. The project identified a variety of contamination sources through field investigations and analysis of groundwater chemistry.

Latrobe Valley Groundwater Decline Study

Large volumes of groundwater are pumped from aquifers in the Latrobe Valley of southern Victoria, fro a number of uses. As a result of concern about potential impacts of the extraction a study of aquifer response was undertaken. This study used modelling to assess the likely long-term trends in regional groundwater levels and to feed into analysis of environmental effects of large scale de-watering of aquifers.

Victorian Hydrogeological Mapping Series

This project has provided valuable maps of the groundwater resources of most of the State in hardcopy format that can be used by a variety of groups in the community to assist in the understanding and use groundwater.

Southern Rural Water Hydrogeological Maps

This project prepared electronic, seamless, hydrogeological maps for southern Victoria. This ground breaking project defined a new standard for groundwater mapping in Victoria.

National Groundwater Information System

Development of the framework of a national groundwater information system for the Bureau of Meteorology and the National Water Commission.

Cumulative Effects of Mining on Groundwater

Development of a national framework for assessing the cumulative effects of mining of groundwater. This framework provides for the first time a national approach to cumulative effects.

Hawkesdale Groundwater Resource Appraisal

Development of a groundwater resources appraisal for the Hawkesdale area of Southern Victoria. This area is a key groundwater development area and has extensive interactions with rivers and other aquifer systems. This complex study was considered a benchmark for the handling of climate change impacts on groundwater resources planning

Victorian Aquifer Framework

Formation of a framework for naming and defining aquifers in Victoria. This framework provides a coherent aquifer description and naming scheme for the first time for the whole State.

Waste Water Disposal

Greg Hoxley has considerable experience in issues associated with disposal of treated effluent to land. Irrigation with treated effluent is the preferred disposal option across the nation, yet this must be done with care to avoid

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unwanted contamination of groundwater. Greg has had considerable experience in all groundwater-related aspects of effluent disposal to land, from field investigations and data collection through analysis and reporting, on to presentation of expert statements at hearings. He has broad experience in many aspects of irrigation planning, design and impact assessment.

Relevant project experience includes:

Waste Water Injection - Koo Wee Rup

Modelling of the potential impact of waste water injection into aquifers in the Koo Wee Rup area of Victoria, for Melbourne Water. This project involved assessment of options for disposal of treated effluent for the Pakenham STP in eastern Victoria. The area suffers from over extraction of groundwater and the option of injection of treated sewage was considered by numerical modelling of the aquifer system.

Lancefield Effluent Disposal Site

Investigation of the suitability of land near Lancefield (central Victoria) for irrigation disposal of effluent. This study involved the evaluation of geological, hydrogeological and soil properties for three sites with a concept design for the preferred site being developed.

Wool Scour Effluent

Investigations of the potential for disposal of effluent from a wool scour site near Ararat, Western Victoria. A proposed wool scour plant site was evaluated for suitability for land based disposal of effluent. Site investigations were conducted and a site water balance prepared.

Mildura Effluent Disposal

Provision of advice to the Victorian Environment Protection Authority on the impacts of proposed irrigation of treated effluent near Mildura.

Cobden Effluent Disposal

Investigation into the suitability of land for effluent disposal near Cobden, Victoria. An existing sewage treatment plant was disposing to a near-by stream and was required to relocate disposal to land. The investigation involved the characterisation of the soils, irrigation potential and preliminary design of the irrigation site.

Melton South Golf development

Assistance with the investigation, evaluation and reporting of the potential impacts of a proposed golf development at Melton South. Included Panel hearing attendance and presentation of expert opinion.

Wallan Effluent Reuse Scheme

Assessment of the potential effects of proposed effluent disposal to land from the Wallan STP. This project involved field data collection, analysis, modelling, assessment of nutrient and salinity effects and threats and presentation to a Panel Hearing.

Groundwater Quality and Contamination

Greg Hoxley has experience in undertaking analysis and assessment of groundwater quality and contamination issues. He has been involved in a number of studies that have assessed the potential for contamination to develop or migrate in groundwater. He has experience in defining and

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supervising site data collection, in QA/QC protocols and chemical handling issues, evaluation and interpretation of site data, modelling of contaminants in soil and groundwater, assessment of contamination risk, and policy evaluation.

Relevant Experience includes:

Pesticide Contamination from Irrigation

This project was involved major site sampling programs to determine the likely occurrence and risk of groundwater based contamination from pesticides in irrigated areas. The study involved detailed field studies and site investigations, groundwater and soil sampling and testing, analysis of results and assessment of risk of contamination of surface and groundwater.

Ballarat and Geelong GMP Site Assessment

This project involved the assessment of the extent and nature of contamination at two former Gas Manufacturing Plant sites. This involved site data collection, analysis of results and characterisation of contamination.

Richmond Site Assessment

This project involved a former industrial site in Richmond that had TCE contamination. Tasks included assessment of field data, planning of data collection, review and assessment of results, design of modelling program.

Redevelopment of former Salt Works Site

This project involved providing specialist advice and interpretation to the Auditor for the site on the salinity issues associated with redevelopment of the site.

Review of modelling - Site Rehabilitation, Adelaide

This project involved undertaking a specialist review of numerical modelling done for a hydrocarbon contaminated site in Adelaide.

Groundwater contamination by Arsenic, South Australia

This project involved the design of field collection programs and analysis of groundwater and soils results for a rail depot in South Australia that had significant Arsenic contamination in soils. The site was within the reach of an urban water supply bore.

Groundwater Contamination, Hobart

This project involved the assessment of widespread contamination of a former rail yard by a variety of contaminants. The project included modelling of groundwater plume migration and assessment and review of potential consequences. This resulted in a revised field data collection program and long term monitoring.

Site Assessment, Northern Territory

This project involved the assessment of potential heavy metal contamination in a site in the Northern Territory. It included design of field data collection, site supervision, data analysis and reporting.

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Other Competencies

- Trained and accredited Auditor for ISO9000 series Quality Assurance Systems
- Proficient FORTRAN Programmer
- Experienced in IT system management and strategic evaluation
- Experienced in Database design and functional specification
- Able to write HTML code and build web sites
- Experienced in operation and maintenance of UNIX based computers
- Experienced manager of people and teams

Language: English

Papers and Presentations

1988 "Hydrogeology of the Mallee Tract of the Murray River" Co-author with R. Thorne. Presented to Murray Basin '88 Conference, Canberra.

1990 "Groundwater Resource and Salinity Management by Hydrogeological Mapping in the Murray Basin" Co-author with W.R Evans, R.M Williams, S.R. Barnett. Presented to International conference on Groundwater in Large Sedimentary Basins, Perth.

1990 "Groundwater Interaction with Lakes in the Kerang Lakes Area, Victoria" Presented to Murray Basin '90 Conference, Mildura.

1990 "Management Implications of the Nyah to the South Australian Border Hydrogeological Project" Co-author with R.S. Evans. Presented to Murray Basin '90 Conference, Mildura.

1991 "Groundwater Management in a high watertable area, near Kerang, Victoria, Australia." Paper presented to the International Hydrology and Water Resources Symposium, Perth, October 1991.

1994 “Influence of Septic Tanks on Groundwater - Results of two case studies in Victoria” Paper presented at the “Water Down Under” international symposium held in Adelaide in November 1994.

Appendix B. Instructions

HARWOOD ANDREWS

Our ref: 3JMH:8JEB 21406061
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4 May 2015

Mr G Hoxley
Principal Hydrogeologist
Jacobs
Email: Greg.Hoxley@jacobs.com

Dear Greg,

Ballarat Saleyards

We refer to your telephone conversation with John Hannagan of our office of 13 April 2015 and confirm that we act for RLX Investment Company Pty Ltd as trustee for RLX Investment Trust (**RLX**).

We seek your appearance to provide evidence at a planning panel scheduled for the week beginning 22 June 2015 in relation to hydrogeological issues related to the proposed relocated Central Victorian Livestock Exchange (**CVLX**).

Background

RLX proposes to relocate the Central Victorian Livestock Exchange (**CVLX**) from its existing site in central Ballarat to the north-west outskirts of the city. The proposed move will require a planning scheme amendment to rezone the new site from Farming Zone to a Special Use Zone (Schedule 15) in order to facilitate the establishment of a regional livestock exchange (saleyard).

The amendment will provide the policy framework to facilitate the relocation of the existing CVLX from its current location in Latrobe Street, Ballarat. While the existing controls in the Farming Zone enable the development of the site for a saleyard as a Section 2 use, the regionally significant nature and scope of the activities proposed for the new CVLX warrant a tailored zoning approach to recognise the use and development of the land for its specific purpose.

Council resolution to request a planning panel

In its meeting of 22 April 2015, the City of Ballarat (**Council**) relevantly resolved to:

- Amend the proposed SUZ15 to ensure any Development Plan prepared under these provisions is to the satisfaction of relevant statutory authorities including VicRoads, Central Highlands Water and Southern Rural Water.
- Request the Minister for Planning to appoint a joint independent Planning Panel to consider submissions received to combined Planning Scheme Amendment C185 Central Victorian Livestock Exchange and Environmental Protection Agency Works Approval.

By letter to Planning Panels Victoria dated 23 April 2015, Council requested that a Panel be appointed under Part 8 of the Planning and Environment Act 1987.

The Panel is scheduled to begin on the week commencing 22 June 2015 and expected to continue into the week commencing 29 June 2015 and possibly into the

week commencing 6 July 2015. Council has requested that the Panel hearing take place at the Ballarat Turf Club in Miners Rest.

A directions hearing will be scheduled for the week commencing 18 May 2015.

Land

The proposed new location for CVLX is approximately 10.5km from the centre of Ballarat, 4 kilometres from the perimeter of Ballarat, more than 1km from the Miners Rest township situated to the north east. The land the subject of proposed planning scheme amendment C185 is more particularly described in certificate of title volume 09369 folio 420 being Lots 1 and 2 on TP840697G; volume 11458 folio 790 being Lot 2 on PS341031L; and a road reserve in volume 11413 folio 187 being Lot 1 on TP944606J (**Land**).

The Land bounded by the Sunraysia Highway to the north and east and the Western Highway to the south. The land to the west is private property used for grazing.

The Land is currently within the Farming Zone and is presently used for grazing. No overlays affect the Land. The area surrounding the Land is typically used for agricultural purposes especially grazing and there are scattered rural dwellings. A disused quarry is located to the east of the site, across the Sunraysia Highway. The Ballarat Airport is located approximately 2 kilometres southeast of the site across the Western Freeway.

There is a small stand of trees in the central north east area of the site and an isolated tree in the south-east of the site but there is otherwise no native vegetation on the Land. . There are stands of trees within the roadside along the northern and eastern site boundaries.

The vegetation and fauna habitat of the Land has been highly modified by past disturbances which have included cattle grazing, hay cutting and fertilizer application. Most of the Land has been significantly degraded and supports predominantly introduced vegetation that is of limited value for native fauna. Ecological values identified within the study area include a small area remnant vegetation (Plains Grassy Wetland Ecological Vegetation Class) and one remnant tree.

The Land generally slopes from south-east to north-west with an approximate difference of 15 metres. There is a large rise in the north east of the site and a smaller rise in the south east of the site.

The western boundary of the Land is located in a floodplain. The Land is proximate to two Declared Water Supply Catchments and within a Water Supply Protection Area.

The Land is well positioned with respect to road infrastructure with the Sunraysia Highway and Western Highways in close proximity. The site is not currently services by potable water, electricity or telephone but services are readily available in the area. The site is not constrained by servicing infrastructure.

The eastern part of the Land is affected by areas of Aboriginal Cultural Sensitivity. Consultants preparing a Cultural Heritage Management Plan identified two areas of Aboriginal Cultural Heritage likelihood: the crest and upper slope of the large rise in the northeast of the Land and the crest and upper slope of the smaller rise in the southeast of the activity Land.

Planning Scheme Amendment

The proposed Special Use Zone Schedule 15 (**SUZ15**) will require completion of a Development Plan before the use can commence, with no further public consultation required if the Development Plan meets the requirements of SUZ15.

The amendment also seeks to introduce the "Central Victoria Livestock Exchange, Ballarat December 2014" incorporated document into the schedule to clauses 53.02 and 81.01 of the Ballarat Planning Scheme. This incorporated document seeks to exclude the land from certain controls contained within the Ballarat Planning Scheme in order to facilitate the ongoing use and development of the land for a livestock exchange facility.

Draft SUZ15 includes requirements for several plans to be prepared to ensure that all environmental requirements are addressed appropriately before the planning permit would be granted. These include a development plan that must be generally in accordance with the concept plan in section 8.0 of SUZ15. The development plan must also include the following to the satisfaction of the responsible authority:

- an existing conditions plan;

- a site layout plan;
- landscape master plan;
- vegetation management plan;
- car parking and traffic management plan;
- flood investigation;
- stormwater management plan; and
- operations and environmental management plan.

A consolidated schedule of conditions and requirements that must be observed by the use and development of the land for the purpose of a saleyards is also required.

The amendment is a combined planning scheme amendment and Environment Protection Authority (**EPA**) works approval application. The works approval application is required as a livestock saleyards is a scheduled premise under the Environment Protection (Scheduled Premises and Exemptions) Regulations 2007. The Planning Panel Hearing will be a joint hearing for Amendment C191 and EPA Works Approval Application Service Order Reference: 1001580.

A Memorandum of Understanding between Department of Transport, Planning and Local Infrastructure (**DTPLI**) and EPA dated 19 December 2013 provides for the joint processing of a Planning Scheme Amendment under the Planning and Environment Act 1987 and an application for a Works Approval under section 19B of the environment Protection act 1970.

Works Approval

The Works Approval requires the following reports:

- Water cycle management report.
- Draft environmental improvement plan.
- Land capability assessment.
- Noise assessment.
- Odour assessment.
- Stormwater investigation.
- Strategic assessment of the amendment.

These reports assess the environmental assets on the site and surrounds and provide that such assets will not be compromised as a result of the future use of the Land for the CVLX.

Proposed use of facilities

The facility is proposed to accommodate 70,000 cattle and 1.6 million sheep annually. The proposed facilities on the Land required to accommodate this capacity include the following:

- 12,800m² of roofed sheep yards;
- 19,800m² of external sheep yards;
- 4,200m² (approximately) of roofed cattle yards;
- 6,800m² (approximately) of external cattle yards;
- truck wash down area able to cater for four trucks (24 hour/7 day access);
- 3,800m² of truck parking area;
- 216 car parking spaces for vehicles;
- an office and administrative complex covering approximately 1,400m²;
- a water storage dam able to capture 5 ML of irrigation water;
- a series of water treatment ponds designed to capture and treat all water runoff from the operational area of the site;
- night lighting and CCTV camera security;
- a maintenance and hay shed; and
- numerous speciality loading and unloading ramps.

The balance of the Land will be used as irrigated grazing land.

RLX anticipates the new CVLX will cater for 17 staff, 48 personnel, six livestock contractors, 12 drovers and up to 100 patrons on peak event days. CVLX is scheduled to host 48 prime cattle sales per year (weekly on

Mondays), 51 sheep sales per year (weekly on Tuesdays) and 13 store cattle sales per year (monthly on Fridays). It is proposed 24 hour, seven day a week access to the facility be provided to retain access to truck wash-down facilities and satisfy pick-up/drop-off requirements. Closed Circuit Television (CCTV) surveillance will be installed at the entry and various other locations on the site.

The proposed CVLX will include the following key elements:

- Efficient network of livestock, yards, scales, crushes that will facilitate enhanced livestock movements, penning, scanning, identification and classification;
- Effluent management systems enabling animal and human waste to be entirely managed on site;
- Complex network of walkways, elevated platforms/catwalks and remotely operated gates, ramps and crushes permitting livestock and human separation enhancing workplace health and safety systems and outcomes;
- Extensive use of low bruise panels and gates and yard designs that eliminate points of potential animal harm;
- Animal enclosures and pavilions built to optimise animal comfort and presentation for sale, including roofed yards for cattle and sheep;
- Facilities designed to provide all necessary support services for users and patrons including offices and meeting rooms, Information Technology and media access, cafeteria, hygiene services and an attractive and competitive market for livestock buyers and sellers;
- Facilities and infrastructure for heavy vehicles, all other forms of livestock delivery vehicles and general user traffic including parking (cars to b-triple heavy vehicles), extensive network of loading and unloading ramps and a modern highly efficient multi-bay truck wash facility;
- Maintenance workshop and feed storage shed;
- Perimeter paddocks to facilitate longer term storage/agistment of livestock;
- On-site water capture to reduce dependence on external sources of water; and
- Advanced livestock processing and tracking IT infrastructure to enhance food security and commercial security outcomes and landscaping.

Submissions/objections

The formal Exhibition period for the proposed planning scheme amendment was from 12 February 2015 to 20 March 2015, with a total of 95 submissions received (40 of these were late submissions); 88 submissions were from community members, generally opposing the proposed saleyards and seven were from referral/public authorities. Further late submissions have also been received and copies of these submissions are in your folder of materials.

The key concerns expressed in submissions can be summarised as follows:

- Proximity to houses and Miners Rest;
- Odour and noise;
- Trucks and traffic;
- Operational matters;
- Flooding and water quality concerns;
- Current saleyards;
- Other issues; and
- Referral Authority responses.

Proximity to Miners Rest

Most submitters raised concerns regarding the proximity of the proposed CVLX to houses and Miners Rest. Concerns relate to the impact CVLX may have on property values; the potential that it will stall the growth of the township; its impact on the quality of life of residents; and its failure to provide any net community benefit to Miners Rest.

The closest dwelling to the proposed saleyards is 890m, with the Miners Rest Township approximately 1.2km away. As a comparison, the current saleyards is located 230m from dwellings.

Odour and noise

Submitters are concerned that CVLX will produce unreasonable odours, impacting people in surrounding houses and Miners Rest. The concerns about odour and noise relate both to the proposed saleyards and also to truck traffic associated with the yards.

Trucks and Traffic

The truck and traffic concerns include which roads trucks will use to access CVLX, with the potential for trucks to travel through Miners Rest or on roads near housing and the Miners Rest Primary School, and related safety and amenity issues. Truck and traffic concerns in the submissions extend to the impact of trucks on roads and degradation of road infrastructure quality and managing and enforcing usage of designated truck routes.

The Development Plan in SUZ15 requires a Car Parking and Traffic Management Plan to be completed, which includes the designation of truck routes to be approved by Council.

Operational matters

Submitters raised a variety of operational concerns, including impacts of lighting from the site; hours of operation and access provisions; loading and unloading arrangements, and compliance with planning requirements.

Water issues

Water related concerns included risk of the site flooding and associated water quality and contamination issues, along with risks of the proposed saleyards exacerbating floods in the Miners Rest area. The potential of surface water contamination arising from uses, water and effluent management on site were also raised. It will be a condition of the Development Plan that these issues are resolved to the satisfaction of the relevant Statutory Authority.

Referral Authorities

The referral authorities that provided submissions were the Country Fire Authority (**CFA**), Glenelg Hopkins Catchment Management Authority (**GHCMA**), Central Highlands Water (**CHW**), VicRoads and the Department of Economic Development, Jobs, Transport and Resources (**DEDJTR**).

CFA state that the proposed development will not increase the risk of fire to adjoining properties and if anything the layout will mitigate grassfire risk. It supports the proposed amendment in its current form.

GHCMA recommends that the development layout plan be modified to account for flood plain management issues relating to:

- the access roadway;
- location of the rainwater pond (detention basin);
- wetland and holding pond embankment freeboard; and
- management of post development water runoff.

CHW's concerns relate to:

1. Environmental impact and risk assessments:
    1.1. the potential for onsite waste water systems failure causing impacts for groundwater quality; and
    1.2. in the event of such failure, the proponent may need to seek an unplanned connection to CHW's reticulated sewer system.
2. Connection to potable water.
3. Proposed planning process.

In the event that the concerns relating to 1.1 are resolved, this also resolves concerns in 1.2. The potable water concern relates to potential future expense for the proponent and is not properly a matter for a planning panel and the concerns regarding planning process are resolved provided the development plan (required by the proposed SUZ15) is referred to CHW for its approval prior to Council's approval.

VicRoads seek a concept plan for the access to the site from the Sunraysia Highway that would be referred to in the development plan. VicRoads also seek a road safety audit of the interchange for southbound traffic heading to the Western Freeway westbound to ensure that it is suitable for a B double.

VicRoads preference is that vehicles can reach the site without passing through Miners Rest. This could be achieved for example, by diverting large vehicles from the Ballarat-Maryborough Road onto the Learmonth-Sulky Road and heading west until the Learmonth-Sulky Road intersects with the Sunraysia Highway.

This bypass and the interchange are requested to be part of a road safety audit.

DEDJTR seeks to have the impact of the CVLX assessed pursuant to the National Airports Safeguarding Framework. In particular, DEDJTR is concerned to have the matter assessed in relation to Guideline C "Managing the risk of wildlife strikes in the vicinity of airports" and Guideline E "Managing the risks of distractions to pilots from lighting in the vicinity of airports".

Instructions

Enclosed is a brief of materials for your consideration.

We seek your fee proposal to:

1. Review the exhibited materials and submissions;

2. Review the proposed SUZ15 and advise if you consider any changes are necessary to the development plan requirements as they relate to your discipline;

3. Prepare a peer review of the exhibited materials as they relate to your discipline;

4. Provide any further relevant information; and

5. Prepare a written report and provide oral evidence at a planning panel proposed for the week beginning 22 June 2015 in relation to potential groundwater effects from the proposed relocated CVLX.

We also attach a copy of Victorian Planning Panels Guide to Expert Evidence and ask that you review its contents and present any evidence consistent with the principles contained in that document. You should act in accordance with that document given the possibility you may be asked to provide evidence in the matter in the future. To be clear, you are being briefed for an independent opinion, and you should evaluate the material as such without recourse or regard to our client's position in the matter.

Our client will be directly responsible for payment of your fees, and has requested that an estimate of your range of fees is provided with (if possible) an upper/maximum limit. We request you send your fee proposal to us prior to commencing work.

Any invoices should be sent to us and also to:

Mr Paul Brown
Executive Director and General Manager
RLX Operating Company Pty Ltd
Level 35, 60 Margaret Street
SYDNEY NSW 2000,

by email: paul.brown@palisadepartners.com.au.

If you have any questions please call John Hannagan on 5225 5202 or Greg Tobin on 5225 5252.

Yours faithfully,

HARWOOD ANDREWS

Encl.

Appendix C. Douglas Partners Report

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 3, 131 Shannon Avenue
Manifold Heights VIC 3218
Phone (03) 5221 0711
Fax (03) 5221 0799

Project: 79187.01
5 June 2015
RL : 001
AR / DAW : ae

Regional Livestock Exchange (RLX) Investment Company Pty Ltd
PO Box R1313
Royal Exchange NSW 1225

Attention: Mr Paul Brown

Email: paul.brown@palisadepartners.com.au
Cc: John Hannagan (jhannagan@harwoodandrews.com.au)
Martin Haege (mhaege@geolyse.com)

Dear Sirs,

Additional Soil Investigation and Testing - Central Victorian Livestock Exchange Western Hwy & Sunraysia Hwy Interchange, Ballarat

1. Introduction

This letter report presents the findings of additional investigation works undertaken by Douglas Partners Pty Ltd (DP) for the proposed Central Victorian Livestock Exchange, northwest of Ballarat. DP previously undertook an On-Site Effluent Disposal Assessment for the site (ref 79187.00 Rev 1 dated 21 August 2014).

The purpose of the current phase of work was to provide three groundwater monitoring standpipes, four additional infiltrometer tests with respect to the procedures outlined in AS/NZS 1547:2012, six additional test pits plus soil and groundwater laboratory analysis.

The work was carried out for Regional Livestock Exchange (RLX) Investment Company Pty Ltd, with Harwood Andrews Pty Ltd acting as the project managers and Geolyse Pty Ltd as part of the design team.

2. Scope of Works

The scope of work was as follows:

- Drilling of three boreholes to 25 m depth, with the installation of a standpipe in each borehole;
- Excavation of six test pits to target depths of 2.5 m or prior refusal;
- Conducting four infiltrometer tests in the subsoil materials;
- Collection of soil and groundwater samples;
- Laboratory analyses of selected subsoil samples and the groundwater samples; and
- Provision of a factual report on the above findings.

During the fieldwork, siltstone was encountered beneath the majority of the site, however, near-surface basalt was encountered in the south eastern corner of the site. Additional test pits were subsequently requested by the design team to delineate the boundary of the basalt flow. Upon completion, a total of 23 test pits were undertaken, including the six originally planned.

During drilling of the borehole in the south western corner of the site (MW102), basalt was also encountered overlying the siltstone. An additional shallow borehole (MW102A) was requested by the design team in this location.

3. Site Description

The site remained in a similar condition as to that found when the 2014 fieldwork was undertaken, and the previous site description has been replicated here.

A site locality and layout plan (Drawing 1) and photographs are presented in Appendix B.

The site, a grass paddock, covers an irregular area approximately 900 m x 600 m in plan dimension and is situated to the west of the Western Highway and Sunraysia Highway interchange, approximately 10 km north west of Ballarat in Victoria.

The site generally slopes gently towards the west to the lowest point along the western boundary. Two gently sloping hillocks were situated in the eastern half of the site. The peaks of the hillocks were approximately 14 m above the lowest lying areas of the site (on the western boundary). The sides of the hillocks sloped down at gradients of between 1° (1.5%) and 3° (5%).

The site was divided into four (fenced) quadrants, containing sheep and cattle. An isolated stand of pine trees were situated in the northeast quadrant. Scattered vegetation was also situated around the eastern boundary outside the site perimeter.

There was a small dam in the north western corner of the site that was surrounded by reeds, with shallow ponded water in the surrounding area. There was another small dam in the centre of the southern site boundary. A large patch of soft wet ground was present on the southern boundary of the site, downslope of the dam. There was an open surface water drain just beyond the western site boundary. The drain was full of standing water that was slowly draining to culverts beneath the Western Highway to the south of the site. Reeds surrounded the culvert and encroached onto the western edges of the site. Surface water was ponding at a low point in the centre of the western boundary. Surface water drains around the eastern half of the site also contained standing water.

4. Investigation Methodology

4.1 Boreholes

Boreholes were drilling using a track mounted drill rig using solid flight augering, wash boring and coring techniques. Disturbed soil samples and rock core were collected from the boreholes for logging purposes.

The borehole drilling works were undertaken between 19 and 25 May 2015. The final depths of boreholes MW101, MW102, MW103 and MW102A were 25.1 m, 23.5 m, 25.2 m and 8.0 m respectively. Following completion of the drilling works, 50 mm diameter standpipes were installed to the base of each of the boreholes.

4.2 Test Pits

Test pits were excavated on 20 May 2015 using a 13.5 tonne excavator equipped with a 450 mm wide bucket. Disturbed and undisturbed tube samples were collected from the test pits for geotechnical and environmental testing purposes. A series of additional shallow test pits were also excavated to determine the extent of the basalt flow on 22 May 2015.

Upon completion, the test pits were reinstated by backfilling in layers, with the each layer tamped by the backhoe bucket. Any excess spoil was mounded and subsequently track rolled by the excavator.

4.3 Infiltrometer Tests

A series of shallow hand auger boreholes were drilled on 19 May 2015 for soil infiltration testing.

To determine the coefficient of permeability or the hydraulic conductivity (k) of the subsoil, four constant head tests were carried out in accordance with the methodology outlined in AS/NZS 1547:2012 (Ref 1).

The constant head test is based on Darcy's law and is used to estimate the saturated permeability of the soil which is situated above the water table. This test is carried out using a permeameter which supplies or recharges the unlined auger hole as water seeps into the ground to maintain a constant head of water within the hole. The loss of water from the permeameter is measured with time and the measurements inserted into a formula to calculate the saturated soil permeability (k).

Four 85 mm diameter holes were augured to between 0.6 m and 0.85 m depth and the bases cleaned of loose material. The locations of the tests are shown on Drawing 1 and the results are presented in Appendix C. The permeameters and support legs were set up such that the bottom opening of the air inlet pipes were between 150 mm and 400 mm above the base of the auger holes (the selected head of water).

Subsequently the holes were all partially filled with water directly from a jerry can using an anti-scour device, such that the water level was about at the pre-selected level. Then the reservoirs were filled with drinking water and upended, with a hand at the base to prevent water from emptying out, and quickly inserted into the test holes. Where test holes were over-filled, excess water was removed using a hand pump.

5. Results of Investigation

5.1 Subsurface Conditions

Full details of the conditions encountered in the boreholes test pits are presented on the logs in Appendix C. These should be read in conjunction with the explanatory notes in Appendix A.

The conditions encountered in the test pits were generally consistent, with the exception of exposing basalt in the south eastern corner of the site in TP106 to TP123 except for TP107, TP109, TP113 and TP122. Siltstone and sandstone was encountered within the boreholes, with a band of basalt encountered in MW102 in the south western corner of the site.

The soil profile comprised a surface layer of sandy / clayey silt typically 0.2 m to 0.4 m thick beneath a grass rootmat surface in the test pits. The surface layer was 1 m thick in borehole MW103. This was underlain by typically hard, orange brown / grey silty clay, typically of high plasticity and 'crumbly' when disturbed (i.e. 'moderate' structure). The sandy / clayey silt was absent in boreholes MW102 and MW102A, where the silty clay was encountered from ground surface. Gravelly silty clay was encountered in test pits TP102 and TP104 beneath the sandy silt. The thickness of the high plasticity silty clay layer ranged from 0.5 m to 2 m in the test pits, and the full thickness was not proven in TP104. The silty clay was 3.5 m and 4 m thick in MW102 and MW102A respectively.

Low plasticity, stiff and very stiff, pale grey and pale orange silty clay was encountered below the high plasticity clay in TPs 101, 102, 103, 105, 107, 109, 113, and 122, below a depth of typically 1 m to 1.2 m. The material contained larger clumps of soil when disturbed (i.e. 'weak' and 'moderate' structure).

Basalt was encountered beneath the high plasticity clay in the test pits noted above. Field observations of recovered fragments from the excavator bucket indicate the basalt to be typically highly weathered and low strength at the surface. The basalt encountered in MW102 was typically slightly weathered, high strength from its upper surface at 7.6 m to the base at 18.2 m depth.

Siltstone was encountered in all of the boreholes except MW102A, from 6.4 m and 7 m in MW101 and MW103. The siltstone was encountered beneath the basalt from 20 m in MW102. The siltstone was typically extremely and highly weathered, extremely low strength. Sandstone bands were encountered near the base of the boreholes in MW101 and MW103, at 1.7 m and 1.2 m thick respectively.

5.2 Infiltration Testing

The loss of water from the permeameter was recorded with time until the loss of water was observed to be relatively constant. The calculated permeability for each location is shown in Table 1 and the test data sheets are presented in Appendix C.

Table 1: Insitu Permeability (Hydraulic Conductivity) Test Results

Test Location	Test Depth (m)	Constant Head		Notes
		m/sec	m/day	
TP101	0.50-0.80	1.9×10^{-6}	0.16	Carried out in silty clay
TP102	0.45-0.60	2.7×10^{-8}	0.002	Carried out in silty clay with readings taking 20 mins to start
TP104	0.45-0.72	3.8×10^{-8}	0.003	Carried out in gravelly silty clay with readings taking 60 mins to start
TP105	0.45-0.85	2.4×10^{-7}	0.02	Carried out in silty clay

5.3 Groundwater

The results of the fieldwork groundwater monitoring and subsequent visit on 1 June 2015 are indicated in Table 2.

Table 2: Measured Groundwater Water Levels

Standpipe	Date	Time	Standing Water Level[1] (m)	Standing Water Level (mAHD)	Base Level[1] (m)	Notes
MW101	25/05/2015	12:45	2.99	413.50		Prior to purging
MW101	25/05/2015	~14:00	5.38	411.11		Following purging of ~100 litres
MW101	1/06/2015	10:41	2.99	413.50	25.3	Prior to purging
MW101	1/06/2015	11:27	5.74	410.75		Following purging of ~140 litres
MW102	25/05/2015		5.03	406.24		During drilling
MW102	1/06/2015	13:34	2.44	408.83	23.67	Prior to purging
MW102	1/06/2015	15:10	>23.67	n/a		Following purging of ~140 litres
MW102A	1/06/2015	12:41	4.93	406.32	8.33	Prior to purging
MW102A	1/06/2015	14:14	7.75	403.50		Following purging of 21 litres
MW103	21/05/2015	13:30	8.41	410.75		Prior to purging
MW103	21/05/2015	~14:15	11.85	407.31		Following purging of 30 litres
MW103	25/05/2015	14:30	8.63	410.53		At end of fieldwork
MW103	1/06/2015	8:54	8.62	410.54	22.1	Prior to purging
MW103	1/06/2015	9:57	17.01	402.15		Following purging of 81 litres

Notes: [1] measured from existing ground surface

It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

6. Laboratory Testing

6.1 Physical Laboratory Testing

The physical laboratory testing program comprised triaxial permeability on undisturbed samples (AS1289.6.7.3 method) and Emerson Class number on soil samples. The tests were carried out in DP's NATA accredited Melbourne laboratory and the results are summarised in Table 3.

Table 3 : Laboratory Test Results - Physical Properties

Test Site	Sample Depth (m)	Soil Texture[1]	Triaxial Permeability (m/s)	Emerson Class Number
TP101	0.5-0.8	Medium clay	5×10^{-9}	5
TP102	0.9-1.25	Medium clay	8×10^{-10}	5
TP104	0.8-1.1	Medium clay	9×10^{-11}	6
TP105	0.6-1.0	Medium clay	3×10^{-8}	5

Notes: 1 Soil texture based on definitions in AS/NZS1547:2012

6.2 Chemical Laboratory Testing

Samples from the subsoils in test pits TP102, TP103, TP104 and TP105 were submitted for the following chemical tests specific to effluent disposal assessment:

- pH determination in aqueous solution;
- Electrical conductivity in aqueous solution;
- Cation Exchange Capacity (CEC);
- Available phosphorous;
- Phosphorus Sorption Index (PSI);
- Total Nitrogen with TKN, nitrite (NO_2) and nitrate (NO_3); and
- Total alkalinity as $CaCO_3$.

The soil samples were submitted to Envirolab Services Pty Ltd in Scoresby for processing and allocating to the appropriate laboratory. The majority of the tests were carried out by Envirolab Services Pty Ltd in Chatswood NSW and East West Enviroag Pty Ltd in Tamworth NSW carried out the phosphorus tests. Detailed results of the laboratory testing outlined above are provided in Appendix D and summarised in Tables 4 and 5.

Table 4: Summary of Laboratory Test Results - Soil

Location / Depth (m)	Description	Textural Class	Soil pH in H_2O	ECe (µS/cm) [1]	CEC (meq%) [2]	PS (mg/kg) [3]	N (mg/kg) [4]
TP102 0.9-1.0	Silty clay	Medium clay	6.6	270	21	960	270
TP103 0.4-0.5	Silty clay	Medium clay	6.6	100	22	1,000	840
TP104 1.4-1.5	Silty clay	Medium clay	4.6	620	13	980	200
TP105 1.4-1.5	Silty clay / siltstone	Silty clay loam	7.4	510	15	680	330

Notes: 1 EC_e is the converted EC (1:5 – soil:water)
2 CEC – Cation exchange capacity
3 PS – Phosphorus sorption capacity
4 N - total nitrogen

Table 5: Summary of Laboratory Soil Cation Exchange Capacity Testing

Location / Depth	Description	Sodium Na (meq%)	Potassium K (meq%)	Calcium Ca (meq%)	Magnesium Mg (meq%)
TP102 0.9-1.0	Silty clay	4.8	0.5	3.1	13
TP103 0.4-0.5	Silty clay	2.6	0.6	4.8	13
TP104 1.4-1.5	Silty clay	1.0	0.3	1.3	10
TP105 1.4-1.5	Silty clay / siltstone	3.3	0.3	3.2	8.3

Notes: 1 meq/100g = 1 meq%

Groundwater samples from the standpipes in boreholes MW101, MW102, MW102A and MW103 were also submitted to Envirolab Services Pty Ltd in Scoresby for processing and allocating to the appropriate laboratory. Detailed results of the groundwater laboratory testing results are provided in Appendix D and summarised in Tables 6 and 7.

Table 6: Laboratory Test Results - Groundwater

Location	pH	EC (µS/cm) [1]	TDS (mg/L) [2]	P (mg/L) [3]	Al-D (µg/L) [4]	Na-D (mg/L) [5]	K-D (mg/L) [6]	Ca-D (mg/L) [7]	Mg-D (mg/L) [8]
MW101	6.9	2,700	1,800	0.1	<10	390	3.8	59	120
MW102	7.2	860	390	<0.05	<10	100	2.6	23	31
MW102A	6.4	5,900	3,900	0.2	<10	840	2.0	96	210
MW103	6.6	2,000	1,100	<0.05	<10	300	4.0	32	53

Notes: 1 EC - Electrical conductivity
2 TDS - Total dissolved solids
3 P - Phosphorus - total
4 Al-D - Aluminium - dissolved
5 Na-D - Sodium - dissolved
6 K-D - Potassium - dissolved
7 Ca-D - Calcium - dissolved
8 Mg-D - Magnesium - dissolved

Table 7: Laboratory Test Results - Groundwater

Location	N (mg/L) [1]	Phosphate (mg/L) [2]	NH_3 (mg/L) [3]	NO_2 (mg/L) [4]	NO_3 (mg/L) [5]	TKN (mg/L) [6]	NOx (mg/L) [7]
MW101	0.82	0.043	0.005	<0.005	0.017	0.8	0.017
MW102	1.9	<0.005	0.15	0.006	0.032	1.9	0.038
MW102A	1.7	0.006	0.007	0.006	0.097	1.6	0.1
MW103	1.7	<0.005	0.15	0.14	0.22	1.3	0.35

Notes: 1 N - Nitrogen - total
2 Phosphate - Phosphate as phosphorous
3 NH_3 - Ammonia as nitrogen
4 NO_2 - Nitrite as nitrogen
5 NO_3 - Nitrate as nitrogen
6 TKN - Total Kjeldahl nitrogen
7 NOx - Nitrogen oxides

7. Limitations

Douglas Partners (DP) has prepared this report for this project at Western Highway and Sunraysia Highway Interchange, Ballarat in accordance with DPs proposal ref GGG150016 (Rev 2) dated 11 May 2015 and acceptance received from Greg Tobin of Harwood Andrews Pty Ltd dated 13 May 2015. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Regional Livestock Exchange (RLX) Investment Company Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Please contact either of the undersigned for clarification of the above as necessary.

Yours faithfully,
Douglas Partners Pty Ltd

Reviewed by

for **Arthur Rowling**
Senior Associate

Dean Woods
Senior Associate

Appendix A	Notes About This Report Notes on Sampling Methods Notes on Soil Descriptions Notes on Rock Descriptions
Appendix B	Drawing 1 Site Photographs
Appendix C	Borehole Logs Rock Core Photos Standpipe Construction Details Test Pit Logs Infiltrometer Test Results
Appendix D	Laboratory Test Results

Appendix A

Notes About this Report
Notes on Sampling Methods
Notes on Soil Descriptions
Notes on Rock Descriptions

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Sampling Methods

Douglas Partners

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

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Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

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Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

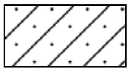
Soils


Topsoil

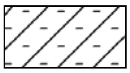

Peat


Clay

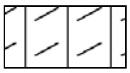

Silty clay

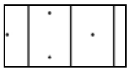

Sandy clay

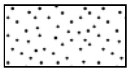

Gravelly clay

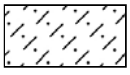

Shaly clay

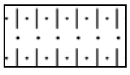

Silt


Clayey silt


Sandy silt

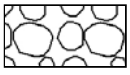

Sand

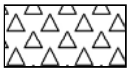

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

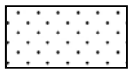

Talus

Sedimentary Rocks

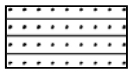

Boulder conglomerate

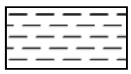

Conglomerate


Conglomeratic sandstone

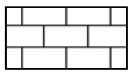

Sandstone


Siltstone


Laminite

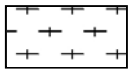

Mudstone, claystone, shale

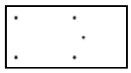

Coal


Limestone

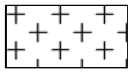
Metamorphic Rocks

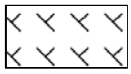

Slate, phyllite, schist

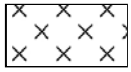

Gneiss

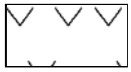

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite

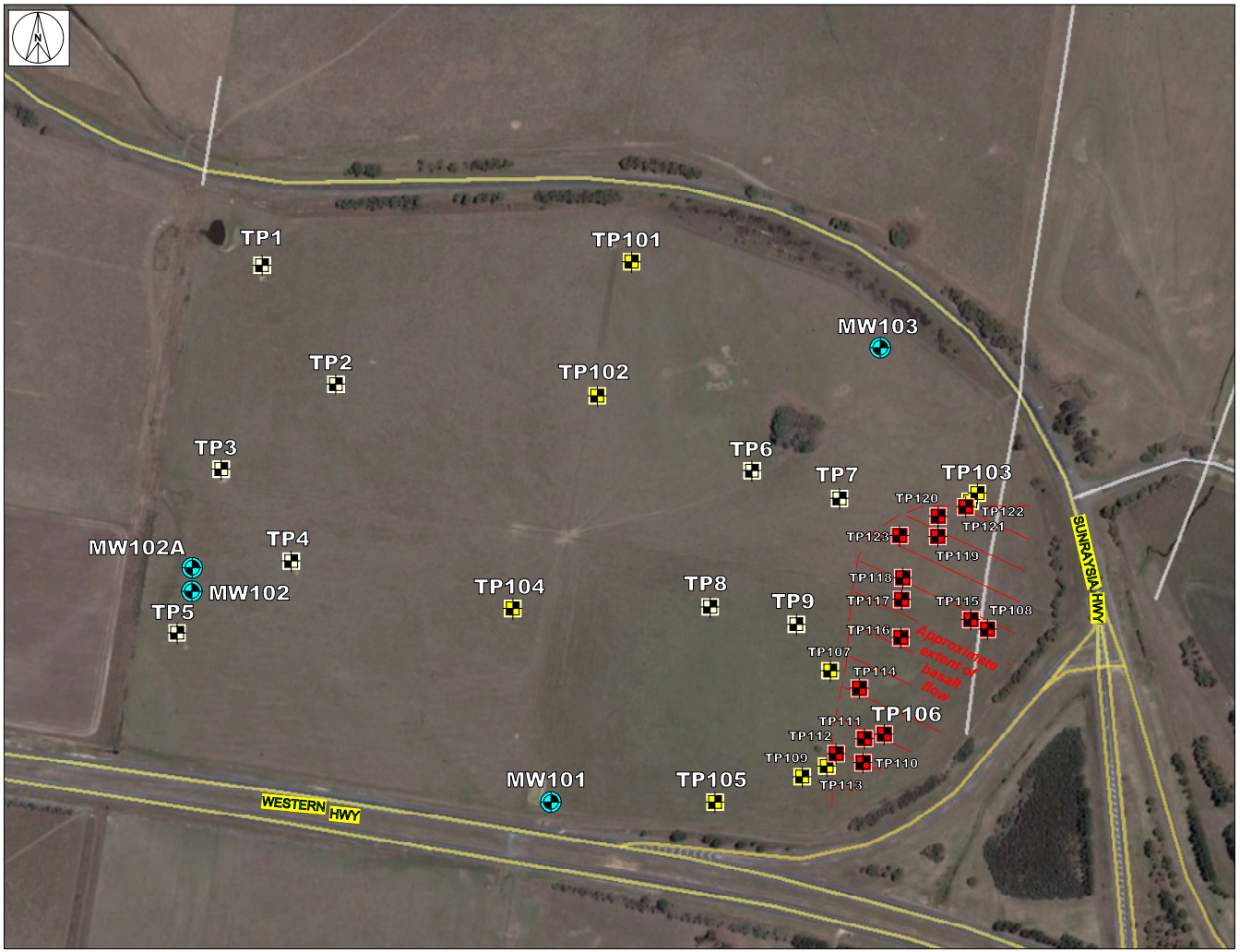

Dacite, epidote


Tuff, breccia

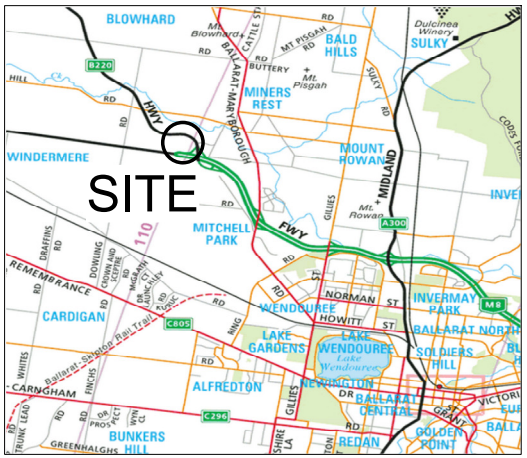

Porphyry

Appendix B

Drawing 1
Site Photographs



Google Earth aerial image



Locality Plan

www.street-directory.com.au

LEGEND

- Groundwater Monitoring Well
- Test Pit (2014)
- Test Pit (2015) - note red coloured pits denote where basalt was encountered

0 50 100 150 200 250 m

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: RLX Investment Company Pty Ltd OFFICE: Melbourne DATE: May 2015	**Monitoring Well and Test Pit Location Plan** **Livestock Exchange** **Miners Rest**	PROJECT No: 79187.01 DRAWING No: 1 REVISION: -

Photo 1 – Drilling borehole MW103.

Photo 2 – Excavating test pit TP103, showing siltstone fragments.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Central Vic Livestock Exchange** **Ballarat**	PROJECT: 79187.01 PLATE No: 1 REV: -
	CLIENT: Regional Livestock Exchange (RLX) Investment Company Pty Ltd	DATE: 5.6.15

Photo 3 – Excavated spoil from TP121 showing basalt fragments.

Photo 4 – Groundwater monitoring and sampling of boreholes MW102 and MW102A.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Central Vic Livestock Exchange** **Ballarat**	PROJECT: 79187.01 PLATE No: 2 REV: -
	CLIENT: Regional Livestock Exchange (RLX) Investment Company Pty Ltd	DATE: 5.6.15

Appendix C

Borehole Logs
Rock Core Photographs
Test Pit Logs
Infiltrometer Test Results

s

BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 416.49 m AHD **BORE No:** MW 101
EASTING: 745894 **PROJECT No:** 79187.01
NORTHING: 5847326 **DATE:** 20 - 21/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
416	0.4	SANDY CLAYEY SILT (ML): Very stiff, brown, humid, fine grain sand.							D			
		SILTY CLAY (CH): Very stiff, brown, dark brown, grey, humid to damp. Orange brown, damp below 0.7 m.							D			
415	1.5	SILTSTONE (EW) / SILTY CLAY (CI): Hard, pale grey, humid.				25-05-15			D			
414	4.0	SILTSTONE (EW): Extremely low strength, orange brown, humid, trace HW-MW low strength siltstone fragments.							D			
411	5.7	Core Loss.						5.7m: CORE LOSS: 700mm	C	20	0	
410	6.4	SILTSTONE (EW): Extremely low strength, orange brown, pale grey, occasional seams of HW very low strength Siltstone.							C	100	0	
408									C	80	0	
407	9.2	SANDSTONE (HW): Very low strength, orange brown, fractured.						9.2 - 18.1 m: J 10° - 15°, ro, un, cly vn 9.3m: J 65°, ro, un, cly vn	C	100	57	
	10.0											

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 5.5 m

TYPE OF BORING: Solid flight auger to 5.6 m, HQ3 coring to end

WATER OBSERVATIONS: No free groundwater to 5.5 m, observations obscured below this level by drilling water.

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 416.49 m AHD **BORE No:** MW 101
EASTING: 745894 **PROJECT No:** 79187.01
NORTHING: 5847326 **DATE:** 20 - 21/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
406	10.6	SANDSTONE (HW): Very low strength, orange brown, fractured.							C	100	57	
	11	Core Loss.						10.6m: CORE LOSS: 700mm				
405	11.3	(HW): Extremely low to very low strength.							C	53	55	
	12							11.8m: J 40°, ro,un, cly vn				
404	12.1	(HW): Very low strength, orange brown, pale grey, red brown.						12.6m: Sv J 12.6 - 12.8 m	C	100	54	
	13											
403	14											
	14.1	(EW-HW): Extremely low strength.							C	100	58	
402	14.7	(HW): Very low strength.										
	15	15.0 Core Loss.						15m: CORE LOSS: 600mm				
401	15.6	(EW)/ Silty clay, hard, orange brown.							C	60	0	
	16	16.0 SANDSTONE (EW): Extremely low strength, some (EW-HW) Very low strength siltstone / sandstone fragments.										
400	16.6	Core Loss.						16.6m: CORE LOSS: 500mm				
	17	17.1 (EW-HW): Extremely low to very low strength, with some HW very low to low strength fragments.							C	66	10	
399	18											
	18.1	SILTSTONE (EW) / SILTY CLAY (CH): Hard, orange brown.						18.1 - 25.1 m: J 5° - 10°, ro, un, cly vn, with bands of variously oriented j				
398	18.5	Core Loss.						18.5m: CORE LOSS: 1100mm	C	27	0	
	19											
397	19.6	(EW) / Silty Clay (CH): Hard, orange brown.							C	40	0	

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 5.5 m

TYPE OF BORING: Solid flight auger to 5.6 m, HQ3 coring to end

WATER OBSERVATIONS: No free groundwater to 5.5 m, observations obscured below this level by drilling water.

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
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BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 416.49 m AHD **BORE No:** MW 101
EASTING: 745894 **PROJECT No:** 79187.01
NORTHING: 5847326 **DATE:** 20 - 21/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
396	20.2	Core Loss.						20.2m: CORE LOSS: 1600mm	C	40	0	
395	21											
	21.8	SANDSTONE (HW): Very low to low strength, brown, red, fragmented to highly fractured.							C	53	18	
394	22	Orange brown below 22.6 m.										
	23											
	23.1	(EW-HW): Extremely low to very low strength, orange brown, fragmented.							C	60	0	
393	23.5	Core Loss.						23.5m: CORE LOSS: 600mm				
	24											
	24.1	SILTSTONE (HW-MW): Low to medium strength, orange brown, red brown, fractured.							C	80	14	
392	24.6	Core Loss.						24.6m: CORE LOSS: 200mm				
	24.8	(EW-HW): Extremely low to very low strength, orange brown, fragmented.										
	25											
	25.1	Bore discontinued at 25.1m										
391	26											
390	27											
389	28											
388	29											
387												

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 5.5 m

TYPE OF BORING: Solid flight auger to 5.6 m, HQ3 coring to end

WATER OBSERVATIONS: No free groundwater to 5.5 m, observations obscured below this level by drilling water.

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 411.27 m AHD **BORE No:** MW 102
EASTING: 745537 **PROJECT No:** 79187.01
NORTHING: 5847535 **DATE:** 21 - 25/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
411	0	SILTY CLAY (CH): Hard, brown, dark brown, humid, some fine quartz gravel.							D			
410	1								D			
409	2								D			
	2.0	SILTY CLAY (CH): Stiff, brown, damp, M≥Wp, some fine ferruginised gravel and quartz gravel, with coarse grain quartz sand.										
408	3											
	3.5	SANDY CLAY (CL): Stiff, brown, moist to wet, fine to coarse grain sand, with fine quartz gravel.										
407	4								D			
	4.5	SILTY CLAY (CH): Stiff, brown, dark brown, moist to wet, some fine to medium grain sand, with fine quartz gravel.										
406	5					25-05-15						
405	6								D			
404	7	Wet to saturated below 7.1 m.							D			
	7.6	BASALT (SW): High strength, grey, slightly fractured to fractured, highly vesicular, occasional clay seams.						7.6m: Unless otherwise stated all joints 3° - 5°, ro, un, cly vn, fe stn				
403	8											
402	9							9m: Cs 200 mm thick, with basalt fg 9.3 - 10.9 m: Sv, fr, with highly fr zones	C	100	70	
									C	100	69.3	

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 8.2 m

TYPE OF BORING: Solid flight auger to 8.2 m, HQ 3 coring to end.

WATER OBSERVATIONS: Water standing at 4.22 m bgl on morning of 22/05/15

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 411.27 m AHD **BORE No:** MW 102
EASTING: 745537 **PROJECT No:** 79187.01
NORTHING: 5847535 **DATE:** 21 - 25/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
401		BASALT (SW): High strength, grey, slightly fractured to fractured, highly vesicular, occasional clay seams. *(continued)*							C	100	69.3	
	11	Highly fractured below 10.7 m.										
400								11.2 - 11.4 m: J 20° - 30°, ro, un, cly vn, fe stn	C	100	36	
	12											
399									C	100	0	
	13											
398		Band of EW extremely low strength basalt / gravelly sand below 13.2 m .										
	13.6	(SW / FR): Very high strength, blue grey, fractured to slightly fractured.										
	14								C	100	94	
397												
	15											
396		Slightly fractured below 15.3 m.							C	100	100	
	16											
395												
	17								C	100	100	
394												
	18											
	18.2	SILTY CLAY (CH): Hard, orange brown, dark brown.							C	100	66	
393									C	100	0	
	19								C	100	0	
392									C	100	0	
	20.0											

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 8.2 m

TYPE OF BORING: Solid flight auger to 8.2 m, HQ 3 coring to end.

WATER OBSERVATIONS: Water standing at 4.22 m bgl on morning of 22/05/15

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 411.27 m AHD **BORE No:** MW 102
EASTING: 745537 **PROJECT No:** 79187.01
NORTHING: 5847535 **DATE:** 21 - 25/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
391		SILTSTONE (EW) / SILTY CLAY (CH): Extremely low strength / hard, pale grey, orange brown, minor brown red.							C	100	0	
390	21											
	22								C	100	0	
389	22.3	SILTSTONE (HW): Low strength, brown, orange brown, fractured to fragmented.						22.3 - 22.9 m: J 10° - 12°, ro,un, cly vn	C	58	14	
	23 23.0	Core Loss.						22.9m: Cs, with EW-HW siltstone fg 100 mm thick 23m: CORE LOSS: 500mm				
388	23.5	Bore discontinued at 23.5m										
387	24											
	25											
386	26											
385	27											
384	28											
383	29											
382												

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 8.2 m

TYPE OF BORING: Solid flight auger to 8.2 m, HQ 3 coring to end.

WATER OBSERVATIONS: Water standing at 4.22 m bgl on morning of 22/05/15

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 411.25 m AHD **BORE No:** MW 102 A
EASTING: 745538 **PROJECT No:** 79187.01
NORTHING: 5847540 **DATE:** 25/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
411	0	SILTY CLAY (CH): Hard, brown, humid, some fine quartz gravel.										
410	1											
409	2	Damp below 2.5 m.										
408	3											
407	4	4.0 SANDY CLAY (CL): Stiff, brown, moist, some fine quartz gravel.										
406	5	4.9 SILTY CLAY (CH): Stiff, brown, moist to wet.										
405	6											
404	7	Saturated below 7 m.										
403	8	8.0 Bore discontinued at 8.0m										
402	9											

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:**

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419.16 m AHD **BORE No:** MW 103
EASTING: 746221 **PROJECT No:** 79187.01
NORTHING: 5847777 **DATE:** 19 - 20/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
419		SANDY CLAYEY SILT (MH): Hard, pale grey, white, becoming pale yellow below 0.4 m, ferruginised gravel below 0.5 m.							D			
418	1 1.0	SILTY CLAY (CH): Very stiff, brown, red brown, trace fine to medium ferruginised gravel. Orange brown, red brown and pale grey below 1.5 m.							D			
417	2 2.5	SILTY CLAY (CI): Hard, pale yellow, pale grey, humid.										
416	3								D			
415	4											
414	5								D			
413	6											
412	7 7.0	SILTSTONE (EW) / SILTY CLAY (CI): Extremely low strength / hard, orange brown, minor pale grey, some fine grain sand.							D			
411	8	Some fine gravel below 8 m.										
410	9					25-05-15			D			
	10.0											

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 7 m

TYPE OF BORING: Solid flight auger to 7.5 m, washboring to 23.0 m and HQ3 coring to end.

WATER OBSERVATIONS: No free groundwater to 7.5 m, observations obscured below this level by drilling water.

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419.16 m AHD **BORE No:** MW 103
EASTING: 746221 **PROJECT No:** 79187.01
NORTHING: 5847777 **DATE:** 19 - 20/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
409		SILTSTONE (EW): Extremely low strength, orange brown, pale grey, thinly bedded to laminated.										
408	11								S			30, 20 / 50 mm double bouncing
407	12	Orange brown, laminated below 12.5 m.							D			
406	13											
405	14								D			
404	15											
403	16								D			
402	17								D			
401	18											
400	19								S			23, 20/75 mm
	20.0											

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 7 m

TYPE OF BORING: Solid flight auger to 7.5 m, washboring to 23.0 m and HQ3 coring to end.

WATER OBSERVATIONS: No free groundwater to 7.5 m, observations obscured below this level by drilling water.

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419.16 m AHD **BORE No:** MW 103
EASTING: 746221 **PROJECT No:** 79187.01
NORTHING: 5847777 **DATE:** 19 - 20/5/2015
DIP/AZIMUTH: 90°/-- **SHEET** 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
399		SILTSTONE (EW): Extremely low strength, orange brown, pale grey, thinly bedded to laminated.							D			
398	21											
397	22											
396	23 23.0	SANDSTONE (HW): Very low to low strength, orange brown, fractured.						23m: 23.0 -24.0 J 5-7°, ro, un, cly vn	C	100	52	
		Highly fractured below 23.8 m.						23.6m: 2.6 m: cl seam 15 mm thick				
395	24							24m: 24.0 - 24.5 m variously oriented fractures, ro, un, cly vn				
	24.2	SILTSTONE (EW): Extremely low strength, orange brown, pale grey.						24.1m: 24.1 m - 24.2 m frag	C	100	0	
394	25											
	25.2	Bore discontinued at 25.2m										
393	26											
392	27											
391	28											
390	29											

RIG: DB 420 **DRILLER:** Urban Drilling **LOGGED:** TM **CASING:** HWT to 7 m

TYPE OF BORING: Solid flight auger to 7.5 m, washboring to 23.0 m and HQ3 coring to end.

WATER OBSERVATIONS: No free groundwater to 7.5 m, observations obscured below this level by drilling water.

REMARKS: Location coordinates are in WGS 84 Zone 54 H. RL surveyed by SPIIRE, ref drawing 136360FS00-ACADBORES

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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Core Photo 1: MW101,5.7 m to 25.1 m.

Douglas Partners Geotechnics / Environment / Groundwater	**Rock Core Photographs** **Central Victorian Livestock Exchange** **Western Hwy & Sunraysia Hwy Interchange, Ballarat**	PROJECT NO. : 79187.01 PLATE No: 1
	CLIENT: RLX Investment Company P/L	DATE: May 2015

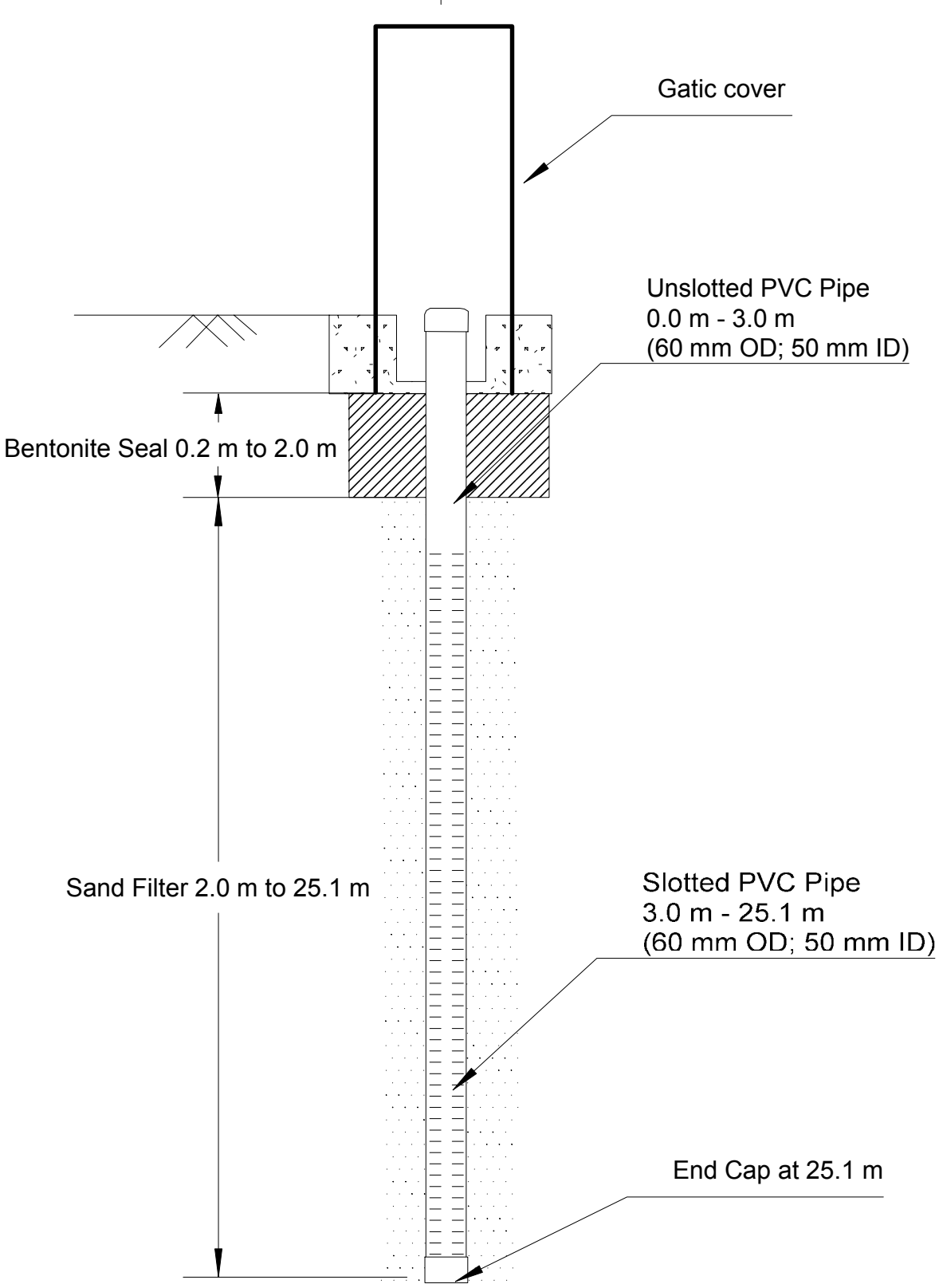
Core Photo 2: MW102, 8.2 m to 23.5 m.

Douglas Partners Geotechnics / Environment / Groundwater	**Rock Core Photographs** **Central Victorian Livestock Exchange** **Western Hwy & Sunraysia Hwy Interchange, Ballarat**	PROJECT NO. : 79187.01 PLATE No: 2
	CLIENT: RLX Investment Company P/L	DATE: May 2015

Core Photo 3: MW103, 23.0 m to 25.2 m.

Douglas Partners Geotechnics / Environment / Groundwater	**Rock Core Photographs** **Central Victorian Livestock Exchange** **Western Hwy & Sunraysia Hwy Interchange, Ballarat**	PROJECT NO. : 79187.01
		PLATE No: 3
	CLIENT: RLX Investment Company P/L	DATE: May 2015

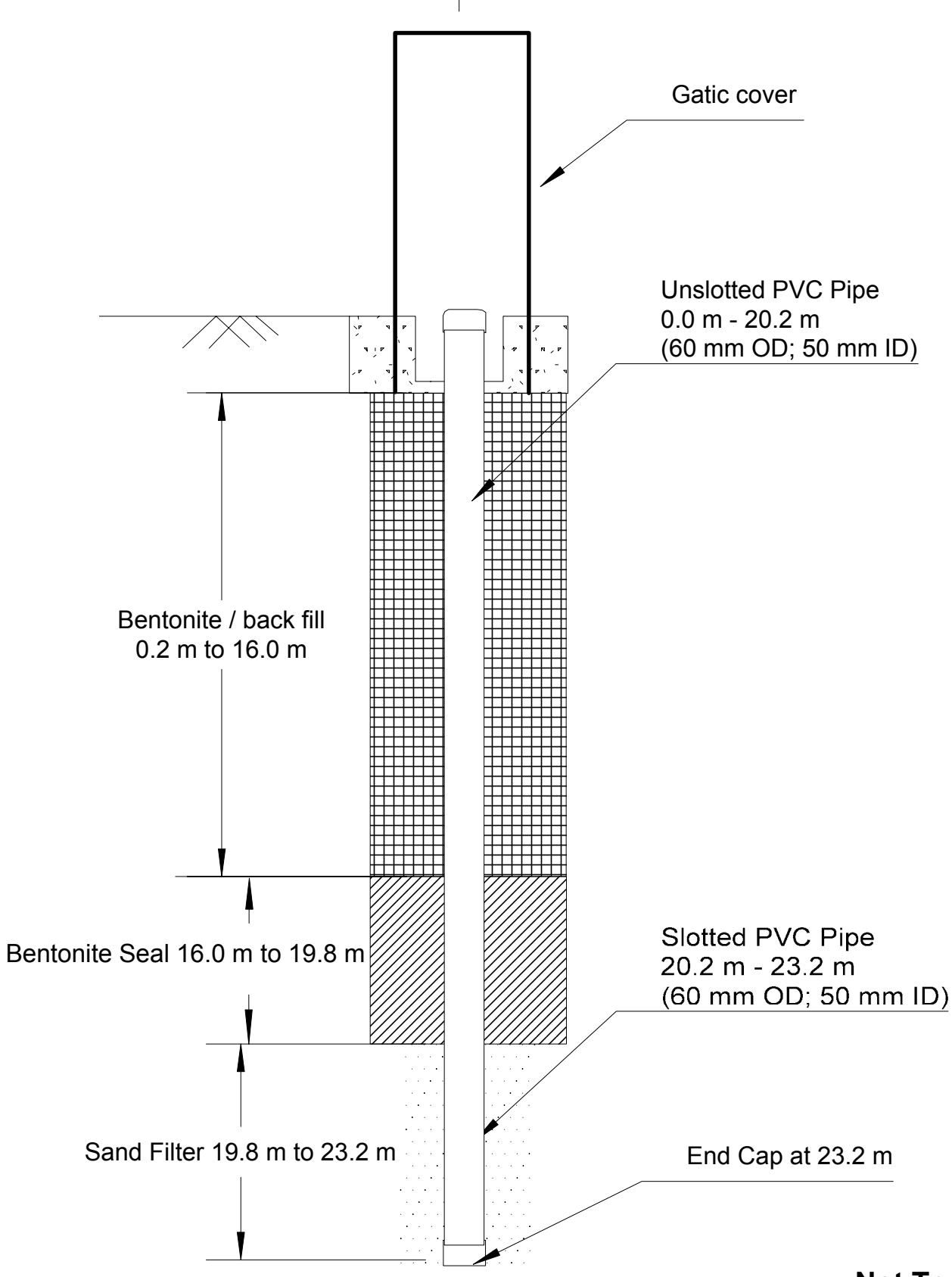
MW101



Not To Scale

Douglas Partners Geotechnics / Environment / Groundwater	**Standpipe Construction Details** **Borehole MW101** **Ballarat, Livestock Exchange Groundwater** **22-76 Victoria Street, Miners Rest**	PROJECT No: 79187.01 DRAWING No: 2 REVISION: 0
	CLIENT: RLX Investment Company Pty Ltd	DATE: May-2015

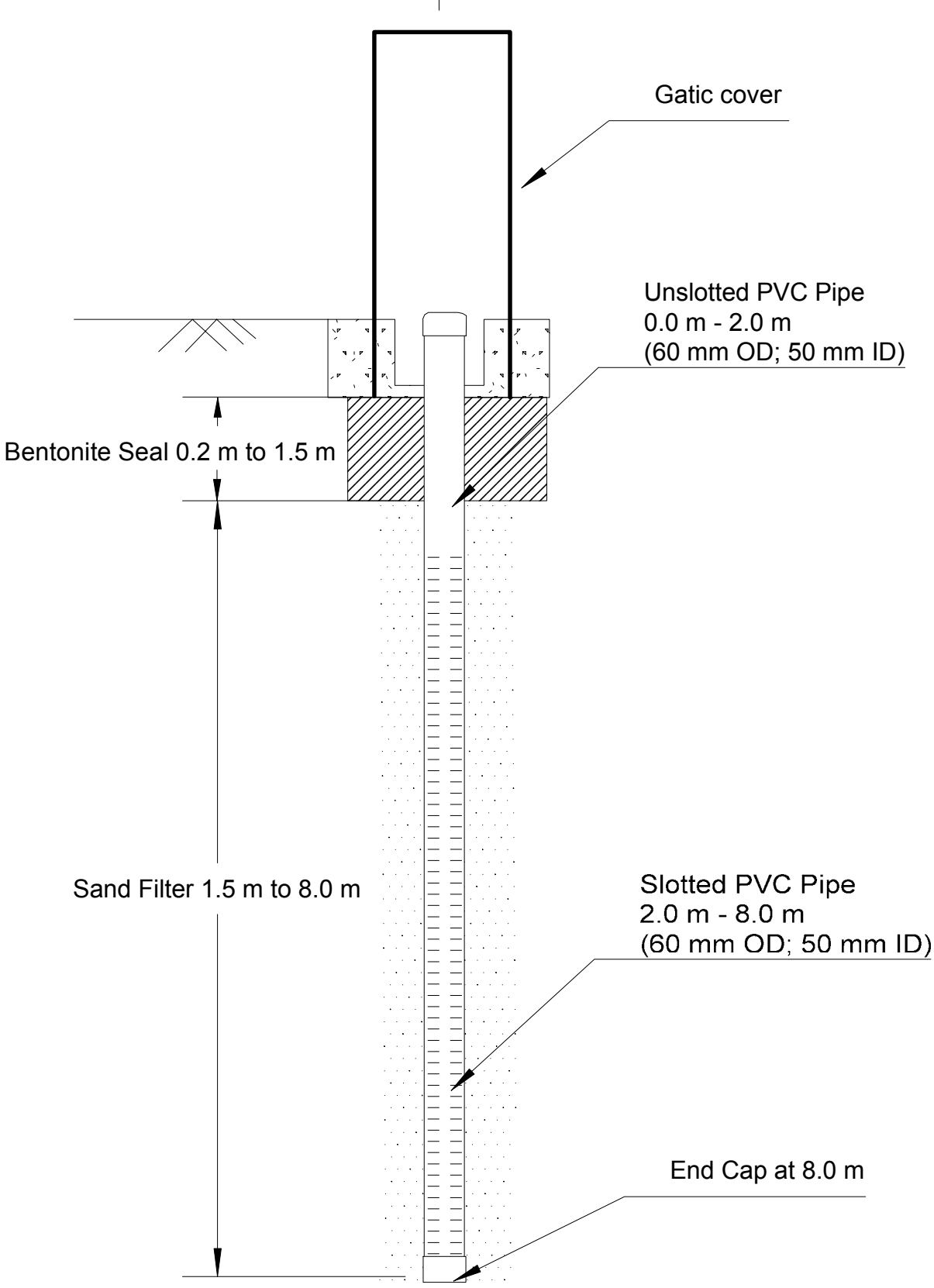
MW102



Not To Scale

Douglas Partners Geotechnics / Environment / Groundwater	**Standpipe Construction Details** **Borehole MW102** **Ballarat, Livestock Exchange Groundwater** **22-76 Victoria Street, Miners Rest**	PROJECT No: 79187.01 DRAWING No: 3 REVISION: 0
	CLIENT: RLX Investment Company Pty Ltd	DATE: May-2015

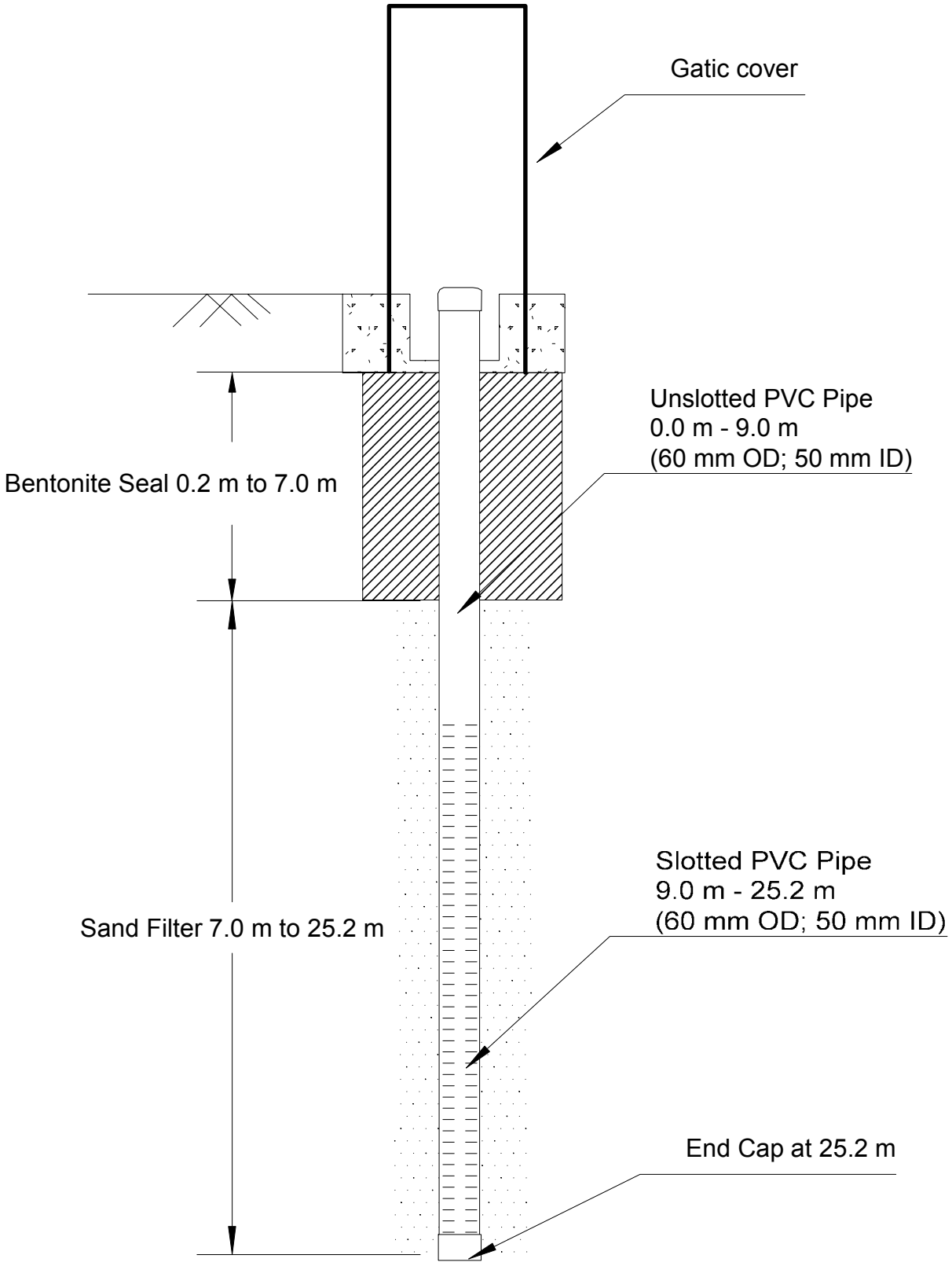
MW102A



Not To Scale

Douglas Partners Geotechnics / Environment / Groundwater	**Standpipe Construction Details** **Borehole MW102A** **Ballarat, Livestock Exchange Groundwater** **22-76 Victoria Street, Miners Rest**	PROJECT No: 79187.01 DRAWING No: 4 REVISION: 0
	CLIENT: RLX Investment Company Pty Ltd	DATE: May-2015

MW103



Not To Scale

Douglas Partners Geotechnics / Environment / Groundwater	**Standpipe Construction Details** **Borehole MW103** **Ballarat, Livestock Exchange Groundwater** **22-76 Victoria Street, Miners Rest**	PROJECT No: 79187.01 DRAWING No: 5 REVISION: 0
	CLIENT: RLX Investment Company Pty Ltd	DATE: May-2015

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 414 m AHD
EASTING: 745973
NORTHING: 5847862

PIT No: TP 101
PROJECT No: 79187.01
DATE: 20/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
414	0.02	Grass rootmat.							
		SANDY SILT (ML): Grey brown, becoming pale brown, humid, some quartz gravel, fine sand.							
	0.4	SILTY CLAY (CH): Hard, grey and orange mottled, humid / crumbly, becoming damp. Texture: "Medium Clay" Structure: "Moderate"		E	0.4	TP101 - 1	Disturbed sample (D) also taken 0.5 - 0.7 m		
				U_{64}	0.5				
					0.8				
413	1			E	0.9	TP101 - 2			1
		Band of quartz gravel at 1.1 m.			1.0				
	1.2	SILTY CLAY (CL): Stiff, pale grey and pale orange, damp, becoming moist. Texture: "Silty Clay Loam" Structure: "Weak"			1.3		pp = 150-200		
				E	1.4	TP101 - 3			
				D	1.5		pp = 100-150		
					1.7				
412	2								2
	2.0	SILTSTONE (RS / EW): Some rock texture / ferruginised bands.			2.0		pp = 150		
	2.5	Pit discontinued at 2.5m							

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13. 'Texture' & 'Structure' as per AS/NZS 1547:2012

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 415 m AHD
EASTING: 745939
NORTHING: 5847729

PIT No: TP 102
PROJECT No: 79187.01
DATE: 20/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
415	0.02	Grass rootmat.							
		SANDY SILT (ML): Grey brown, becoming pale brown, humid, some quartz gravel, fine sand.							
	0.4	GRAVELLY SILTY CLAY (CH): Hard, grey and orange mottled, humid, becoming damp, abundant tightly packed fine to coarse quartz gravel, some fine ironstone 'buckshot' gravel.		E	0.4	TP2 - 1			
					0.5				
	0.9	SILTY CLAY (CH): Hard, grey, mottled orange / red, damp.			0.9		Enviro sample (E) also taken 0.9 - 1 m		
414	1	Texture: "Medium Clay" Structure: "Moderate"		U_{64}	1.0		pp >600		1
					1.25		pp >600		
				E	1.4	TP2 - 3	pp = 450-500		
					1.5				
					1.6		pp = 400-450		
				D					
	1.8	SLIGHTLY SANDY SILTY CLAY (CL): Stiff, pale grey and pale orange, damp to moist, fine sand.		D	1.8				
413	2	Texture: "Silty Clay Loam" Structure: "Weak"			2.0		pp = 150-200		2
	2.5	Pit discontinued at 2.5m							

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13. 'Texture' & 'Structure' as per AS/NZS 1547:2012

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419 m AHD
EASTING: 746317
NORTHING: 5847632

PIT No: TP 103
PROJECT No: 79187.01
DATE: 20/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
419	0.02	Grass rootmat.							
		SANDY SILT (ML): Grey brown, becoming pale brown, humid, rounded ironstone 'buckshot' gravel band near base of layer.							
	0.4	SILTY CLAY (CH): Hard, grey, mottled orange / red, damp.		E	0.4	TP103 - 1			
		Texture: "Medium Clay"			0.5				
		Structure: "Moderate"							
		Becoming very stiff, pale brown below 0.8 m.		E	0.9	TP103 - 2			
418	1				1.0				1
					1.1		pp = 550-600		
	1.2	SILTY CLAY (CL): Very stiff, pale grey and pale orange, damp.			1.3		pp = 350-400		
		Texture: "Silty Clay Loam"							
		Structure: "Moderate"		E	1.4	TP103 - 3			
					1.5		pp = 250		
417	2								2
	2.0	SILTY CLAY (CL) / SILTSTONE (EW): Extremely low strength, pale grey and pale orange, bands of low to medium strength siltstone.							
	2.5	Pit discontinued at 2.5m							

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13. 'Texture' & 'Structure' as per AS/NZS 1547:2012

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 414 m AHD
EASTING: 745856
NORTHING: 5847517

PIT No: TP 104
PROJECT No: 79187.01
DATE: 20/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
414	0.02	Grass rootmat.							
		SANDY SILT (ML): Grey brown, becoming pale brown, humid, some quartz gravel, fine sand.							
	0.4	GRAVELLY SILTY CLAY (CH): Hard, grey and orange mottled, humid, becoming damp, abundant fine to coarse quartz and ironstone gravel.		E	0.4 0.5	TP104 - 1			
	0.6	SILTY CLAY (CH): Hard, grey, mottled orange and red, damp. Texture: "Medium Clay" Structure: "Moderate"		U_{64}	0.8 0.9		Enviro sample (E) also taken 0.9 - 1.0 m		
413	1				1.1 1.2		pp = 550-600		1
				E	1.4 1.5	TP104 - 3			
				D	1.7				
412	2				2.0		pp >=600		2
	2.5	Pit discontinued at 2.5m							

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13. 'Texture' & 'Structure' as per AS/NZS 1547:2012

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 424.5 m AHD
EASTING: 746056
NORTHING: 5847325

PIT No: TP 105
PROJECT No: 79187.01
DATE: 20/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
424	0.02	Grass rootmat.							
		SANDY SILT (ML): Grey, brown, becoming pale brown, humid, slightly gravelly (quartz / 'buckshot').							
	0.3	SILTY CLAY (CH): Hard, dark brown, becoming red / orange mottled, humid / crumbly, becoming damp.		E	0.4	TP105 - 1			
		Texture: "Medium Clay"			0.5				
		Structure: "Moderate"			0.6				
		Colours becoming paler.		U_{64}	0.9		Enviro sample (E) also taken 0.9 - 1.0 m		
	1.0	SILTY CLAY (CL) / SILTSTONE (EW): Very stiff to hard / extremely low strength, pale grey and pale orange, damp.		D	1.0				1
		Texture: "Silty Clay Loam"			1.2		pp = 400		
		Structure: "Moderate"			1.4	TP105 - 3	pp = 300		
423				E	1.5				
		Bands of low to medium strength siltstone, pale red / purple below 2 m.							2
422	2.5	Pit discontinued at 2.5m							

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13. 'Texture' & 'Structure' as per AS/NZS 1547:2012

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419.8 m AHD
EASTING: 746225
NORTHING: 5847393

PIT No: TP 106
PROJECT No: 79187.01
DATE: 20/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
419	0.02	Grass rootmat.							
		CLAYEY SILT (ML): Dark brown, damp, slightly clayey.							
	0.2	SILTY CLAY (CH): Hard, red brown, humid / crumbly, becoming damp. Trace to some fine rounded ironstone 'buckshot' gravel. Texture: "Heavy Clay" Structure: "Strong"		E	0.4	TP106 - 1			
				U_{64}	0.5				
					0.7				
				E	0.9	TP106 - 2			
	1.0	BASALT (HW): Low strength, grey / pale brown, vesicular (excavated through a portion in middle of pit).			1.0				
	1.5	Pit discontinued at 1.5m. Refusal on basalt.							
418									
417									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13. 'Texture' & 'Structure' as per AS/NZS 1547:2012

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 422 m AHD
EASTING: 746171
NORTHING: 5847456

PIT No: TP 107
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
422		SANDY SILT (ML): Grey brown, becoming pale brown, humid, gravelly near base of layer.							
	0.4	SILTY CLAY (CH): Hard, brown, mottled orange, damp.							
421	1								1
	1.2	SILTY CLAY (CL): Very stiff, pale grey and pale orange, damp, inferred residual siltstone / mudstone.							
	1.3	Pit discontinued at 1.3m							
420	2								2

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 418.3 m AHD
EASTING: 746327
NORTHING: 5847497

PIT No: TP 108
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
418	0.3	CLAYEY SILT (ML): Dark brown, becoming pale brown, damp, becoming humid.							
		SILTY CLAY (CH): Hard, red / orange brown, damp.							
417	1.5	Pit discontinued at 1.5m. Refusal on basalt.							
416									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 423 m AHD
EASTING: 746143
NORTHING: 5847350

PIT No: TP 109
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
423		SANDY SILT (ML): Grey brown, becoming pale brown, humid, gravelly near base of layer.							
	0.4	SILTY CLAY (CH): Hard, brown, mottled orange, damp.							
422	1								1
	1.4	SILTY CLAY (CL): Very stiff, pale grey and pale orange, damp, inferred residual siltstone / mudstone.							
	1.5	Pit discontinued at 1.5m							
421	2								2

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 420.5 m AHD
EASTING: 746204
NORTHING: 5847365

PIT No: TP 110
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
420	0.0	CLAYEY SILT (ML): Dark brown, becoming pale brown, damp, becoming humid.							
	0.3	SILTY CLAY (CH): Hard, red / orange brown, damp.							
	0.9	Pit discontinued at 0.9m. Refusal on basalt.							
	1								1
419									
	2								2
418									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 420.8 m AHD
EASTING: 746206
NORTHING: 5847389

PIT No: TP 111
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
420	0.3	CLAYEY SILT (ML): Dark brown, becoming pale brown, damp, becoming humid.							1
	1	SILTY CLAY (CH): Hard, red brown, damp.							
	1.2	Pit discontinued at 1.2m. Refusal on basalt.							
419	2								2
418									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 422.5 m AHD
EASTING: 746177
NORTHING: 5847373

PIT No: TP 112
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
422	0.3	CLAYEY SILT (ML): Dark brown, becoming pale brown and gravelly, humid, some basalt floaters.							
	1	SILTY CLAY (CH): Hard, pale brown, mottled grey and orange, damp.							1
	1.3	Pit discontinued at 1.3m. Refusal on basalt.							
421									
	2								2
420									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 422.7 m AHD
EASTING: 746168
NORTHING: 5847361

PIT No: TP 113
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
422		SANDY SILT (ML): Grey brown, becoming pale brown, humid, gravelly near base of layer.							
	0.4	SILTY CLAY (CH): Hard, pale brown, damp.							
	1								1
	1.4	SILTY CLAY (CI): Very stiff, pale grey and pale orange, damp, inferred residual siltstone / mudstone.							
	1.5	Pit discontinued at 1.5m							
421									
	2								2
420									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 421.8 m AHD
EASTING: 746200
NORTHING: 5847439

PIT No: TP 114
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
421	0.3	SANDY SILT (ML): Grey brown, becoming pale brown and gravelly, humid.							
	1	SILTY CLAY (CH): Hard, orange brown, mottled red and grey, damp.							1
	1.2	SILTY CLAY (CH): Hard, brown grey, damp, inferred residual basaltic clay.							
420	1.4	Pit discontinued at 1.4m. Refusal on basalt.							2
419									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 418.5 m AHD
EASTING: 746311
NORTHING: 5847507

PIT No: TP 115
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
418	0.3	CLAYEY SILT (ML): Dark brown, becoming pale brown, damp, becoming humid.							1
		SILTY CLAY (CH): Hard, red / orange brown, damp.							
	1.1	Pit discontinued at 1.1m. Refusal on basalt.							
417	1								
	2								2
416									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 420.5 m AHD
EASTING: 746241
NORTHING: 5847489

PIT No: TP 116
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
420	0.0	CLAYEY SILT (ML): Dark brown, becoming pale brown, damp.							
	0.3	SILTY CLAY (CH): Hard, red / orange brown, damp.							
	1								1
419	1.5	SILTY CLAY (CH): Hard, brown grey, damp, inferred residual basaltic clay.							
	2								2
	2.0	Pit discontinued at 2.0m. Refusal on basalt.							
418									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 420.5 m AHD
EASTING: 746242
NORTHING: 5847526

PIT No: TP 117
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
420		CLAYEY SILT (ML): Dark brown, becoming pale brown, damp.							
	0.35	SILTY CLAY (CH): Hard, red / orange brown, damp.							
	1								1
	1.4	Pit discontinued at 1.4m. Refusal on basalt.							
419									
	2								2
418									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 420.3 m AHD
EASTING: 746243
NORTHING: 5847548

PIT No: TP 118
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
420	0.3	CLAYEY SILT (ML): Dark brown, becoming pale brown and gravelly, humid.							
		SILTY CLAY (CH): Hard, orange, mottled grey, damp.							
419	1.3	Pit discontinued at 1.3m. Refusal on basalt.							
418									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419.7 m AHD
EASTING: 746278
NORTHING: 5847590

PIT No: TP 119
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
419	0.3	CLAYEY SILT (ML): Dark brown, becoming pale brown and gravelly, humid, some basalt cobbles.							
		SILTY CLAY (CH): Hard, red / orange brown, damp.							
	0.8	Pit discontinued at 0.8m. Refusal on basalt.							
	1								1
418									
	2								2
417									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419.8 m AHD
EASTING: 746278
NORTHING: 5847609

PIT No: TP 120
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
419	0.3	CLAYEY SILT (ML): Dark brown, becoming pale brown, humid.							
		SILTY CLAY (CH): Hard, red / orange brown, damp, basalt cobble at 0.4 m. Top of basalt rock (eastern side) at 0.8 m.							
	1.0	Pit discontinued at 1.0m. Refusal on basalt.							
418									
417									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20; 1; 2

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419.3 m AHD
EASTING: 746307
NORTHING: 5847619

PIT No: TP 121
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
419	0.2	CLAYEY SILT (ML): Dark brown, damp.							
		SILTY GRAVEL (GM): Pale brown, fine to medium subrounded ironstone gravel.							
	0.5	SILTY CLAY (CH): Hard, brown, mottled red / orange, damp.							
	1								1
418	1.1	BASALT (RS / EW / HW): Mix of residual clay and EW/HW basalt, typically low strength corestones, grey and pale yellow / pale brown.							
	1.9	Pit discontinued at 1.9m							
	2								2
417									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 419.2 m AHD
EASTING: 746310
NORTHING: 5847624

PIT No: TP 122
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
419	0.0	CLAYEY SILT (ML): Grey brown, becoming pale brown, humid.							
	0.4	SILTY CLAY (CH): Hard, brown, mottled orange / red, damp.							
	1	Very stiff, pale brown and pale grey mottled below 1 m.							1
418									
	2								2
417	2.4	SILTY CLAY (CI): Stiff to very stiff, pale grey / brown, mottled pale orange / yellow, inferred residual siltstone.							
	2.7	Pit discontinued at 2.7m							

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: RLX Investment Co Pty Ltd
PROJECT: Central Victorian Livestock Exchange
LOCATION: Western HWY / Sunraysia HWY Ballarat

SURFACE LEVEL: 420.3 m AHD
EASTING: 746240
NORTHING: 5847590

PIT No: TP 123
PROJECT No: 79187.01
DATE: 22/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
420	0.3	CLAYEY SILT (ML): Dark brown, becoming pale brown, humid.							
		SILTY CLAY (CH): Hard, orange / pale brown, damp.							
	0.9	Pit discontinued at 0.9m. Refusal on basalt.							
	1								1
419									
	2								2
418									

RIG: Kobelco 135SR excavator, 450 mm bucket

LOGGED: ED

SURVEY DATUM: WGS 84 Zone 54 H

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: RL interpolated from SPIIRE drawing 1354956799, 21/02/13

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Constant Head Permeameter Test Report [AS1547-2012 App G]

Client:	RLX Investment Company Pty Ltd	Project No:	79187.01
Project:	Ballarat - Central Victorian Livestock Exchange	Date:	19-May-15
Location:	Sunraysia & Western Hwy, Ballarat	Tested by:	AR/ED

Test Location — **Test No.** TP101

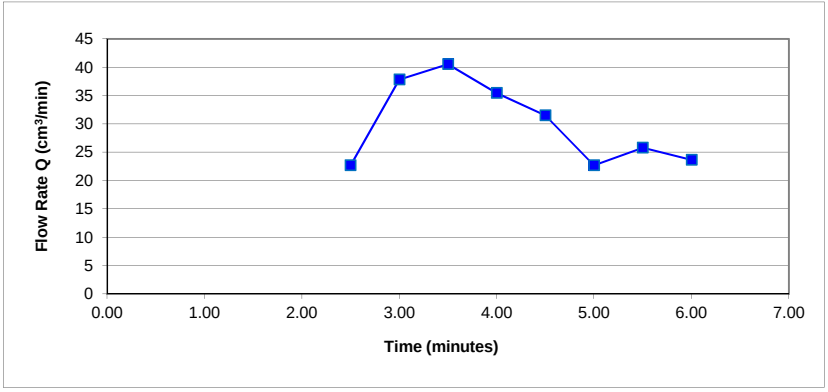
Description:	Near northern edge of site	Easting:	745973	m
Material type:	Hard grey and orange silty clay	Northing	5847862	m
Condition of ground surface before test:	Covered with grass.	Surface Level:	414	m AHD
Weather during test:	Raining, windy			

Details of Bore Installation

Depth of augered hole (500 mm target)	800	mm	Depth to impermeable layer	2	m
Depth of constant water below permeameter	300	mm	Time from filling to start	2	minutes
Diameter of hole	85	mm			

Test Results

Time (minutes)	Change in water level (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)	
0.00	0	0		
2.50	10	57	22.7	
3.00	20	113	37.8	
3.50	25	142	40.5	
4.00	25	142	35.5	
4.50	25	142	31.5	
5.00	20	113	22.7	
5.50	25	142	25.8	
6.00	25	142	23.6	Values used for K_{sat} calculation
10.75	220	1248	116.1	
15.75	220	1248	79.3	
Totals	25	142	23.6	Overall



Saturated Hydraulic Conductivity - Over total duration of test

K_{sat} =	**1.1E-02**	cm/min	where $K_{sat} = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H)^2+0.25]}+r/H]/2\pi H^2$
=	**1.9E-06**	m/sec	ref. AS1547-2012 App G
=	**0.16**	m/day	

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Constant Head Permeameter Test Report [AS1547-2012 App G]

Client:	RLX Investment Company Pty Ltd	Project No:	79187.01
Project:	Ballarat - Central Victorian Livestock Exchange	Date:	19-May-15
Location:	Sunraysia & Western Hwy, Ballarat	Tested by:	AR/ED

Test Location — **Test No.** TP102

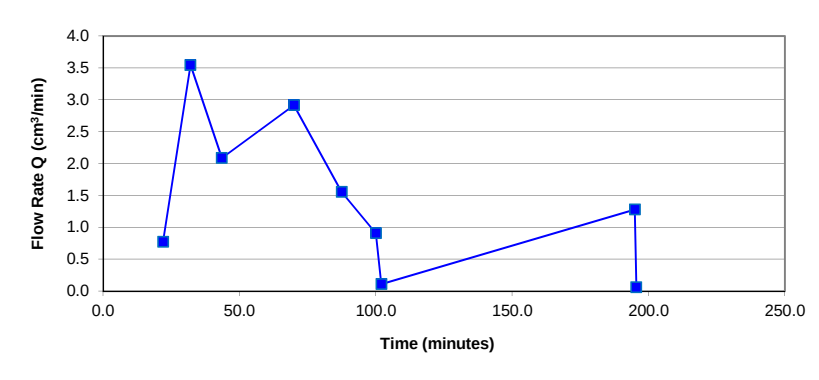
Description:	In central northern section of site, close to low lying area	Easting:	745939	m
Material type:	Hard grey and orange gravelly silty clay	Northing	5847729	m
Condition of ground surface before test:	Covered with grass.	Surface Level:	415	m AHD
Weather during test:	Raining, windy			

Details of Bore Installation

Depth of augered hole (500 mm target)	600	mm	Depth to impermeable layer	1.8	m
Depth of constant water below permeameter	150	mm	Time from filling to start	20	minutes
Diameter of hole	85	mm			

Test Results

Time (minutes)	Change in water level (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)	
20.0	0	0		
22.0	3	17	0.8	
32.0	20	113	3.5	
43.5	16	91	2.1	
70.0	36	204	2.9	
87.5	24	136	1.6	
100.0	16	91	0.9	
102.0	2	11	0.1	Values used for K_{sat} calculation
195.0	44	250	1.3	
195.5	2	11	0.1	
Totals	2	11	0.1	Overall



Saturated Hydraulic Conductivity - Over total duration of test

K_{sat} =	**1.6E-04**	cm/min	where $K_{sat} = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H)^2+0.25]}+r/H]/2\pi H^2$	
=	**2.7E-08**	m/sec	ref. AS1547-2012 App G	
=	**0.0023**	m/day		

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Constant Head Permeameter Test Report [AS1547-2012 App G]

Client:	RLX Investment Company Pty Ltd	Project No:	79187.01
Project:	Ballarat - Central Victorian Livestock Exchange	Date:	19-May-15
Location:	Sunraysia & Western Hwy, Ballarat	Tested by:	AR/ED

Test Location — **Test No.** TP104

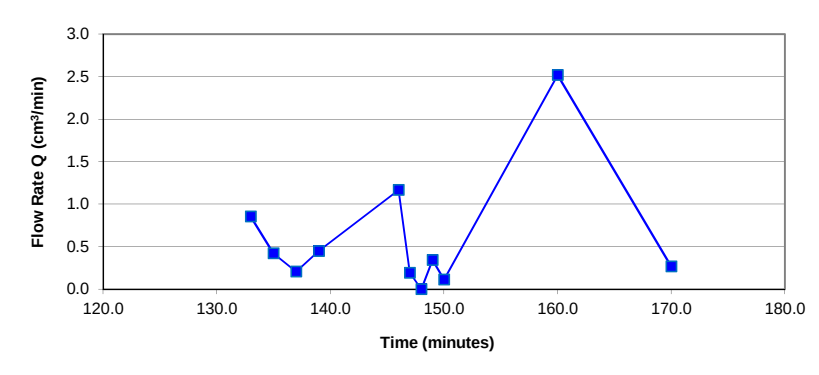
Description:	In central southern section of site, in low lying area	Easting:	745856	m
Material type:	Hard grey and orange gravelly silty clay	Northing	5847517	m
Condition of ground surface before test:	Covered with grass.	Surface Level:	414	m AHD
Weather during test:	Raining, windy			

Details of Bore Installation

Depth of augered hole (500 mm target)	720	mm	Depth to impermeable layer	2.5	m
Depth of constant water below permeameter	270	mm	Time from filling to start	60	minutes
Diameter of hole	85	mm			

Test Results

Time (minutes)	Change in water level (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)	
60.0	0	0		
133.0	20	113	0.9	
135.0	10	57	0.4	
137.0	5	28	0.2	
139.0	11	62	0.4	
146.0	30	170	1.2	
147.0	5	28	0.2	
148.0	0	0	0.0	
149.0	9	51	0.3	
150.0	3	17	0.1	
160.0	71	403	2.5	
170.0	8	45	0.3	Values used for K_{sat} calculation
180.0	36	204	1.1	
Totals	8	45	0.4	Overall



Saturated Hydraulic Conductivity - Over total duration of test

K_{sat} =	**2.3E-04**	cm/min	where $K_{sat} = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H)^2+0.25]}+r/H]/2\pi H^2$	
=	**3.8E-08**	m/sec	ref. AS1547-2012 App G	
=	**0.0033**	m/day		

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Constant Head Permeameter Test Report [AS1547-2012 App G]

Client:	RLX Investment Company Pty Ltd	Project No:	79187.01
Project:	Ballarat - Central Victorian Livestock Exchange	Date:	19-May-15
Location:	Sunraysia & Western Hwy, Ballarat	Tested by:	AR/ED

Test Location

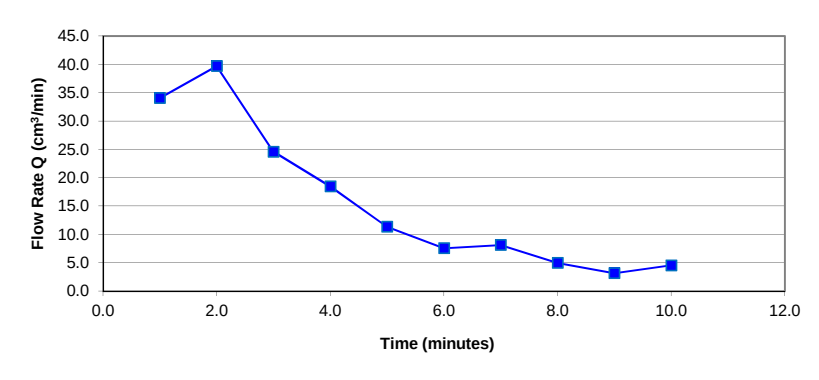
Description:	In south east corner on hillock	**Test No.**	TP105	
Material type:	Hard dark brown silty clay	Easting:	746056	m
Condition of ground surface before test:	Covered with grass.	Northing	5847325	m
Weather during test:	Misty, windy	Surface Level:	424.5	m AHD

Details of Bore Installation

Depth of augered hole (500 mm target)	850	mm	Depth to impermeable layer	2	m
Depth of constant water below permeameter	400	mm	Time from filling to start	0	minutes
Diameter of hole	85	mm			

Test Results

Time (minutes)	Change in water level (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)	
0.0	0	0		
1.0	6	34	34.0	
2.0	14	79	39.7	
3.0	13	74	24.6	
4.0	13	74	18.4	
5.0	10	57	11.3	
6.0	8	45	7.6	
7.0	10	57	8.1	
8.0	7	40	5.0	
9.0	5	28	3.2	
10.0	8	45	4.5	Values used for K_{sat} calculation
14.0	35	199	14.2	
20.0	60	340	17.0	
30.0	112	636	21.2	
40.0	136	772	19.3	
Totals	8	45	4.5	Overall



Saturated Hydraulic Conductivity - Over total duration of test

K_{sat} =	**1.4E-03**	cm/min	where $K_{sat} = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H)^2+0.25]}+r/H]/2\pi H^2$
=	**2.4E-07**	m/sec	ref. AS1547-2012 App G
=	**0.0206**	m/day	

Appendix D

Laboratory Test Results

ENVIROLAB SERVICES
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ENVIROLAB GROUP

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 6403

Client:
Douglas Partners
231 Normanby Road
PO Box 5051
South Melbourne
VIC 3205

Attention: Dean Woods

Sample log in details:

Your Reference:	**79187.01 - Ballarat**
No. of samples:	4 Waters
Date samples received / completed instructions received	02/06/2015 / 02/06/2015

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	3/06/15 / 3/06/15
Date of Preliminary Report:	Not Issued

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Results Approved By:

Analisa Mathrick
Laboratory Supervisor

NATA
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Metals in Waters - Total					
Our Reference:	UNITS	6403-1	6403-2	6403-3	6403-4
Your Reference	----------	MW101-010615	MW102-010615	MW102A-010615	MW103-010615
Date Sampled	----------	1/06/2015	1/06/2015	1/06/2015	1/06/2015
Type of sample		Water	Water	Water	Water
Date prepared	-	03/06/2015	03/06/2015	03/06/2015	03/06/2015
Date analysed	-	03/06/2015	03/06/2015	03/06/2015	03/06/2015
Phosphorus - Total	mg/L	0.1	<0.05	0.2	<0.05

HM in water - dissolved					
Our Reference:	UNITS	6403-1	6403-2	6403-3	6403-4
Your Reference	----------	MW101-010615	MW102-010615	MW102A-010615	MW103-010615
Date Sampled	----------	1/06/2015	1/06/2015	1/06/2015	1/06/2015
Type of sample		Water	Water	Water	Water
Date prepared	-	02/06/2015	02/06/2015	02/06/2015	02/06/2015
Date analysed	-	02/06/2015	02/06/2015	02/06/2015	02/06/2015
Aluminium-Dissolved	µg/L	<10	<10	<10	<10

Cations in water Dissolved					
Our Reference:	UNITS	6403-1	6403-2	6403-3	6403-4
Your Reference	----------	MW101-010615	MW102-010615	MW102A-010615	MW103-010615
Date Sampled	----------	1/06/2015	1/06/2015	1/06/2015	1/06/2015
Type of sample		Water	Water	Water	Water
Date digested	-	03/06/2015	03/06/2015	03/06/2015	03/06/2015
Date analysed	-	03/06/2015	03/06/2015	03/06/2015	03/06/2015
Sodium - Dissolved	mg/L	390	100	840	300
Potassium - Dissolved	mg/L	3.8	2.6	2.0	4.0
Calcium - Dissolved	mg/L	59	23	96	32
Magnesium - Dissolved	mg/L	120	31	210	53

Miscellaneous Inorganics					
Our Reference:	UNITS	6403-1	6403-2	6403-3	6403-4
Your Reference	----------	MW101-010615	MW102-010615	MW102A-010615	MW103-010615
Date Sampled	----------	1/06/2015	1/06/2015	1/06/2015	1/06/2015
Type of sample		Water	Water	Water	Water
Date prepared	-	02/06/2015	02/06/2015	02/06/2015	02/06/2015
Date analysed	-	03/06/2015	03/06/2015	03/06/2015	03/06/2015
Phosphate as P in water	mg/L	0.043	<0.005	0.006	<0.005
Ammonia as N in water	mg/L	0.005	0.15	0.007	0.15
Total Nitrogen in water	mg/L	0.82	1.9	1.7	1.7
Nitrate as N in water	mg/L	0.017	0.032	0.097	0.22
Nitrite as N in water	mg/L	<0.005	0.006	0.006	0.14
pH	pH Units	6.9	7.2	6.4	6.6
Electrical Conductivity	µS/cm	2,700	860	5,900	2,000
Total Dissolved Solids (grav)	mg/L	1,800	390	3,900	1,100
TKN in water	mg/L	0.8	1.9	1.6	1.3
NOx as N in water	mg/L	0.017	0.038	0.10	0.35

Method ID	Methodology Summary
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Soils are analysed following a water extraction.
Inorg-057	Ammonia - determined colourimetrically based on EPA350.1 and APHA latest edition 4500-NH3 F, Soils are analysed following a KCl extraction.
Inorg-055/062	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen.
Inorg-055	Nitrate - determined colourimetrically. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Soils are analysed following a water extraction.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180oC +/-5oC.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg.

QUALITY CONTROL Metals in Waters - Total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			03/06/2015	6403-1	03/06/2015 || 03/06/2015	LCS-1	03/06/2015
Date analysed	-			03/06/2015	6403-1	03/06/2015 || 03/06/2015	LCS-1	03/06/2015
Phosphorus - Total	mg/L	0.05	Metals-020 ICP-AES	<0.05	6403-1	0.1 || 0.1 || RPD: 0	LCS-1	102%
QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			02/06/2015	[NT]	[NT]	LCS	02/06/2015
Date analysed	-			02/06/2015	[NT]	[NT]	LCS	02/06/2015
Aluminium-Dissolved	µg/L	10	Metals-022 ICP-MS	<10	[NT]	[NT]	LCS	108%
QUALITY CONTROL Cations in water Dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			03/06/2015	6403-1	03/06/2015 || 03/06/2015	LCS-1	03/06/2015
Date analysed	-			03/06/2015	6403-1	03/06/2015 || 03/06/2015	LCS-1	03/06/2015
Sodium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	6403-1	390 || 390 || RPD: 0	LCS-1	96%
Potassium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	6403-1	3.8 || 3.8 || RPD: 0	LCS-1	101%
Calcium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	6403-1	59 || 57 || RPD: 3	LCS-1	100%
Magnesium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	6403-1	120 || 120 || RPD: 0	LCS-1	99%
QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			2/06/2015	[NT]	[NT]	LCS	2/06/2015
Date analysed	-			3/06/2015	[NT]	[NT]	LCS	3/06/2015
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	[NT]	[NT]	LCS	108%
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	[NT]	[NT]	LCS	95%
Total Nitrogen in water	mg/L	0.1	Inorg-055/062	<0.1	[NT]	[NT]	[NR]	[NR]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	LCS	87%
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	LCS	107%
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS	98%
Electrical Conductivity	µS/cm	1	Inorg-002	<1	[NT]	[NT]	LCS	103%
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	[NT]	[NT]	LCS	98%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
TKN in water	mg/L	0.1	Inorg-062	<0.1	[NT]	[NT]	LCS	98%
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	LCS	87%

QUALITY CONTROL Metals in Waters - Total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	6403-2	03/06/2015
Date analysed	-	[NT]	[NT]	6403-2	03/06/2015
Phosphorus - Total	mg/L	[NT]	[NT]	6403-2	103%

QUALITY CONTROL Cations in water Dissolved	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date digested	-	[NT]	[NT]	6403-2	03/06/2015
Date analysed	-	[NT]	[NT]	6403-2	03/06/2015
Sodium - Dissolved	mg/L	[NT]	[NT]	6403-2	113%
Potassium - Dissolved	mg/L	[NT]	[NT]	6403-2	100%
Calcium - Dissolved	mg/L	[NT]	[NT]	6403-2	105%
Magnesium - Dissolved	mg/L	[NT]	[NT]	6403-2	106%

Report Comments:

TKN analysed by Envirolab Sydney. Report number 128963.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

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Determination of Emerson Class Number of Soil

Client:	**RLX INVESTMENT COMPANY PTY LTD**	**Project No:**	79187.01
		Report No:	M15077001
Project:	Ballarat Livestock Exchange Groundwater Assessment	**Report Date:**	04-JUN-2015
Location:	22-76 Victoria Street, Miners Rest, VIC 3352	**Date of Test:**	03-JUN-2015
		Page:	1 of 1

Sample No.	Depth (m)	Description	Water Type	Water Temp	Class No.
TP101	0.5-0.8	Silty CLAY	Distilled	19	5
TP102	0.9-1.25	Silty CLAY	Distilled	19	5
TP104	0.8-1.1	Silty CLAY	Distilled	19	6
TP105	0.6-1.0	Silty CLAY	Distilled	19	5

Test Methods: AS 1289 3.8.1

Sampling Methods: Sampled by Engineering Department

Remarks:

NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

ACCREDITED FOR TECHNICAL COMPETENCE

Tested: DC
Checked: AG

Andrew Murphy
Senior Associate

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Results of Constant Head Permeability Test using a Flexible Wall Permeameter

Client :	RLX Investment Company Pty Ltd	**Project No. :**	79187.01
		Report No. :	M15077002
Project :	Ballarat Livestock Exchange Groundwater Assessment	**Report Date :**	04 Jun 2015
Location :	22-76 Victoria Street, Miners Rest, VIC 3352	**Date of Test:**	22 May 2015
		Page:	1 of 1

Sample No:	TP101	
Depth / Layer:	0.5-0.8(m)	
Sample Description:	Silty CLAY	
Sample Preparation:	Undisturbed	
Oversized Material Retained:	Undisturbed sample - Not Applicable	
Averaged Sample Length:	53	mm
Averaged Sample Diameter:	49	mm
Length-to-Diameter Ratio	1.1 :1	
Moisture Content After Test:	42.4	%
Permeant Used:	Melbourne Tap Water	
Mean Effective Stress:	25	kPa
Coefficient of Permeability:	**5×10^{-9}**	m/s

Test Method(s): AS1289.6.7.3, AS 1289.2.1.1

Sampling Method(s): Sampled by Engineering Department.

Remarks:

NATA Accredited Laboratory No 828
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ACCREDITED FOR TECHNICAL COMPETENCE

Tested: AD
Checked: AG

Andrew Murphy
Senior Associate

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Results of Constant Head Permeability Test using a Flexible Wall Permeameter

Client :	RLX Investment Company Pty Ltd	**Project No. :**	79187.01
		Report No. :	M15077003
Project :	Ballarat Livestock Exchange Groundwater Assessment	**Report Date :**	04 Jun 2015
Location :	22-76 Victoria Street, Miners Rest, VIC 3352	**Date of Test:**	25 May 2015
		Page:	1 of 1

Sample No:	TP102	
Depth / Layer:	0.9-1.25(m)	
Sample Description:	Silty CLAY	
Sample Preparation:	Undisturbed	
Oversized Material Retained:	Undisturbed sample - Not Applicable	
Averaged Sample Length:	49	mm
Averaged Sample Diameter:	49	mm
Length-to-Diameter Ratio	1.0 :1	
Moisture Content After Test:	41.8	%
Permeant Used:	Melbourne Tap Water	
Mean Effective Stress:	25	kPa
Coefficient of Permeability:	**8×10^{-10}**	m/s

Test Method(s): AS1289.6.7.3, AS 1289.2.1.1

Sampling Method(s): Sampled by Engineering Department.

Remarks:

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Tested: AD
Checked: AG

Andrew Murphy
Senior Associate

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Results of Constant Head Permeability Test using a Flexible Wall Permeameter

Client :	RLX Investment Company Pty Ltd	**Project No. :**	79187.01
		Report No. :	M15077004
Project :	Ballarat Livestock Exchange Groundwater Assessment	**Report Date :**	04 Jun 2015
Location :	22-76 Victoria Street, Miners Rest, VIC 3352	**Date of Test:**	25 May 2015
		Page:	1 of 1

Sample No:	TP104	
Depth / Layer:	0.8-1.1(m)	
Sample Description:	Silty CLAY	
Sample Preparation:	Undisturbed	
Oversized Material Retained:	Undisturbed sample - Not Applicable	
Averaged Sample Length:	57	mm
Averaged Sample Diameter:	49	mm
Length-to-Diameter Ratio	1.2 :1	
Moisture Content After Test:	28.6	%
Permeant Used:	Melbourne Tap Water	
Mean Effective Stress:	25	kPa
Coefficient of Permeability:	**9×10^{-11}**	m/s

Test Method(s): AS1289.6.7.3, AS 1289.2.1.1

Sampling Method(s): Sampled by Engineering Department.

Remarks:

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Tested: AD
Checked: AG

A. R. Murphy

Andrew Murphy
Senior Associate

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Results of Constant Head Permeability Test using a Flexible Wall Permeameter

Client :	RLX Investment Company Pty Ltd	**Project No. :**	79187.01
		Report No. :	M15077005
Project :	Ballarat Livestock Exchange Groundwater Assessment	**Report Date :**	04 Jun 2015
Location :	22-76 Victoria Street, Miners Rest, VIC 3352	**Date of Test:**	25 May 2015
		Page:	1 of 1

Sample No:	TP105	
Depth / Layer:	0.6-1.0(m)	
Sample Description:	Silty CLAY	
Sample Preparation:	Undisturbed	
Oversized Material Retained:	Undisturbed sample - Not Applicable	
Averaged Sample Length:	53	mm
Averaged Sample Diameter:	48	mm
Length-to-Diameter Ratio	1.1 :1	
Moisture Content After Test:	32.8	%
Permeant Used:	Melbourne Tap Water	
Mean Effective Stress:	25	kPa
Coefficient of Permeability:	**3×10^{-8}**	m/s

Test Method(s): AS1289.6.7.3, AS 1289.2.1.1

Sampling Method(s): Sampled by Engineering Department.

Remarks:

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Tested: AD
Checked: AG

Andrew Murphy
Senior Associate

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CERTIFICATE OF ANALYSIS 128438

Client:
Douglas Partners Pty Ltd (Melbourne)
68 Brighton St
Richmond
VIC 3121

Attention: Dean Woods

Sample log in details:

Your Reference:	**79187.01, Ballarat**
No. of samples:	17 Soils
Date samples received / completed instructions received	25/05/2015 / 25/05/2015

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	2/06/15 / 5/06/15
Date of Preliminary Report:	Not Issued

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Results Approved By:

Jacinta Hurst
Laboratory Manager

Phosphorus Sorption					
Our Reference:	UNITS	128438-5	128438-7	128438-12	128438-15
Your Reference	----------	TP102-2	TP103-1	TP104-3	TP105-3
Date Sampled	----------	20/05/2015	20/05/2015	20/05/2015	20/05/2015
Type of sample		Soil	Soil	Soil	Soil
Phosphorus Buffer Index	mg/kg	500	1,400	650	160
Reactive Phosphorus - Colwell*	mg/kg	20	10	8	5
Phosphorus Sorption Capacity	mg/kg	960	1,000	980	680

Miscellaneous Inorg - soil					
Our Reference:	UNITS	128438-5	128438-7	128438-12	128438-15
Your Reference	----------	TP102-2	TP103-1	TP104-3	TP105-3
Date Sampled	----------	20/05/2015	20/05/2015	20/05/2015	20/05/2015
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	26/05/2015	26/05/2015	26/05/2015	26/05/2015
Date analysed	-	26/05/2015	26/05/2015	26/05/2015	26/05/2015
pH 1:5 soil:water	pH Units	6.6	6.6	4.6	7.4
Electrical Conductivity 1:5 soil:water	µS/cm	270	100	620	510
Total Nitrogen in soil	mg/kg	270	840	200	330
Nitrate as N in soil	mg/kg	<0.5	<0.5	<0.5	<0.5
Nitrite as N in soil	mg/kg	0.1	0.3	<0.1	0.1
TKN in soil	mg/kg	270	840	200	330
Total Alkalinity as $CaCO_3$	mg/kg	210	180	<50	1,300

CEC Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	128438-5 TP102-2 20/05/2015 Soil	128438-7 TP103-1 20/05/2015 Soil	128438-12 TP104-3 20/05/2015 Soil	128438-15 TP105-3 20/05/2015 Soil
Date extracted	-	02/06/2015	02/06/2015	02/06/2015	02/06/2015
Date analysed	-	02/06/2015	02/06/2015	02/06/2015	02/06/2015
Exchangeable Ca	meq/100g	3.1	4.8	1.3	3.2
Exchangeable K	meq/100g	0.5	0.6	0.3	0.3
Exchangeable Mg	meq/100g	13	13	10	8.3
Exchangeable Na	meq/100g	4.8	2.6	1.0	3.3
Cation Exchange Capacity	meq/100g	21	22	13	15

Method ID	Methodology Summary
Ext-062	Analysed by East West Enviroag
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-055/062	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen.
Inorg-055	Nitrate - determined colourimetrically. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soil based on Rayment and Lyons 2011.

QUALITY CONTROL Phosphorus Sorption	UNITS	PQL	METHOD	Blank
Phosphorus Buffer Index	mg/kg	2	Ext-062	<2.0
Reactive Phosphorus - Colwell*	mg/kg	1	Ext-062	<1
Phosphorus Sorption Capacity	mg/kg	2	Ext-062	<2.0

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			26/05/2015	[NT]	[NT]	LCS-1	26/05/2015
Date analysed	-			26/05/2015	[NT]	[NT]	LCS-1	26/05/2015
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-1	102%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	LCS-1	101%
Total Nitrogen in soil	mg/kg	10	Inorg-055/062	<10	[NT]	[NT]	LCS-1	91%
Nitrate as N in soil	mg/kg	0.5	Inorg-055	<0.5	[NT]	[NT]	LCS-1	104%
Nitrite as N in soil	mg/kg	0.1	Inorg-055	<0.1	[NT]	[NT]	LCS-1	112%
TKN in soil	mg/kg	10	Inorg-062	<10	[NT]	[NT]	LCS-1	91%
Total Alkalinity as $CaCO_3$	mg/kg	5	Inorg-006	<5	[NT]	[NT]	LCS-1	100%

QUALITY CONTROL CEC	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			02/06/2015	[NT]	[NT]	LCS-1	02/06/2015
Date analysed	-			02/06/2015	[NT]	[NT]	LCS-1	02/06/2015
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	109%
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	108%
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	108%
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	118%
Cation Exchange Capacity	meq/100g	1	Metals-009	<1.0	[NT]	[NT]	[NR]	[NR]

Report Comments:

Phosphorus analysed by EastWest. Report No.EW150496.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.