DA19/0036 – Waste Disposal Facility (Non-Putrescible Landfill)
Council Supplementary Report Following Submission of Peer Reviews
Steven Cook, Senior Town Planner, 8/3/22

The Southern Regional Planning Panel (SRPP) deferred determination of DA19/0036 pending the provision of the following information:

1. Submission of an independent review of the potential impact of the development on existing overland flows and groundwater contamination. The independent review shall be undertaken by a suitably qualified expert, whose appointment shall be endorsed by Council.

   The independent review shall address:

   - The veracity of the hydrological and hydrogeological assessment provided by the Applicant. In particular,
   - Potential for contamination or other long-term impacts on the existing groundwater supplies and the implications for surrounding groundwater users (ie. bores)
   - Advise on appropriateness of the proposed monitoring and management measures proposed by the Applicant.
   - Make recommendations, if appropriate, with respect to additional measures that could be put in place to manage the potential impacts of the development.

   Following receipt of the independent assessment, Council shall prepare a supplementary report for the Panel on the additional information.

2. Advice, prepared by a suitably qualified expert, addressing the potential for airborne particles associated with landfill material, in particular fly ash, to contaminate agricultural produce associated with the Riverina Oils facility. The advice should address the risk of contamination and management and mitigation measures that could be employed to manage this risk.

3. Advice from Council with regard to how the proposed development addresses the following objective of the Regional Enterprise Zone under *State Environmental Planning Policy (Activation Precincts) Amendment (Wagga Wagga) 2021:*

   To effectively manage land uses of varying intensities or environmental sensitivities, and to minimise the risk of conflict associated with incompatible land uses

In relation to point 3, this information was provided to the Panel in December 2021.

Peer reviews addressing points 1 and 2 have been now been submitted.

<u>Groundwater Peer Review</u>
The independent peer review of the hydrological and hydrogeological assessment was carried out by Australian Environmental Auditors (**attachment 1**).

The peer review identified are number of concerns with the hydrological assessment and made the following conclusions:

- *The current groundwater SWLs for the two aquifers beneath the proposed landfill are not well established;*

- *The current local groundwater flow direction, gradient and rate in the two aquifers beneath the proposed landfill area are not known as these have been assessed based on regional groundwater flow information and out of date groundwater monitoring data obtained from the site;*
- *The baseline geochemistry (natural and/or existing contamination) of the groundwater up-hydraulic gradient, beneath and down-hydraulic gradient of the proposed landfill area has not been established;*
- *The potential for impacts on groundwater supplies and surrounding groundwater users cannot be reliably considered based on the current EIS due to the conclusions mentioned above;*
- *The gradients of the proposed leachate barrier system and leachate collection system do not meet the requirements of EPA NSW Environmental Guidelines: Solid Waste Landfills, Second edition 2016, and;*
- *The proposed groundwater monitoring for the landfill during its operational and post closure phases does not specify bore locations, number, depth or design.*

The following recommendations were made in the peer review in response to these conclusions:

1. *The hydrogeological and hydrological sections of the EIS should be expanded into a HRA in order to meet the impact assessment requirements of EPA NSW, 2016 for new landfills. The hydrogeological assessment components of the HRA should accord with EPA Victoria publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines (September 2006). Specifically;*
    - *That a sufficient number of the dry groundwater monitoring bores onsite are re-developed or replaced to deeper elevations to enable groundwater gauging and sampling of both aquifers. Replacement or re-developed bores should be carefully logged to ensure the correct aquifer is being monitored;*
    - *For both aquifers the onsite groundwater levels, gradient, flow direction and flow rate should be established by obtaining contemporaneous gauging data and subsequent new groundwater contour diagrams should be developed;*
    - *The likelihood of groundwater and surface water interaction should be examined based on established current groundwater levels and (if necessary based on the groundwater depth) the elevation of the beds of surface water bodies surrounding the site of the proposed landfill should be surveyed. As such, this assessment should be revisited upon installation and gauging of the additional groundwater bores and new SWL data;*
    - *The baseline onsite groundwater geochemistry should be established in both aquifers prior to commencement of landfilling. Baseline condition means the geochemistry of the natural background groundwater as well as any contamination present;*
    - *Scaled, diagrammatic hydrogeological cross sections of the proposed landfill should be prepared based on groundwater bore logs (from replacement/re-developed bores) and current onsite groundwater SWLs, with all levels shown in metres Australian Height Datum (mAHD) showing the landfill within the local hydrogeological and hydrological setting; and EA0909-C01 Wagga Wagga Waste Disposal Facility 225-265 Trahairs Road, Bomen, NSW 2650 Review of Hydrological and Hydrogeological Assessment*
    - *Should the landfill be developed, a groundwater monitoring bore network should be established that is sufficient to identify any changes in groundwater condition during landfilling or in the landfill aftercare phase.*

2. *The base liner is graded to greater than 1% longitudinally and greater than 3% in transverse directions;*

3. *The leachate collection pipework is laid at gradients of at least 1% longitudinally into the sump and 3% in transverse directions;*

4. *The need for the groundwater relief layer under the landfill cells is reconsidered once the current elevation of the groundwater beneath the proposed landfill is known and can be properly evaluated to determine if the groundwater level could affect the stability and performance of the leachate barrier (landfill liner);*

5. *The power boiler fly ash and power boiler sand wastes listed in Table 3-1 for acceptance at the proposed landfill are tested in accordance with EPA NSW Waste Classification Guidelines Part 1: Classifying waste (November 2014) to ascertain if these wastes are restricted solid waste;*

6. *The groundwater monitoring bore network referred to in recommendation 1. above should be established once the HRA is complete and the hydrogeological context of the proposed landfill is understood in order to be representative of any leachate contamination from the proposed landfill;*

7. *Groundwater samples being analysed for metals should be field-filtered and per and polyfluorinated alkyl substances (PFAS) should be included for analysis in both leachate and groundwater; and*

8. *Prior to construction of the landfill cells any previous groundwater bores which are to be constructed over should be decommissioned using full grouting in accordance with the Minimum Construction Requirements for Water Bores in Australia Fourth Edition 2020 (National Uniform Drillers Licensing Committee 2020) to avoid creating a direct pathway to the aquifer beneath the landfill cells.*

In response to the peer review, the Applicant's consultant provided the following:

- *The nature of groundwater levels and flow direction are well understood at the site.*
- *The geology of the area is well known and mapped and this is the controlling feature for groundwater.*
- *The site occupies the lower ridge of the western side of the catchment, as such flow directions will be to the south east.*
- *The ground water monitoring piezometers around the site have many years of data.*
- *The piezometers have indicated that the ground water levels are well below the base of the intended landfill.*
- *Additional monitoring will further demonstrate the stability of ground water conditions in the area.*
- *The information provided in the EIS was similar to and sufficient for the approval of the ROBE liquid waste pond above the site.*
- *The design drawings indicate minimum drainage gradients of 1%. 3% for transverse drainage could be conditioned as required.*
- *Groundwater levels have been historically demonstrated to be below the level of the groundwater relief layer.*
- *The power boiler flyash (mostly burnt pine bark) has been tested and shown not to be restricted solid waste.*
- *The power boiler flyash has also been the subject of waste reuse and recovery exemptions.*
- *Flyash is a common component of concrete manufacture in NSW.*

- *The proponent would prepare an operational environmental monitoring plan (OEMP) and a separate post closure plan in accordance with the typical requirements of an EPL.*

The most fundamental concerns raised in the peer review relate to potential information gaps, particularly in relation to:

- The standing water level of the two aquifers beneath the proposed landfill.
- The current local groundwater flow direction, gradient and rate in the two aquifers beneath the proposed landfill.
- The baseline geochemistry of the groundwater.

These concerns led the peer reviewer to conclude that "the potential for impacts on groundwater supplies and surrounding groundwater users cannot be reliably considered". This is contended by the Applicant on the basis that the geology is well understood and is the controlling feature for groundwater, flow direction is known, and that many years of groundwater data exists for the site.

It is noted that the EPA, including its groundwater experts, reviewed the EIS and had made these comments:

The EPA has reviewed the information provided and notes that the assisted drainage of groundwater that may generate along the weathered rock profile protects the integrity of the engineered waste cells and prevents groundwater ingress and contamination downgradient. The geological siting of the facility on a weathered granite ridge away from high yielding alluvial groundwater is appropriate.

The EPA notes that the proposed groundwater monitoring objectives and design are aligned with an efficient conceptualisation during baseline, operation and post-closure of the proposal. Any impacts are considered manageable through the preparation and implementation of a Groundwater Management Plan which would include the development of a groundwater monitoring strategy.

Previous discussions with the EPA have confirmed their satisfaction with regard to potential groundwater impacts from the development. GTAs also include conditions regarding ongoing monitoring.

As such, there appears to be a degree of disagreement between experts as to the potential for impacts on groundwater, however, there does seem to be sufficient uncertainty to cause concern. This uncertainty could potentially be resolved by requesting the information sought by the peer reviewer. In the absence of the information sought, it is considered difficult to conclude that there would not be significant impacts on groundwater. This raised issues under Section 4.15 of the Environmental Planning and Assessment Act 1979 in terms of:

1. Consistency with environmental planning instruments (4.15(1)(a)(i)), specifically:
    a. Consistency with *State Environmental Planning Policy (Activation Precincts) 2020* (now incorporated into *State Environmental Planning Policy (Precincts—Regional) 2021*) and the Wagga Wagga Special Activation Precinct Master Plan which requires the consideration of certain groundwater matters, including performance objectives 3.3.4 (E) that development must:

        be designed to prevent adverse environmental impacts including the risk of contamination to groundwater sources and the town water supply;

Uncertainty makes concluding compliance with this control difficult.

Note: Clause 61(7) of the *Environmental Planning and Assessment Regulation 2021* (formerly within Clause 92A of the *Environmental Planning and Assessment Regulation 2000*) also requires consideration of the SAP Master Plan under Section 4.15(1)(a)(iv) of the *Environmental Planning and Assessment Act 1979*.

b. Consistency with *State Environmental Planning Policy (Infrastructure) 2007* (now incorporated into *State Environmental Planning Policy (Transport and Infrastructure) 2021*) which calls up the *EIS Guideline: Landfilling (Department of Planning, 1996)*, which lists environmentally sensitive areas to be avoided as including land that overlays an "aquifer which contains drinking water quality groundwater which is vulnerable to pollution".

   Whilst no further information has been provided to suggest the aquifer underlying the site contains drinking water quality groundwater, further consideration of this matter would be requried if the vulnerability of the groundwater to pollution is less certain.

2. Impacts of the proposed development (4.15(1)(b)) on groundwater. If impacts are not clear, it is difficult to conclude that the development will not have unreasonable impacts on groundwater.

3. The suitability of the site (4.15(1)(c)). Clarity on the potential for impacts on groundwater is required to be able to conclude whether the site is suitable for the proposed development.

It is also noted that concerns were raised in submissions as to the potential for the development to impact on groundwater.

<u>Airborne-Particle Assessment</u>
An independent assessment of the potential for airborne particles to impact on the Riverina Oils Facility was carried out by Vipac Engineers and Scientists Ltd (**attachment 2**). This assessment concluded that AUSPLUME, as used in the EIS, may not be a suitable dispersion model for the assessment of airborne particle impacts, with insufficient information in the EIS to support its use. In addition, the assessment noted that "it is not clear if all of the meteorological parameters required for the modelling assessment have been derived and, in particular, those specified for dust deposition which does not appear to have been modelled in the assessment".

The assessment recommended that further information addressing the above be requested.

In addition, the review considered the potential for dust deposition and contamination on the Riverina Oils Facility. In this regard, the review notes that no information is provided in the report on dust deposition impacts on the Riverina Oils Facility and states:

It is acknowledged that impacts from suspended particulate emissions (i.e. TSP, PM10 and PM2.5) are not predicted to exceed criteria at modelled sensitive receptors during operations. However, there is potential for dust deposition and for contamination from contaminants present in the waste materials (e.g. fly ash, sand, road waste products) on the Riverina Oils Facility which should be addressed.

The review recommended that an assessment be carried out considering these matters.

In response the Applicant provided the following:

- *The use of AUSPLUME is questioned base on the potential for calm night time conditions. AUSPLUME is approved for use by the guidelines.*
- *The NSW EPA did not question the use of the AUSPLUME model for this assessment.*
- *NGH considered AUSPLUME suitable because:*
    - *The facility will not operate after 6pm or before 7am and as such emissions from the facility would not occur at night.*
    - *The setting is a simple landscape with gentle slopes*
    - *Night cover would be employed to minimise dust*
    - *Materials at the facility will be watered to supress dust generation.*
- *Dust deposition gauges (pictured below) are a common method for monitoring dusty operations especially during road works.*
- *The OEMP could specify the use of dust deposition gauges as a form of monitoring and respond to any level exceedances.*

Like the groundwater assessment, there now appears to be a degree of uncertainty around dust impacts. The concern is on two levels. The first is the methodology used in the assessment of dust impacts. The second is the absence of an adequate consideration of impacts on ROBE, which indeed may go beyond a more general consideration of dust guidelines/standards, but rather into the realm of contamination of the ROBE site from airborne waste particles. The matter of contamination of the ROBE site, and seed products used in their production process, was raised in submissions by ROBE.

This uncertainty could potentially be resolved by requesting the information sought by the peer reviewer. In the absence of the information sought, it is considered difficult to conclude that there would not be significant impacts on air quality, and more specifically, potentially contamination of products at the ROBE site adjacent to the proposed development. This raised issues under Section 4.15 of the Environmental Planning and Assessment Act 1979 in terms of:

1. Consistency with environmental planning instruments (4.15(1)(a)(iii)), specifically:
    a. Consistency with *State Environmental Planning Policy (Activation Precincts) Amendment (Wagga Wagga) 2021* and the following objective of the Regional Enterprise Zone:

        To effectively manage land uses of varying intensities or environmental sensitivities, and to minimise the risk of conflict associated with incompatible land uses

        Uncertainty, along with acknowledged potential for impacts on ROBE to occur, makes concluding compliance with this objective difficult.

    b. Consistency with *State Environmental Planning Policy (Infrastructure) 2007* (now incorporated into *State Environmental Planning Policy (Transport and Infrastructure) 2021*) which calls up the *EIS Guideline: Landfilling (Department of Planning, 1996)*, which sets locational principles, and where a landfill is "likely to be incompatible with surrounding zoning/land use considering separation distances", directs applicants to "seek alternate sites".

        Uncertainty, along with acknowledged potential for impacts on ROBE to occur, makes concluding incompatibility with the locational principle as 'not likely' difficult.

2. Impacts of the proposed development (4.15(1)(b)) on surrounding developments, and particularly ROBE, from airborne waste. Impacts are not adequately assessed, and thus it cannot be concluded that unacceptable impacts will not occur.

3. The suitability of the site (4.15(1)(c)). Clarity on the potential for dust/airborne contaminate impacts on surrounding properties is required to be able to conclude whether the site is suitable for the proposed development.

It is noted that in submissions, the operators of the Riverina Oils facility have indicated that contamination of their raw product used in their processing operations would cause considerable harm to their business.

Conclusion

Groundwater

The groundwater peer review raises concerns in regard to the groundwater assessment, and flags data gaps in relation to information considered necessary to conclude that the impacts of the proposed development on groundwater will be acceptable. Data gaps identified include SWL and local groundwater flow direction, gradient and rate in the two aquifers beneath the proposed landfill area.

The Applicant contents that it is established that the aquifer level is below the level of the proposed landfill, and that the geology of the area, which is well known, is the main controlling feature for groundwater impacts.

The EPA has advised that they are satisfied with the development with regard to the groundwater matters.

Airborne-Particle Impacts

The airborne-particle assessment recommends further information with regard to the modelling method, and seeks further information in regard to meteorological parameters.

Furthermore, the assessment notes that no information has been provided in the report on dust deposition impacts on the Riverina Oils Facility. The assessment states that there is potential for "for dust deposition and for contamination from contaminants present in the waste materials (e.g. fly ash, sand, road waste products) on the Riverina Oils Facility".

The Applicant contends that the modelling method is appropriate, but did not directly address the matter of impacts on the Riverina Oils Facility.

Overall

In light of these matters it is considered that the initial recommendation to the Panel, that the development be approved subject to conditions, should be altered. The Panel could request further information consistent with the recommendations of the peer review. Alternatively, given the considerable period of time that has elapsed since lodgement of this Development Application (over 3 years), it may be more appropriate to resolve the matter by refusing the Development Application due to the uncertainty around potential impacts on groundwater, the potential for unacceptable dust impacts, and the potential for contamination for airborne waste material on the Riverina Oils Facility and their products.

Recommendation

That DA19/0036 for a "Waste Disposal Facility (Non-Putrescible Landfill)" at Lots 2 and 4 DP 1249028, 225 Trahairs Rd, Bomen, NSW 2650, be refused for the following reasons:

1. Potential impacts on groundwater are unclear and have been insufficiently established. As such it cannot be concluded that the development:

    a. is consistent with performance objective (E) of section 3.3.4 of the Wagga Wagga Special Activation Precinct Master Plan, as requried to be considered under *State Environmental Planning Policy (Activation Precincts) Amendment (Wagga Wagga) 2021* and Clause 61(7) of the *Environmental Planning and Assessment Regulation 2021.*

    b. is consistent with the *EIS Guideline: Landfilling (Department of Planning, 1996)*, as called up under Clause 2.156 (1)(c)(ii) of *State Environmental Planning Policy (Transport and Infrastructure) 2021,* which lists environmentally sensitive areas to be avoided as including land that overlays an "aquifer which contains drinking water quality groundwater which is vulnerable to pollution".

    c. will not result in unacceptable impacts on groundwater.

    d. is located on a site suitable for the proposed development.

2. Potential impacts from dust and airborne waste particles are unclear and have been insufficiently established. Potential exists for airborne waste particles to contaminate adjoining properties, including businesses sensitive to such contamination. As such it cannot be concluded that the development:

    a. is consistent with the following objective of the Regional Enterprise Zone of the Wagga Wagga Special Activation Precinct:

        To effectively manage land uses of varying intensities or environmental sensitivities, and to minimise the risk of conflict associated with incompatible land uses

    b. is consistent with the *EIS Guideline: Landfilling (Department of Planning, 1996)*, as called up under Clause 2.156 (1)(c)(ii) of *State Environmental Planning Policy (Transport and Infrastructure) 2021,* which sets locational principles, and where a landfill is "likely to be incompatible with surrounding zoning/land use considering separation distances", directs applicants to "seek alternate sites".

    c. will not result in unacceptable impacts on adjoining properties from dust and airborne waste particles

.

    d. is located on a site suitable for the proposed development.

3. It is not in the public interest to permit development where the impacts of the proposed development are not fully understood.

Attachment 1 - Review of Hydrological and Hydrogeological Assessment

Review of Hydrological and Hydrogeological Assessment

Wagga Wagga Waste Disposal Facility

225-265 Trahairs Road, Bomen, NSW 2650

Prepared for:
Wagga Wagga City Council

Prepared by:
Australian Environmental Auditors Pty Ltd

Date of Report:
18 February 2022

Project Number:
EA0909

Review of Hydrological and Hydrogeological Assessment

Wagga Wagga Waste Disposal Facility
225-265 Trahairs Road, Bomen, NSW 2650

Prepared for:

Wagga Wagga City Council
243 Baylis Street
Wagga Wagga
NSW 2650

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Date or Report:

18 February 2022

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Review/ Approval

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AUSTRALIAN
ENVIRONMENTAL AUDITORS

AEA Ref: EA0909-C01

18 February 2022

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Wagga Wagga Waste Disposal Facility, 225 – 265 Trahairs Road, Bomen, NSW 2650
Review of the Hydrological and Hydrogeological Assessments of the Environmental Impact Statement

Dear Chris,

In accordance with proposal AEA210114, Australian Environmental Auditors Pty Ltd (AEA) is pleased to provide this independent review of the hydrological and hydrogeological assessment for the proposed landfill at 225-265 Trahairs Road, Bomen, NSW 2650. The expert review is required to satisfy the requirements of a NSW Planning Panels public meeting on 19 October 2021. We understand that Wagga Wagga City Council will be the reviewer and approver of this independent review and the administrative contact is NGH Consulting. The documents provided for review were:

NGH Environmental (2019) Environmental Impact Statement North Ridge Materials Facility, 30 May 2019 (EIS) (refer Appendix 1)

ENSR|AECOM (2008) Groundwater Review for Integrated Oilseed Processing and Biodiesel Plant, 19 March 2008 (referenced as ROBE, 2008 in the EIS and referenced as such herein) (refer Appendix 2)

The review addresses the NSW Planning Panel members specific requirement for an independent review of the potential impact of the development on existing overland flows and groundwater contamination and includes:

- The veracity of the hydrological and hydrogeological assessment provided by the applicant. In particular;
- Potential for contamination or other long term impacts on the existing groundwater supplies and the implications for surrounding groundwater users (i.e. bores)
- Advise on appropriateness of the proposed monitoring and management measures proposed by the applicant, and;
- Make recommendations, if appropriate, with respect to additional measures that could be put in place to manage the potential impacts of the development.

1. Background and Setting

Mr Nick Simmons of Australian Environmental Auditors was engaged by Mr Chris Egan of Egan valuers/Riverina Warehousing Solutions to undertake an independent assessment of the hydrological and hydrogeological assessments within the EIS prepared for the proposed landfill at 225-265 Trahairs Road, Bomen, NSW 2650. The proposed development would convert an area of historic liquid waste evaporation ponds into a non-putrescible solid waste landfill, leachate evaporation pond and associated waste management infrastructure.

The proposed development includes:

• Construction of an 8 m deep landfill comprised of six lined cells with a total area of 77 600 m^2 with a leachate collection system and a groundwater relief system;

• Construction of a leachate storage and evaporation pond with a total area of 9084 m^2;

• Internal access roads;

• A transfer station and recycling bays;

• A storage shed with amenities;

• Allowance for a future weighbridge;

Based on the projected waste receival rates given in the EIS, the facility would have a lifespan of approximately nine years.

2. Veracity of the hydrological and hydrogeological assessment

The following sections review the hydrological and hydrogeological sections of the EIS and address the planning panel members requirements as well as best practice landfill management and appropriate guidance. The review considers if the EIS has addressed these aspects sufficiently, such that appropriate decisions may be made on siting the proposed landfill and monitoring the ongoing risks to groundwater from the operation and aftercare of the proposed landfill should it be permitted for operation.

2.1 Hydrological Assessment

The Environmental Impact Statement (EIS) has adequately characterised the surface water body locations relative to the site and the sheet flow paths to these bodies, which is defined by the topography. The link between groundwater and surface water bodies proximal to the site is not well defined, principally because the current groundwater levels are not known, which is discussed in Section 2.2 below. Section 6.2.3 of the EIS states that; '*there are minor drainage lines around 100 m south of the development site boundary, about 1 km east of the development site (Schillers Creek), and Dukes Creek around 2 km west of the development site'* and based on a 2018 publication by the NSW Department of Primary Industries that *'upland streams around the development site and throughout the catchment are hydraulically connected, where flow is received from fractured rock aquifers'.*

Though only presenting data up to July 2010, the hydrograph at Figure 6-7 of the EIS indicates that groundwater in two bores on the site of the proposed landfill (Bore 5B) or close to it (Bore 13) ranged from approximately 4 m below ground level (mBGL) to less than 1 mBGL between January and July 2010. This indicates that groundwater has in the past risen to elevations that could connect it to surface water bodies even if these bodies are only shallowly incised, which is likely given they are described as ephemeral. The EIS does not compare the relative elevations of the beds of these surface water bodies to the historic groundwater levels. Test pits excavated to the immediate west of the westernmost dam on the site of the proposed landfill on 21 February 2017 were advanced to between 1.25 mBGL and 3.1 mBGL. The test pit logs indicate that none of these test pits encountered groundwater. Though the test pit logs are more recent than

the hydrograph, they are still five years old. Further examination of the potential linkages between groundwater and surface water should be undertaken.

2.2 Hydrogeological Assessment

Standing water level

The regional geology has been established based upon published literature and geological mapping. The regional and local hydrogeology has been determined based principally on ROBE 2008. Based on gauging of 16 bores located in and around the proposed landfill area in 2008, groundwater is anticipated to occur within two aquifer units beneath the proposed landfill area;

- An upper aquifer or perched laterally discontinuous groundwater within sandy clay and sand lenses within clay strata encountered in 2008 approximately 2 mBGL; and
- A lower aquifer with groundwater likely within weathered granite encountered in 2008 between 4 to 13 mBGL.

The degree of vertical connectivity between these aquifers or perched groundwater has not been established.

Very minimal groundwater gauging data appears to be available after 2008 for the area of the proposed landfill. The EIS indicates that the shallower groundwater monitoring bores on and around the proposed landfill have been dry since 2007, and references Table 6-9, however Table 6-9 does not give any dates for when the bores were found to be dry or found to have groundwater present. Table 6-9 does not present the standing groundwater level (SWL) for the four bores that groundwater was encountered in, only the well depth below ground is given. No bore logs are provided for the onsite bores to enable evaluation of the groundwater SWLs and water bearing strata when the bores were installed.

Hydrographs used in the EIS (Figure 6-7) present groundwater level monitoring data from 2007 to 2010 for four bores on the site of the proposed landfill. Data collected 12 to 15 years ago is of very limited utility to determine current groundwater SWLs, as these levels are highly likely to have changed in the significant time that has elapsed since this groundwater level data was collected. This is somewhat illustrated by the groundwater levels for 2010 presented in Figure 6-7, which all increase markedly between approximately January and July of that year. This is likely to be indicative of the breaking of the millennium drought (Bureau of Meteorology, 2022).

Groundwater bore P1B was sampled and the groundwater SWL recorded in June 2018, but all other bores onsite were found to be dry. No recent groundwater level data is provided within the EIS for any of the bores, and the groundwater level recorded in June 2018 is not sufficient to determine the groundwater level in 2022. Further, the groundwater level and flow direction at the site of the proposed landfill cannot be determined from one bore – three bores are required for determination of this via triangulation and typically, one is installed up-hydraulic gradient and two down-hydraulic gradient to determine groundwater levels, flow direction and gradient (EPA Victoria, 2006). However, given the size of the site and the multiple aquifers, more than three bores are recommended in order to refine this in sufficient detail. Greater than three bores are typically required when the groundwater levels established after bore installation differ from the hydraulic gradient inferred by literature reviews or geological mapping.

Determination of the local groundwater SWL is heavily based on data presented in ROBE 2008 and there are significant groundwater SWL data gaps after 2008 due to dry bores. The current groundwater SWL for the aquifers beneath the proposed landfill is therefore not well established as it relies on data gathered a notable number of years ago. Knowing the current groundwater SWL is of key importance in assessing risks to groundwater as it establishes the thickness of the vadose zone beneath the landfill. Leachate contaminants that transit the landfill liner will attenuate or biodegrade wholly or to some extent within the vadose zone. Understanding the current groundwater SWL and vadose zone thickness is therefore an important

component for a hydrogeological risk assessment (along with the characteristics of the strata that the vadose zone is comprised of) for determining the risks to groundwater from the proposed landfill.

When establishing a new landfill, part A of the EPA NSW Environmental Guidelines: Solid Waste Landfills, Second edition 2016 (EPA NSW, 2016) requires a hydrogeological risk assessment (HRA) as part of the impact assessment. Due to the data gaps discussed herein, the risks to groundwater from the proposed landfill development are not fully understood as the following is not fully established by the EIS:

- The baseline condition of groundwater within the two aquifers prior to landfilling (natural background groundwater geochemistry and any existing contamination from previous uses of the site or uses of surrounding sites);
- The current groundwater level or flow direction in the two aquifers beneath the proposed landfill area;
- The likelihood of interaction between groundwater and surface water bodies;
- A representative groundwater monitoring bore network for both aquifers; and
- The groundwater receptors potentially at risk should groundwater quality be impacted by the landfill.

It is recommended that the hydrogeological and hydrological sections of the EIS are expanded into a HRA in order to meet the impact assessment requirements of EPA NSW, 2016 for new landfills. The hydrogeological assessment components of the HRA should accord with EPA Victoria publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines (September 2006), specifically;

- That a sufficient number of the dry groundwater monitoring bores onsite are re-developed or replaced to deeper elevations to enable groundwater gauging and sampling of both aquifers. Replacement or re-developed bores should be carefully logged to ensure the correct aquifer is being monitored;
- For both aquifers the onsite groundwater levels, gradient, flow direction and flow rate are established by obtaining contemporaneous gauging data and subsequent development of new groundwater contour diagrams;
- The likelihood of groundwater and surface water interaction is examined based on current groundwater levels and (if necessary based on the groundwater depth) surveying the elevation of the beds of surface water bodies surrounding the site of the proposed landfill. As such, this assessment should be revisited upon installation and gauging of the additional bores and new groundwater SWL data;
- The background and onsite groundwater geochemistry is established in both aquifers to determine its baseline condition prior to commencement of landfilling. Baseline condition means the geochemistry of the natural background groundwater as well as any contamination present;
- That scaled, diagrammatic hydrogeological cross sections of the proposed landfill be prepared based on groundwater bore logs (from replacement/re-developed bores) with all levels shown in metres Australian Height Datum (mAHD) showing the landfill within the local hydrogeological and hydrological setting; and
- Should the landfill be developed, that a groundwater monitoring bore network is established which is sufficient to identify any changes in groundwater condition during landfilling or in the landfill aftercare phase.

Groundwater flow direction

In establishing the groundwater flow direction on the site of the proposed landfill, the EIS relies principally on;

- The Riverina Wool Combing Soil and Water Management Plan prepared by McMahon Earth Sciences in 2010 (referenced in the EIS as McMahon 2010); and
- Groundwater contour maps for 2004 to 2007 presented in a groundwater review for the adjacent integrated oilseed processing and biodiesel plant undertaken in 2008 by ENSR/AECOM (ROBE 2008).

Whilst this historical information may be indicative of groundwater flow at the time it was obtained, these data and information sources are not sufficient to determine the groundwater flow in 2022. Given the drop in groundwater SWLs, groundwater flow may have changed to some degree as a result of several factors including changes in regions of preferential flow. As previously noted, up to date groundwater SWLs have not been sufficiently established and therefore the groundwater flow direction for either aquifer is not known. The assessment of the regional groundwater flow has been determined based on published literature values and it is inferred that this applies to the proposed landfill site. Local groundwater flow directions can be different to the regional flow due to local geology as well as anthropogenic disturbance/development. It is recommended that the groundwater levels, gradient, flow direction and flow rate for the two aquifers in the area of the proposed landfill is determined based on contemporary gauging data from groundwater bores local to the site.

3. Potential for contamination or other long term impacts on existing groundwater supplies and implications for surrounding groundwater users

As the current baseline condition of groundwater, current groundwater levels, gradient and flow direction have not been established, the potential for impacts on groundwater supplies and surrounding groundwater users cannot be reliably considered based on the EIS.

4. Appropriateness of the applicant's proposed monitoring and management measures

The landfill is proposed to be lined with a leachate barrier system (landfill liner) and constructed and filled progressively in a series of six cells with leachate collection systems conveying leachate to a storage and evaporation dam for disposal. The leachate collection system is comprised of collection pipework within a 300 mm thick gravel layer connected to a sump where leachate can be pumped out of the cell. If managed and maintained appropriately this system will be sufficient to maintain a maximum leachate level within the cells of 300 mm in depth which meets the requirements of EPA NSW 2016. The EIS includes a water balance calculation which indicates that the proposed leachate dam capacity is sufficient based on conservative estimates of leachate generation derived from 120 years of rainfall data for the area. This will remain an acceptable water balance estimate for leachate generation as long the landfill cells are not constructed below the water table.

Section 3.3.9 indicates that the cells would be progressively rehabilitated (capped) once each is filled. The approximate sequencing and timing of filling and rehabilitation of each cell is not explicitly stated in the EIS. Progressive rehabilitation is a minimum standard required by EPA NSW, 2016 and is best practice for reducing leachate impacts on groundwater and facilitating efficient capture of landfill gas. Though the EIS includes statements regarding progressive rehabilitation, a filling plan and rehabilitation plan are recommended to ensure that capping materials can be ordered and earthworks contractors engaged in a timely manner to achieve the intended rehabilitation timeframe.

Proposed landfill design – leachate barrier system, leachate collection system and landfill cap

Under the EPA NSW 2016 guidelines the base liner must be graded to greater than 1% longitudinally and greater than 3% in transverse directions, and similarly, the leachate collection pipework should also be laid at gradients of at least 1% longitudinally into the sump and 3% in transverse directions. However, Section 3.2.5 of the EIS proposes that the base liner will have a gradient of 0.5 % longitudinally and 0.7 % in transverse directions and the leachate collection pipework be laid at a gradient also of 0.5 % longitudinally and 0.7 % in transverse directions. Therefore, the gradients of the proposed leachate barrier system and leachate collection system do not meet the requirements of EPA NSW, 2016.

The proposed landfill cap design meets the requirements of EPA NSW, 2016 for the intended landfill type.

Proposed landfill design – groundwater relief layer

Section 3.2.4 of the EIS states that a groundwater relief layer will be installed beneath the leachate barrier system as the 'groundwater level could affect the stability and performance of the leachate barrier', in accordance with EPA NSW, 2016. Whilst this intends to meet the requirements of EPA NSW, as noted previously the current groundwater levels are not known, therefore this may be an unnecessary requirement for the proposed landfill. Section 3.2.2 of the EIS states that the landfill cells will be excavated to 8mBGL, which is higher than elevation that groundwater has been encountered based on the information in the EIS, with groundwater now inferred to be at a lower elevation due to dry bores (noting the limitation of this data discussed above). As such, in the absence of knowing the current groundwater SWLs, and groundwater indicatively lower than in the past (i.e. further from the base of the proposed landfill cells) it is currently not known if a groundwater relief layer is needed to ensure the stability and performance of the leachate barrier.

Proposed wastes for landfilling

The power boiler fly ash and power boiler sand wastes listed in Table 3-1 for acceptance at the proposed landfill may be classed as restricted solid waste after testing. If this were to occur these wastes would not be permitted to be accepted at the landfill based on its proposed design, as a double composite liner is required for landfilling restricted solid wastes (EPA NSW, 2016). Therefore, it is recommended that any power boiler fly ash and power boiler sand wastes intended for landfilling at site be tested prior to disposal in accordance with EPA NSW Waste Classification Guidelines Part 1: Classifying waste (November 2014) to ascertain if these wastes are restricted solid waste.

Proposed landfill monitoring

Section 3.2.10 of the EIS states that additional groundwater monitoring bores would be installed to assess for impacts from the construction and operation of the proposed landfill. No further details in relation to bore location, number, depth or design were provided. As noted previously, the current groundwater SWLs and flow direction are not known, it is only inferred from older gauging data and literature reviews. As above in the hydrogeological assessment discussion, it is recommended that the existing groundwater bores onsite be redeveloped or replaced in order to establish current hydrogeological information. Once this has occurred sufficient information will be available to adequately design a monitoring bore network sufficient for the landfill (i.e. bore location, number, depth, and design based on the established local hydraulic gradient). It appears likely that some of the existing groundwater monitoring bores will need to be decommissioned to allow construction of the landfill cells. Considering this, it is recommended that these groundwater bores are not re-developed and instead are replaced with offsite bores in close proximity to the site which can later be used for ongoing groundwater monitoring after initial use for hydrogeological investigation. All bores should be constructed in accordance with the updated Minimum Construction Requirements for Water Bores in Australia Fourth Edition 2020 (National Uniform Drillers Licensing Committee 2020) (the EIS references the superseded third edition published in 2012).

Table 6-14 in Section 6.2.5 of the EIS states that groundwater would be monitored quarterly, which meets the minimum requirements of EPA NSW, 2016. Table 6-14 specifies which analytes groundwater samples will be analysed for. These represent typical leachate contaminants, however, it is recommended that the metals samples are filtered and that per and polyfluorinated alkyl substances (PFAS) are included for analysis in both leachate and groundwater. As recommended previously, the baseline condition of groundwater should be determined prior to commencement of landfilling. It is strongly recommended that groundwater is analysed for PFAS when this is undertaken. An ultra-trace or similar PFAS analytical suite should be used, with the results then guiding the PFAS that should be analysed for in the ongoing groundwater monitoring program, as well as the PFAS identified in leachate once the landfill is operational.

Any groundwater bores that the landfill is to be constructed over should be decommissioned using full grouting in accordance with the Minimum Construction Requirements for Water Bores in Australia Fourth

Edition 2020 (National Uniform Drillers Licensing Committee 2020) to avoid creating a direct pathway to the aquifer beneath the landfill cells.

5. Conclusions

The conclusions of this review are:

- The current groundwater SWLs for the two aquifers beneath the proposed landfill are not well established;
- The current local groundwater flow direction, gradient and rate in the two aquifers beneath the proposed landfill area are not known as these have been assessed based on regional groundwater flow information and out of date groundwater monitoring data obtained from the site;
- The baseline geochemistry (natural and/or existing contamination) of the groundwater up-hydraulic gradient, beneath and down-hydraulic gradient of the proposed landfill area has not been established;
- The potential for impacts on groundwater supplies and surrounding groundwater users cannot be reliably considered based on the current EIS due to the conclusions mentioned above;
- The gradients of the proposed leachate barrier system and leachate collection system do not meet the requirements of EPA NSW Environmental Guidelines: Solid Waste Landfills, Second edition 2016, and;
- The proposed groundwater monitoring for the landfill during its operational and post closure phases does not specify bore locations, number, depth or design.

6. Recommendations

Based on my assessment conclusions summarised above, the following recommendations are made:

1. The hydrogeological and hydrological sections of the EIS should be expanded into a HRA in order to meet the impact assessment requirements of EPA NSW, 2016 for new landfills. The hydrogeological assessment components of the HRA should accord with EPA Victoria publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines (September 2006). Specifically;

    - That a sufficient number of the dry groundwater monitoring bores onsite are re-developed or replaced to deeper elevations to enable groundwater gauging and sampling of both aquifers. Replacement or re-developed bores should be carefully logged to ensure the correct aquifer is being monitored;
    - For both aquifers the onsite groundwater levels, gradient, flow direction and flow rate should be established by obtaining contemporaneous gauging data and subsequent new groundwater contour diagrams should be developed;
    - The likelihood of groundwater and surface water interaction should be examined based on established current groundwater levels and (if necessary based on the groundwater depth) the elevation of the beds of surface water bodies surrounding the site of the proposed landfill should be surveyed. As such, this assessment should be revisited upon installation and gauging of the additional groundwater bores and new SWL data;
    - The baseline onsite groundwater geochemistry should be established in both aquifers prior to commencement of landfilling. Baseline condition means the geochemistry of the natural background groundwater as well as any contamination present;
    - Scaled, diagrammatic hydrogeological cross sections of the proposed landfill should be prepared based on groundwater bore logs (from replacement/re-developed bores) and current onsite groundwater SWLs, with all levels shown in metres Australian Height Datum (mAHD) showing the landfill within the local hydrogeological and hydrological setting; and

- Should the landfill be developed, a groundwater monitoring bore network should be established that is sufficient to identify any changes in groundwater condition during landfilling or in the landfill aftercare phase.

2. The base liner is graded to greater than 1% longitudinally and greater than 3% in transverse directions;
3. The leachate collection pipework is laid at gradients of at least 1% longitudinally into the sump and 3% in transverse directions;
4. The need for the groundwater relief layer under the landfill cells is reconsidered once the current elevation of the groundwater beneath the proposed landfill is known and can be properly evaluated to determine if the groundwater level could affect the stability and performance of the leachate barrier (landfill liner);
5. The power boiler fly ash and power boiler sand wastes listed in Table 3-1 for acceptance at the proposed landfill are tested in accordance with EPA NSW Waste Classification Guidelines Part 1: Classifying waste (November 2014) to ascertain if these wastes are restricted solid waste;
6. The groundwater monitoring bore network referred to in recommendation 1. above should be established once the HRA is complete and the hydrogeological context of the proposed landfill is understood in order to be representative of any leachate contamination from the proposed landfill;
7. Groundwater samples being analysed for metals should be field-filtered and per and polyfluorinated alkyl substances (PFAS) should be included for analysis in both leachate and groundwater; and
8. Prior to construction of the landfill cells any previous groundwater bores which are to be constructed over should be decommissioned using full grouting in accordance with the Minimum Construction Requirements for Water Bores in Australia Fourth Edition 2020 (National Uniform Drillers Licensing Committee 2020) to avoid creating a direct pathway to the aquifer beneath the landfill cells.

If you wish to discuss any issues raised or require any further information, please do not hesitate to contact me on 0423 340 732.

Yours sincerely,

Australian Environmental Auditors Pty Ltd

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Version Control Record		
Draft By / Date	Reviewed By / Date	Administrative Review By / Date
N. Simmons / 11 February 2022	C. Barber / 16 February 2022	D. Smith / 17 January 2022

References

EPA Victoria (2006) EPA Publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines (EPA Victoria, 2006).

ENSR|AECOM (2008) Groundwater Review for Integrated Oilseed Processing and Biodiesel Plant, 19 March 2008 (ROBE, 2008)

EPA NSW Waste Classification Guidelines Part 1: Classifying waste (EPA NSW, 2014)

EPA NSW Environmental Guidelines: Solid Waste Landfills, Second edition 2016 (EPA NSW, 2016)

NGH Environmental (2019) Environmental Impact Statement North Ridge Materials Facility, 30 May 2019 (EIS)

http://www.bom.gov.au/climate/drought/knowledge-centre/previous-droughts.shtml (accessed 07.02.2022, 14:25 hrs) (Bureau of Meteorology, 2022).

Appendix 1

Environmental Impact Statement North Ridge Materials Facility
NGH Environmental, 30 May 2019

Appendix not duplicated in Wagga Wagga City Council Supplementary Report to Southern Regional Planning Panel

Appendix 2

Groundwater Review for Integrated Oilseed Processing and Biodiesel Plant
ENSR|AECOM, 19 March 2008

ENSR | AECOM

Prepared for:

Riverina Oils and Bio Energy Pty Ltd

Wagga Wagga

Groundwater Review for Integrated Oilseed Processing and Biodiesel Plant

Wagga Wagga

Final

ENSR Australia Pty Ltd (HLA ENSR)

19 March 2008

Document No.: S6054304_RPTFinal_19Mar08.doc

HLA Merged with ENSR in 2007


HLA
Merged
with ENSR
in 2007

Distribution

Groundwater Review for Integrated Oilseed Processing and Biodiesel Plant
Wagga Wagga

19 March 2008

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Contents

1.0 Introduction

ENSR Australia Pty Ltd (HLA ENSR) has undertaken a review of groundwater data in support of the environmental assessment (EA) currently being prepared for a proposed integrated oilseed processing and bio-diesel plant near Wagga Wagga, NSW.

The proposed development site is approximately 17 ha in size and located about 10 kilometres north of Wagga Wagga, at the intersection of Trahairs Road and Byrnes Road (Refer to **Figure 1**).

The proposed bio-diesel facility would be located immediately to the north of the existing Wool Combing facility, which includes a processing plant and treatment and evaporation ponds which are no longer utilised. It is proposed that the bio-diesel facility will utilise the westernmost existing evaporation pond from the wool combing facility for disposal of wastewater, as well as irrigation of 10 hectares of pasture. It is understood that prior to the use of the existing evaporation pond, the pond would be refurbished and lined in accordance with appropriate industry standards including at least 900 mm of compacted clay with an in-situ permeability of less than 10^{-9} metres per second (m/s). The pond will be constructed to a capacity of 27 megalitres (ML).

1.1 Objective

The objective of this review is to:

- Collate and review available historical groundwater information;
- Anticipate the likely impacts associated with the use of the refurbished evaporation pond and irrigation of effluent on the groundwater system; and
- Provide recommendations for the management of potential impacts.

1.2 Available Information

The main sources of information which were used for the preparation of this report were:

- Charles Sturt University (CSU, 2006) Annual Environmental Report 2006, Riverina Wool Combing Pty Ltd.
- Charles Sturt University (CSU, 2005) Annual Environmental Report 2005, Riverina Wool Combing Pty Ltd.
- Johnstone Centre (2005) Annual Environmental Report 2004, Riverina Wool Combing Pty Ltd. Report No. 114. March 2005.
- HLA ENSR (2008) Irrigation Assessment, Wagga Wagga. 27 February 2008.
- HLA ENSR (2007) Soil Suitability Assessment, Use of Effluent by Irrigation – Riverine Oils and Bio Energy. 12 December 2007.

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2.0 Hydrogeological Regime

2.1 Geology

2.1.1 Regional Geology

The geology of the Wagga Wagga region is summarised as extensive folded Ordovician metasediments and large intruded Silurian granite masses as well as minor Devonian sandstones occupying hilly areas. Up to 10 m of Cainozoic alluvial, slope-wash and windblown clay has been deposited in the valley alluvial plains of all drainage systems.

2.1.2 Local Geology

The geology underlying the site is dominated by the Silurian granites, predominantly Wantabadgery Grandiorite and Collingullie Granite (Adamson and Loudon, *Wagga Wagga* 1:250,000 Geological Series Sheet S1-55-15, 1st ed. 1966). Thick clay sequences are present overlying the granite, with significant Aeolian clay in drainage depressions.

During previous investigations in the locality of the subject site (CSIRO, 1990; Coffey Partners, 1992), soils comprising surficial sandy loams over plastic silty to sandy clays were encountered to depths of approximately 6 metres. Fine gravels consistent with weathered granitic bedrock (saprolite) were encountered in clay materials from approximately 3 metres below ground surface. Variably weathered bedrock could occur to depths of approximately 40 metres below grade.

2.2 Soils

The *Soil Landscapes of the Wagga Wagga 1:100,000 Sheet* (DLWC, 1997) describes the soils in the vicinity of the site as being part of the East Bomen soil landscape group, comprising shallow to moderately deep (40-150cm) Eutrophic Red Dermosols on crests and ridges; deep (80-200cm) Eutrophic Red Dermosols on slopes; and moderately deep (80-150cm) Eutrophic Brown Dermosols in drainage lines.

2.3 Surface Water, Topography and Drainage

The topography in the vicinity of the site is generally flat with an elevation of approximately 245 metres (*Wagga Wagga* 8327-1-N 1:25,000 Topographic Map, 2nd ed. NSW Department of Lands 1991).

The site is located within the Wagga Wagga catchment area, located along the Murrumbidgee River. The proposed location for the bio-diesel plant is approximately 7 km north of the Murrumbidgee River. A number of minor tributaries and drainage lines are located in the vicinity of the site and suggest a southerly drainage direction in the event of storm events.

2.4 Hydrogeology

2.4.1 Regional Hydrogeology

The Wagga Wagga catchment area is predominantly situated on a large drainage basin comprising heavy clay soils, with only a small catchment discharge point. The combination of geographical and geological features prevents groundwater from easily migrating away from the area, resulting in waterlogging and increased salinity, affecting both urban and agricultural environments (Wagga Wagga City Council, 2007).

There are three regional hydrogeological units of the Wagga Wagga area, including the Ordovician metasediments, the Silurian granites and Tertiary and Quaternary alluvium (CSIRO, 2001). Groundwater

yields within the metasediments typically range between 0.3 and 0.5 litres per second (L/s), with higher yields experienced where well-fractured zones are intersected. Bores constructed within granites have typically been unsuccessful, although yields of up to 0.2 L/s have been recorded. Yields from alluvium production bores are up to 200 L/s. The depth of the water table in the Wagga Wagga area varies, but has been recorded at less than 2 m in areas where salinity has affected urban infrastructure and vegetation (CSIRO, 2001).

2.4.2 Local Hydrogeology

Historical reports have identified the presence of two aquifers beneath the site including:

- A shallow, or perched aquifer is present at approximately 2 metres depth; and
- A deeper aquifer is present between 4 and 13 metres below the surface.

Little data are available regarding shallow groundwater flow directions prior to excavation and use of the evaporation ponds, however groundwater is expected to have flowed in an easterly direction from recharge areas on the elevated ground towards lower ground along the water courses.

Falling head permeability tests reported in previous annual reports indicate lateral infiltration rates of approximately 0.15 m/d in sandy clay and 0.0012 m/d to 0.0018 m/d in clay with minor sand content in the vicinity of the subject site

In addition to groundwater within the weathered granite zone, groundwater is likely to flow through fractures within the underlying granite bedrock, with variable flow rates depending on the local interconnectivity of fractures.

2.5 Rainfall

Wagga Wagga has an average annual rainfall of 572 mm, distributed fairly equally over the full 12 months.

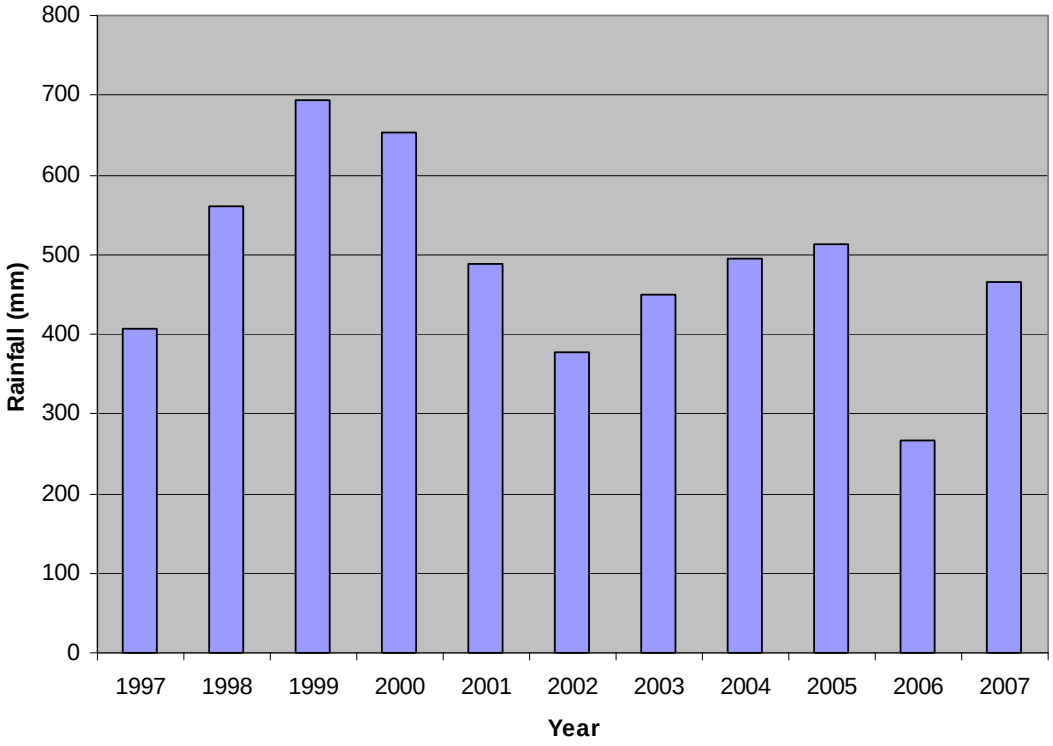
Maximum temperatures in summer are warm, averaging between 29°C and 32°C. The winters are cool to cold with overnight minimums averaging 3°C and daily maximums climbing to only 12°C to 14°C on average.

Average monthly rainfall over the period 1997 to 2007 is presented in **Table 1** below.

Table 1: Monthly Rainfall - Wagga Wagga (Weather Station 072150)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Jan	49.8	25.8	46.6	62.8	22.8	3.6	7.0	22.8	13.2	69.4	40.2
Feb	6.2	32.0	8.8	26.6	86.4	139.8	58.6	9.4	46.8	1.8	54.6
Mar	42.8	2.0	78.4	26.0	56.6	24.0	1.6	0.0	6.6	10.6	23.8
Apr	0.6	77.2	77.6	61.6	31.2	25.0	9.2	15.4	14.6	17.4	46.0
May	57.4	8.0	42.2	71.8	8.0	30.2	28.4	40.8	4.6	4.6	52.4
Jun	34.2	101.4	43.0	55.0	62.8	50.8	69.4	73.4	69.0	39.4	19.4
Jul	26.4	48.8	32.0	56.4	31.6	14.4	60.2	38.0	65.0	49.2	38.2
Aug	42.4	43.4	50.2	92.4	47.6	32.4	67.2	66.8	56.4	7.6	22.2
Sep	81.2	71.8	60.6	46.8	39.2	36.0	26.0	53.6	85.0	20.0	7.4
Oct	17.6	39.6	119.6	102.0	86.8	0.6	55.4	26.0	77.6	3.8	14.6
Nov	23.4	60.4	27.0	32.4	12.0	12.2	28.0	87.6	44.8	34.0	73.0
Dec	25.8	50.6	107.4	19.6	3.2	7.8	39.2	60.6	29.4	9.4	74.6
Reported Annual:	407.8	561.0	693.4	653.4	488.2	376.8	450.2	494.4	513.0	267.2	466.4

Figure 1: Graphical Representation of Annual Rainfall 1999 – 2006



2.6 Existing Groundwater Bores

A search of Department of Water and Energy (DWE – formerly known as the Department of Natural Resources) licensed groundwater bores was undertaken to determine existing groundwater users in the vicinity of the proposed site. The results of this search are shown in **Table 3** and **Figure 2**.

Table 2: Licensed Groundwater Users

Groundwater Bore ID	Authorised Purpose	Distance from Study Area
GW010925	Stock	1 km north west
GW400117	Monitoring Bore	
GW400118	Monitoring Bore	
GW400116	Monitoring Bore	
GW400918	Monitoring Bore	
GW400115	Monitoring Bore	
GW400114	Monitoring Bore	
GW400093	Monitoring Bore	
GW400122	Monitoring Bore	
GW400092	Monitoring Bore	
GW400121	Monitoring Bore	
GW010900	Domestic Stock	2 km west

Groundwater Bore ID	Authorised Purpose	Distance from Study Area
GW400926	Monitoring Bore	
GW400119	Monitoring Bore	
GW402564	Monitoring Bore	
GW402565	Monitoring Bore	
GW024160	Domestic Stock	2 km south east
GW045371	Domestic Stock	2 km north west
GW402563	Monitoring Bore	
GW401827	Domestic Irrigation	2 km west
GW037631	Domestic Stock	2.25 km west
GW019939	Domestic Farming Irrigation Stock	2.25 km north east
GW022006	Stock	2.5 km east

Groundwater bores used for irrigation or stock purposes are not located within two kilometres of the study area.

3.0 Historical Data Review

3.1 Monitoring Well Network

A total of 16 paired groundwater monitoring wells are present in the vicinity of the treatment ponds and evaporation basins associated with wool combing site. A further two paired monitoring wells are located east of the evaporation ponds, with one pair located within and one just east of the irrigated lucerne paddock.

Monitoring wells 1 to 12 and 14 to 20 are nested, with the first (a) intercepting the shallow aquifer (approximately 2 metres) and the second (b) intercepting the deeper aquifer (ranging from 4 to 13 metres). The following table provides a description of the monitoring well network.

Table 3: Monitoring Well Network

Monitoring Well ID	Australian Height Datum	Location Description	Well Depth
P1a (shallow)	227.85	Evaporation Basin 3	1.80
P1b (deep)	227.875	Evaporation Basin 3	11.00
P2a	228.17	Evaporation Basin 3	1.80
P2b	228.17	Evaporation Basin 3	6.90
P3a	228.16	Evaporation Basin 3	1.85
P3b	228.16	Evaporation Basin 3	4.90
P4a	228.52	Evaporation Basin 3	1.70
P4b	228.52	Evaporation Basin 3	11.05
P5a	222.27	Evaporation Basin 4	1.80
P5b	222.27	Evaporation Basin 4	4.40
P6a	222.58	Evaporation Basin 4	1.80
P6b	222.58	Evaporation Basin 4	5.40
P7a	222.47	Evaporation Basin 4	1.80
P7b	222.47	Evaporation Basin 4	4.90
P8a	218.03	Evaporation Basin 5	1.80
P8b	218.03	Evaporation Basin 5	5.50
P9a	218.31	Evaporation Basin 5	1.80
P9b	218.31	Evaporation Basin 5	3.80
P10a	218.28	Evaporation Basin 5	1.80
P10b	218.28	Evaporation Basin 5	8.35
P11a	228.79	North of Terminal Pond	1.70
P11b	228.79	North of Terminal Pond	11.05
P12a	222.67	Base of Terminal Pond	1.90

Monitoring Well ID	Australian Height Datum	Location Description	Well Depth
P12b	222.67	Base of Terminal Pond	12.95
P13	223.81	South of Terminal Pond	4.40
P14a	226.84	North of Waste Cell	6.45
P14b	226.84	North of Waste Cell	10.50
P15a	228.15	East of Waste Cell	10.60
P15b	228.15	East of Waste Cell	6.30
P16a	235.33	South of Waste Cell	6.60
P16b	235.33	South of Waste Cell	10.70
P17a	234.01	South of Waste Cell	2.30
P17b	234.01	South of Waste Cell	-
P18a	239.04	Near Main Entrance	2.10
P18b	239.04	Near Main Entrance	7.60
P19a	224.46	East of Evaporation Basin 4	3.15
P19b	224.53	East of Evaporation Basin 4	8.26
P20a	225.08	East of Evaporation Basin 4	3.20
P20b	225.13	East of Evaporation Basin 4	10.95

Monitoring wells P14 to P17 were located to detect issues associated with leachate from the dry waste cell. Monitoring well P18 provides an indication of off-site groundwater quality, and monitoring wells P19 and P20 were located intercept any problems with wastewater being irrigated on the lucerne paddock.

Monitoring wells P1, P2, P3 P4, P5, P6, P7 and P11 are the closest wells to the subject site and evaporation pond proposed for use. Refer to **Figure 3 to 8** for location of these wells.

Dry weather conditions experienced in the area over the past years have lowered groundwater levels and many of the monitoring wells on-site are now dry. Excluding monitoring wells P19a and P20a located within the adjacent lucerne paddock, all monitoring wells located within the shallow aquifer ('a' series) are currently dry, indicating that the perched aquifer no longer exists, or has lowered to a level beyond the maximum depth of the monitoring wells. A number of wells located within the deeper aquifer ('b' series) are now also dry including P2b, P3b, P7b, P8b, P10b, P11b, P12b, P14b, P16b, P17b and P18b. This decline in water level within the deeper aquifer is considered to reflect regional rainfall patterns.

3.2 Groundwater Level Monitoring

Groundwater levels at the site have been monitored regularly since 1997 and indicate an overall decline in groundwater levels across the site during this time. This is expected to be attributed to the drought conditions experienced in the area during this time. As such, an increase in groundwater levels may be experienced with the onset of wetter weather conditions. Average annual groundwater levels are presented in **Table T1** of the tables section.

Currently, all monitoring wells located within the shallow aquifer are dry, excluding monitoring wells P19a and P20a. Monitoring wells P19a and P20a are located within and adjacent to an irrigated lucerne

paddock and the presence of water within the shallow aquifer east of the site may be attributed to different geology or ongoing irrigation of these paddocks.

Changes in the average annual groundwater levels are presented in **Figures 9** to **15**.

Historical results indicated limited correlation between rainfall and groundwater levels in the shallow (perched) aquifer prior to these wells going dry. The average annual standing water levels reported for the shallow wells were more erratic, indicating the shallow aquifer may be influenced more by surface activities and the intermittent use of the evaporation ponds rather then rainfall events.

Standing water levels within the deeper aquifer generally followed trends in regional rainfall patterns, indicating that the deeper aquifer is influenced more by regional rainfall patterns rather than use of the evaporation ponds and irrigation of the adjacent paddock.

A review of water level data indicates that groundwater flow direction of the deeper aquifer in the vicinity of the evaporation ponds is generally in an east to south-easterly direction (refer to **Figures 9** to **15**). Contour plots for the deep aquifer were produced for three years which represented groundwater flow during use of the evaporation ponds (2004), during reduced use of the ponds (2006) and when the ponds were not in use (2007). Two plots were produces for each year to determine any differences between summer and winter months.

The contour plots show little difference in groundwater flow direction during and after use of the evaporation ponds or from season to season.

Groundwater flow directions and contour maps for the shallow aquifer were unable to be produced due to the wells being dry for a majority of the monitoring period.

Reduced production at the Wool Combing facility began in 2005-2006 and the majority of the evaporation ponds ran at very low levels during 2006, which reflects the reduced production throughout the plant and good evaporation rates during an extended period of low rainfall. This reduction in surface water appears to have slightly increased the rate of groundwater level decline in some wells (P1a, P1b and P6b), indicating some connection between the ponds and the groundwater table. However, the overall climatic conditions appear to have had a far greater influence on deep groundwater levels at the site.

It was noted in the report by Charles Sturt University (2006) titled *Soil and Irrigation Monitoring Report* that no irrigation of nearby paddocks was undertaken in 2005-2006. This may also be a contributing factor in the increased rate of decline in water levels over this period.

Groundwater level monitoring data indicate that in 2006 there was approximately four metres difference in water levels between the shallow and deep aquifers in the vicinity of the evaporation ponds (monitoring wells 1A and 1B) and up to seven metres difference in water level in the irrigation paddock (monitoring wells 19A/B and 20 A/B). In addition, annual trends between the shallow and deep aquifers appear to differ in some wells.

3.3 Groundwater Quality Monitoring

Groundwater quality is protected in NSW by the *Protection of the Environment Operations Act 1997* and the *Water Management Act 2000*. Identification of the receiving environment or the likely beneficial use of the water is essential for selection of the most applicable criteria.

The Murrumbidgee River is the dominant surface water feature within the area, although it lies some seven kilometres south of the site. The Murrumbidgee River has previously been extensively used for local irrigation and stock purposes.

Groundwater analytical results presented in the annual environmental reports were assessed against the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC 2000) for Primary Industries (Irrigation) Water. Trigger levels represent the best current estimates of the concentrations of chemicals that should have no significant adverse effects on the aquatic ecosystem. Where trigger levels are not provided, an assessment of the variation between the years was undertaken.

The groundwater quality impact assessment criteria are provided in **Table 4**.

Table 4: Groundwater Quality Assessment Criteria

Indicator	Irrigation Criteria
pH	>6.5 and <8.5
Conductivity (EC)	No criteria available
Total Dissolved Solids (TDS)	13,000 mg/L
Sodium (Na)	460 mg/L
Potassium (K)	No criteria available
Calcium (Ca)	1000 mg/L
Magnesium (Mg)	No criteria available
Chloride (Cl)	700 mg/L
Bicarbonate (HCO3)	No criteria available
Nitrate (NO3)	400 mg/L
Sulfate (SO4)	1000 mg/ L
Hardness	350 mg/L as CaCO3

Groundwater quality data from 2003 to 2006 is available for limited deep groundwater wells, as all shallow wells and some deep wells were dry. A summary of this data is presented in **Table 5**.

The groundwater analytical results indicate that groundwater is neutral to alkaline and is considered brackish in nature. The analytical results indicate the water is generally suitable for irrigation purposes in accordance with the ANZECC guidelines. There was little variation between results reported from when the ponds were in use (2003, 2004, 2005), and when the ponds were no longer in use (2006).

As background water quality samples were not available, the impact of historical use of the evaporation ponds is unable to be determined. Oil and grease was reported as being present in a majority of groundwater samples, albeit at generally low levels. This suggests some infiltration of surface contaminants to the deep aquifer, however it is unclear if this contamination is from the disposal of wastewater at the site or from further up-hydraulic gradient.

No groundwater quality data was available for P19 and P20 (located in the lucerne paddock) therefore no conclusions could be made regarding the effect of irrigating wastewater on groundwater quality.

Table 5: Groundwater Quality Results

		Average Concentration								
Monitoring Well ID	Year	Nitrogen mg/L	Potassium mg/L	Sodium mg/L	pH	EC uS/cm	Bicarbonate mg/L	Calcium mg/L	Magnesium mg/L	Chloride mg/L
P1b	2003	10.6	2.85	106.5	7.2	1253	359	98	38	179
	2004	9.75	2.85	401	7.1	1325	373	106	36.7	210
	2005	7.2	2.8	128	7.3	1328	376	96	40.3	215
	2006	9	3.03	121	7.4	1358	379	104	42.5	195
P4b	2004					DRY				
	2005	18	4.2	220	8.1	1170	543	15	16.8	27.5
	2006	16	4.4	231	8.2	1200	524	23.6	22.1	28.6
P5b	2003	22.4	1.23	63	7.4	941	327	74.2	37.9	57.4
	2004	29	1.7	76.4	7.4	963	340	73.6	37.9	60
	2005	28	1.7	80.9	7.3	1029	341	70.3	39.3	65.1
	2006	31	1.45	73.7	7.5	964	291	71.2	38.7	56.7
P6b	2003	1	4.1	90.4	7.5	1263	333	75.9	47.5	217
	2004	<2	4.9	114	7.5	1280	348	81.6	50.9	218
	2005	4	5.1	106	7.4	1298	353	75.9	52.3	234
	2006	7	5.1	114.6	7.6	1355	352	84.1	55.8	234
P9b	2003	2.3	7.2	287	7.4	2556	860	117	119	447
	2004	5	9.9	327	7.6	2430	2900	33.8	108	476
	2005					DRY				
	2006					DRY				
P13	2003	6.8	4	123.2	7.3	896	194	24	14	102
	2004	4.7	5.85	127	7.2	689	164	16.2	9.8	89.8
	2005	8	4	116	7.1	688	151	13.7	9	89
	2006	5	4.3	131	7.1	730	218	16.1	10.3	79.1

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4.0 Potential Impacts of Development on Groundwater Regime

4.1 Infiltration of Effluent

As discussed above, groundwater level monitoring results and trends within the two aquifers present at the site indicate there is little connectivity between aquifers, with differences in water levels from paired wells of up to 7 metres and annual trends differing between the two aquifers in some locations.

Aitken Rowe Testing Laboratories completed a geotechnical evaluation of the development site in December 2007. The evaluation determined that the permeability of clays (compacted to 95% standard maximum dry density) underlying the site were in the order of $1.0x10^{-9}$ m/sec. The report also stated, "*Based on the test results, visual inspection of the material and subsurface profile as discussed above, the underlying clays are considered impermeable*".

Some infiltration of effluent may occur in the vicinity of the irrigation area, although this should be minimised by the underlying clay soils.

4.2 Changes in Groundwater Level and Flow Direction

The use of the evaporation pond is unlikely to result in changes of water levels or quality because of the reconstructed clay liner. Irrigation of the adjacent paddock may result in some localised mounding of the groundwater table based on data from the monitoring wells in the lucerne paddock.

Review of the available historical groundwater level data indicates that the previous use of the ponds caused little variation in deep groundwater flow direction. An assessment of the impact to shallow groundwater was unable to be undertaken due to limited historical data.

Historical data suggest that impacts to groundwater levels as a result of use of the evaporation pond and irrigation of the adjacent paddock will be localised and have no significant effect on the surrounding environment.

4.3 Changes in Water Quality

The quality of effluent to be discharged to the evaporation pond and irrigated on the adjacent paddock is detailed in the following table, from HLA ENSR (2008):

Table 6: Effluent Quality

	SOURCE							
Parameter	**Vegetable Oil Refining Unit**	**Glycerin Refining Unit**	**Solvent Extraction Unit**	**Water Treatment Plant**	**Boiler**	**Cooling Towers**	**Cooling Water**	**TOTAL**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Volume (kL)	26	40	24	0.5	1.2	58	20	170
pH	8-10		8.0					7-9
Oil and Grease	200	negligible	negligible	negligible	negligible	negligible	negligible	30
Total Dissolved Solids	2000 – 3000	negligible	negligible	20,000	2,000	1,200	1,200	930 – 1,080

	SOURCE							
Parameter	**Vegetable Oil Refining Unit mg/L**	**Glycerin Refining Unit mg/L**	**Solvent Extraction Unit mg/L**	**Water Treatment Plant mg/L**	**Boiler mg/L**	**Cooling Towers mg/L**	**Cooling Water mg/L**	**TOTAL mg/L**
Total Nitrogren	negligible	negligible	negligible	negligible	negligible	negligible	negligible	negligible
Sulfate	N/A	N/A	N/A	negligible	negligible	negligible	negligible	negligible
Total Phosphorus	146	negligible	negligible	negligible	negligible	negligible	negligible	22
Sodium	325	25	25	2,000	125	125	125	120
Potassium	2	2	2	160	10	10	10	6
Magnesium	13	13	13	1200	65	65	65	41
Calcium	16	16	16	1280	80	80	80	50
Biochemical Oxygen Demand (BOD)	100	negligible	negligible	negligible	negligible	negligible	negligible	15
Chloride	30	30	30	2,400	150	150	150	95

The above concentrations are generally below historical groundwater concentrations. HLA ENSR concluded that the proposed 10 hectare irrigation area was adequate to absorb loading of the following:

- BOD
- Nitrogen
- Phosphorus
- Calcium
- Magnesium
- Potassium

Monitoring the sodium content in the effluent, and soils on which the effluent will be irrigated, will be important to ensure irrigation does not result in soil degradation by increasing soil salinity, which may subsequently increase groundwater salinity. The Irrigation Assessment (HLA ENSR, 2008) details methods that will be undertaken to manage salt concentrations in soil.

Regular monitoring of groundwater quality is recommended so that adverse impacts to groundwater quality can be identified and managed accordingly.

4.4 Impacts to Neighboring Properties

Bores used for irrigation and stock watering are located more than two kilometers from the site and are therefore unlikely to be affected by changes in groundwater levels or water quality. Historical data have indicated that changes to deep aquifer water levels in the vicinity of the evaporation ponds were not found to affect the surrounding area.

Monitoring of groundwater quality and standing water levels would identify any potential for off-site impacts

4.5 Aquifer Connectivity

Groundwater level monitoring and quality result trends indicate there is minimal connectivity between the shallow perched aquifer and the deeper regional aquifer. This is further supported by observations and testing conducted as part of the geotechnical assessment (Aitken Rowe 2007).

Data indicate that in 2006 there was approximately four metres difference in water levels between the shallow and deep aquifers in the vicinity of the evaporation ponds (monitoring wells 1A and 1B) and up to seven metres difference in water levels in the irrigation paddock (monitoring wells 19A/B and 20 A/B). In addition, annual trends between the shallow and deep aquifers appear to differ in a wells.

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5.0 Management of Impacts

5.1 Changes in Groundwater Levels and Flow Direction

Prior to use of the evaporation pond, a complete refurbishment will be undertaken and the pond will be lined in accordance with appropriate industry standards including at least 900 mm of compacted clay with an in-situ permeability of less than 10^{-9} m/s. This lining will minimise infiltration of effluent into the underlying shallow perched aquifer.

Should significant increases in groundwater levels be recorded or unanticipated changes to groundwater quality be reported during routine monitoring, the lining of the pond should be inspected and the quantity of water being irrigated should be assessed. The extent of the groundwater mounding or changes in flow direction may be further investigated through monitoring of additional monitoring wells. If the impact is localised and not found to be affecting adjacent landholders, no mitigation measures should be necessary. It is unlikely that the impact would be widespread.

5.2 Changes in Water Quality

The refurbishment of the evaporation pond will minimise infiltration of effluent into the underlying shallow perched aquifer and should therefore also minimise the impact to groundwater quality. However, some infiltration of effluent to the underlying shallow perched aquifer is expected in the irrigation area.

The Irrigation Assessment (HLA ENSR 2008) details methods by which the irrigation of effluent will be managed and describs methods to ensure sustainability of the operation.

Routine groundwater monitoring will be undertaken so that adverse impacts to groundwater quality can be identified and managed accordingly.

5.3 Installation of Additional Monitoring Wells

An extensive network of groundwater monitoring wells has been established, however many of the wells are dry and/or are not positioned to adequately monitoring the proposed development.

The installation of additional/replacement monitoring wells is recommended prior to operation of the proposed development for the purpose of assessing potential groundwater impacts associated with the development. Recommended additional wells include:

- One shallow and one deep monitoring well located up-hydraulic gradient of the evaporation pond;
- Two shallow and two deep monitoring wells located on the eastern side of the evaporation pond (down-hydraulic gradient);
- One shallow and one deep monitoring well located east (up-hydraulic gradient) of the area to be irrigated and the site; and
- One shallow and one deep monitoring well located west (down-hydraulic gradient) of the area to be irrigated.

The monitoring well located east of the area to be irrigated will also provide background water quality data for groundwater entering the site.

Further details regarding the construction of the additional monitoring wells will be detailed in the Groundwater Monitoring Plan, discussed below.

5.4 Groundwater Monitoring Plan

Groundwater monitoring is required to provide ongoing assessment of the impacts associated with the evaporation and irrigation of effluent and to also enable detection of adverse impacts on the groundwater regime, so that remedial action can be undertaken, where required.

A Groundwater Monitoring Plan (GMP) will be developed and implemented prior to the operation of the proposed development. The GMP will include:

- Recommendations for the installation of additional monitoring wells including construction details;
- Development of a groundwater monitoring schedule including sampling methodology and timetable; and
- Preparation of a consolidated Groundwater Management Plan to be implemented during operation of the proposed development.

It is recommended that groundwater quality monitoring and the collection of groundwater standing water levels be undertaken prior to operation of the proposed development. This information will provide background data to which future monitoring data can be compared. Following the commencement of operations, quarterly groundwater monitoring in conjunction with irrigation and effluent monitoring is recommended.

Tables

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Table T1: Average Annual Groundwater Standing Water Levels

Bore No.	Well Depth (m from ground surface)	Standpipe Height (m)	AHD (m at ground surface)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1a	**1.80**	**0.49**	**227.85**	DRY	227.00	226.35	226.33	226.19	226.11	225.53	DRY	226.10	224.88	DRY
1b	**11.00**	**0.44**	**227.85**	222.65	222.95	221.98	222.26	221.72	221.23	220.95	220.64	221.03	219.93	219.20
2a	**1.80**	**0.52**	**228.17**	DRY	227.42	226.54	226.55	226.44	226.33	DRY	DRY	DRY	DRY	DRY
2b	**6.90**	**0.43**	**228.17**	DRY	DRY	221.25	222.10	DRY	DRY	DRY	DRY	221.41	DRY	DRY
3a	**1.85**	**0.30**	**228.16**	DRY	DRY	226.10	226.23	DRY	DRY	DRY	DRY	226.24	DRY	DRY
3b	**4.90**	**0.37**	**228.16**	DRY	DRY	DRY	224.16	223.51	DRY	DRY	DRY	223.96	DRY	DRY
4a	**1.70**	**0.31**	**228.52**	DRY	DRY	DRY	219.18	DRY	DRY	DRY	DRY	DRY	DRY	DRY
4b	**11.05**	**0.33**	**228.52**	222.12	221.72	219.41	218.27	217.80	217.27	DRY	DRY	219.42	217.54	214.06
5a	**1.80**	**0.11**	**222.27**	221.15	221.05	220.51	220.84	220.74	220.23	DRY	DRY	220.22	DRY	DRY
5b	**4.40**	**0.31**	**222.27**	221.28	222.08	220.68	220.85	220.81	220.20	219.61	218.94	218.91	217.70	219.63
6a	**1.80**	**0.42**	**222.58**	222.43	221.93	221.05	220.91	220.98	220.81	DRY	DRY	220.68	DRY	DRY
6b	**5.40**	**0.42**	**222.58**	221.33	221.03	220.50	220.66	220.63	219.93	219.28	218.67	218.49	217.13	215.93
7a	**1.80**	**0.41**	**222.47**	221.97	221.67	220.82	220.75	220.61	DRY	DRY	DRY	220.60	DRY	DRY
7b	**4.90**	**0.39**	**222.47**	DRY	DRY	DRY	DRY	217.94	DRY	DRY	DRY	DRY	DRY	DRY
8a	**1.80**	**0.36**	**218.03**	DRY	DRY	216.22	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
8b	**5.50**	**0.33**	**218.03**	217.33	215.73	212.47	213.59	DRY	DRY	DRY	215.92	DRY	DRY	DRY
9a	**1.80**	**0.38**	**218.31**	217.41	217.31	216.73	216.48	216.38	216.37	DRY	DRY	216.15	DRY	DRY
9b	**3.80**	**0.41**	**218.31**	217.41	217.21	216.67	216.65	216.43	215.99	215.62	214.94	214.77	213.52	213.09
10a	**1.80**	**0.44**	**218.28**	DRY	DRY	216.52	216.58	DRY	DRY	DRY	DRY	216.52	DRY	DRY
10b	**8.35**	**0.47**	**218.28**	214.08	213.68	212.31	211.58	211.76	210.66	210.87	DRY	210.73	DRY	DRY
11a	**1.70**	**0.21**	**228.79**	DRY	DRY	DRY	226.71	DRY	DRY	DRY	DRY	DRY	DRY	DRY
11b	**11.05**	**0.32**	**228.79**	DRY	DRY	DRY	DRY	DRY	DRY	DRY	217.25	DRY	DRY	DRY
12a	**1.90**	**0.61**	**222.67**	221.87	222.07	221.09	221.07	221.19	220.76	DRY	DRY	DRY	DRY	DRY
12b	**12.95**	**0.73**	**222.67**	211.57	212.27	210.99	211.73	212.56	213.09	212.84	210.48	209.37	DRY	DRY
13	**4.40**	**0.58**	**223.81**	223.41	223.21	222.61	222.78	222.49	222.48	220.66	222.18	222.33	219.92	215.59
14a	**6.45**	**0.44**	**226.84**	DRY	DRY	DRY	220.68	DRY	DRY	DRY	DRY	221.26	219.85	DRY
14b	**10.50**	**0.53**	**226.84**	DRY	DRY	216.70	221.69	DRY	DRY	DRY	DRY	DRY	DRY	DRY

Bore No.	Well Depth (m from ground surface)	Standpipe Height (m)	AHD (m at ground surface)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
15a	**10.60**	**0.50**	**228.15**	DRY	DRY	217.93	DRY	DRY	DRY	DRY	DRY	DRY	216.95	DRY
15b	**6.30**	**0.51**	**228.15**	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
16a	**6.60**	**0.42**	**235.33**	DRY	DRY	DRY	230.52	229.23	DRY	DRY	DRY	229.80	DRY	DRY
16b	**10.70**	**0.44**	**235.33**	DRY	DRY	224.87	225.03	DRY	DRY	DRY	225.13	DRY	DRY	DRY
17a	**2.30**	**0.49**	**234.01**	DRY	233.36	DRY	232.07	DRY	DRY	DRY	DRY	232.16	DRY	DRY
17b	**7.50**	**0.51**	**234.01**	DRY	231.83	227.06	DRY	DRY	DRY	228.20	DRY	226.98	225.79	DRY
18a	**2.10**	**0.55**	**239.04**	DRY	DRY	DRY	237.91	DRY	DRY	DRY	DRY	DRY	DRY	DRY
18b	**7.60**	**0.81**	**239.04**	DRY	DRY	DRY	235.18	DRY	DRY	DRY	DRY	DRY	DRY	DRY
19a	**2.75**	**0.52**	**224.46**	Monitoring wells 19a, 19b, 20a and 20b were established in 2003. No water level data was available for these wells prior to 2005.								221.90	220.81	220.80
19b	**7.88**	**0.5**	**224.53**									217.00	215.79	215.46
20a	**2.8**	**0.55**	**225.08**									222.50	221.37	221.40
20b	**10.55**	**0.5**	**225.13**									215.06	213.75	214.56

Figures

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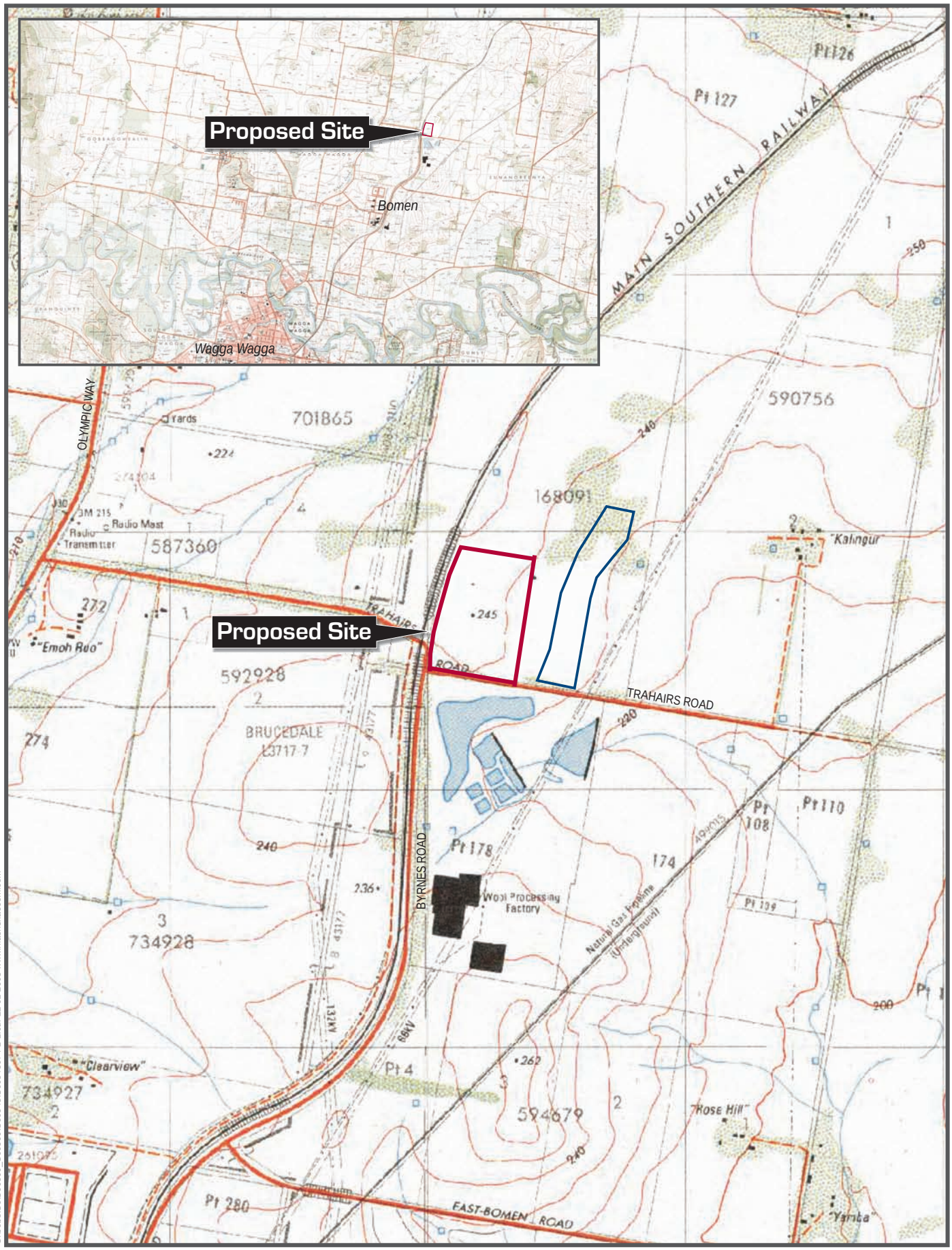

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ENSR | AECOM

Approximate IOPBP footprint
Proposed evaporation pond

Figure 1 | **Regional Context**

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Groundwater Review

Integrated Oilseed Processing and Biodiesel Plant

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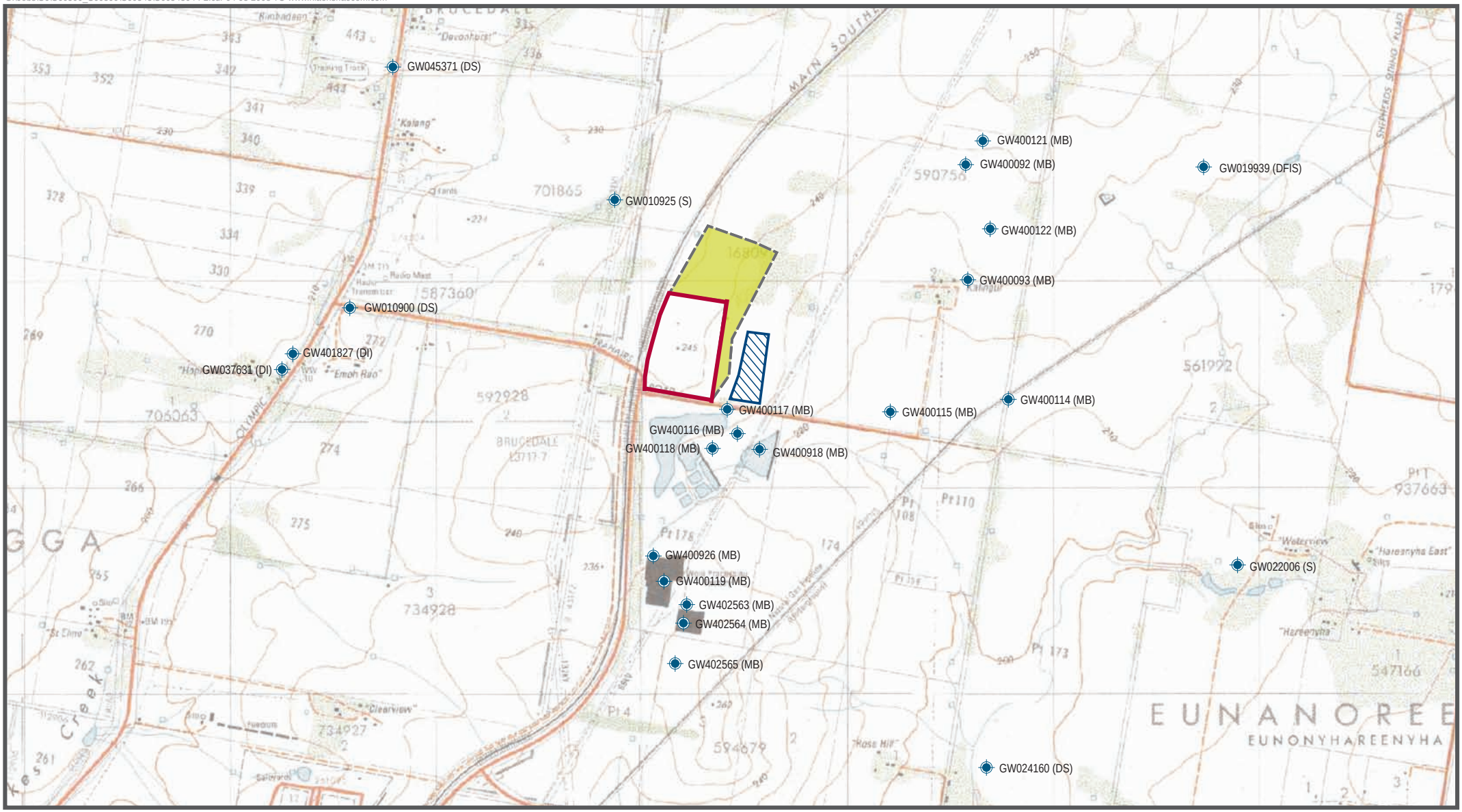

ENSR | AECOM

0 500m

- Approximate IOPBP footprint
- Proposed 27ML storage pond
- Proposed irrigation area
- Groundwater bore location (Dept of Natural Resources)

DS	Domestic Stock
S	Stock
MB	Monitoring Bore
DFIS	Domestic Farming Irrigation Stock
DI	Domestic Irrigation

Figure 2 | **Licensed Groundwater Bore Locations**

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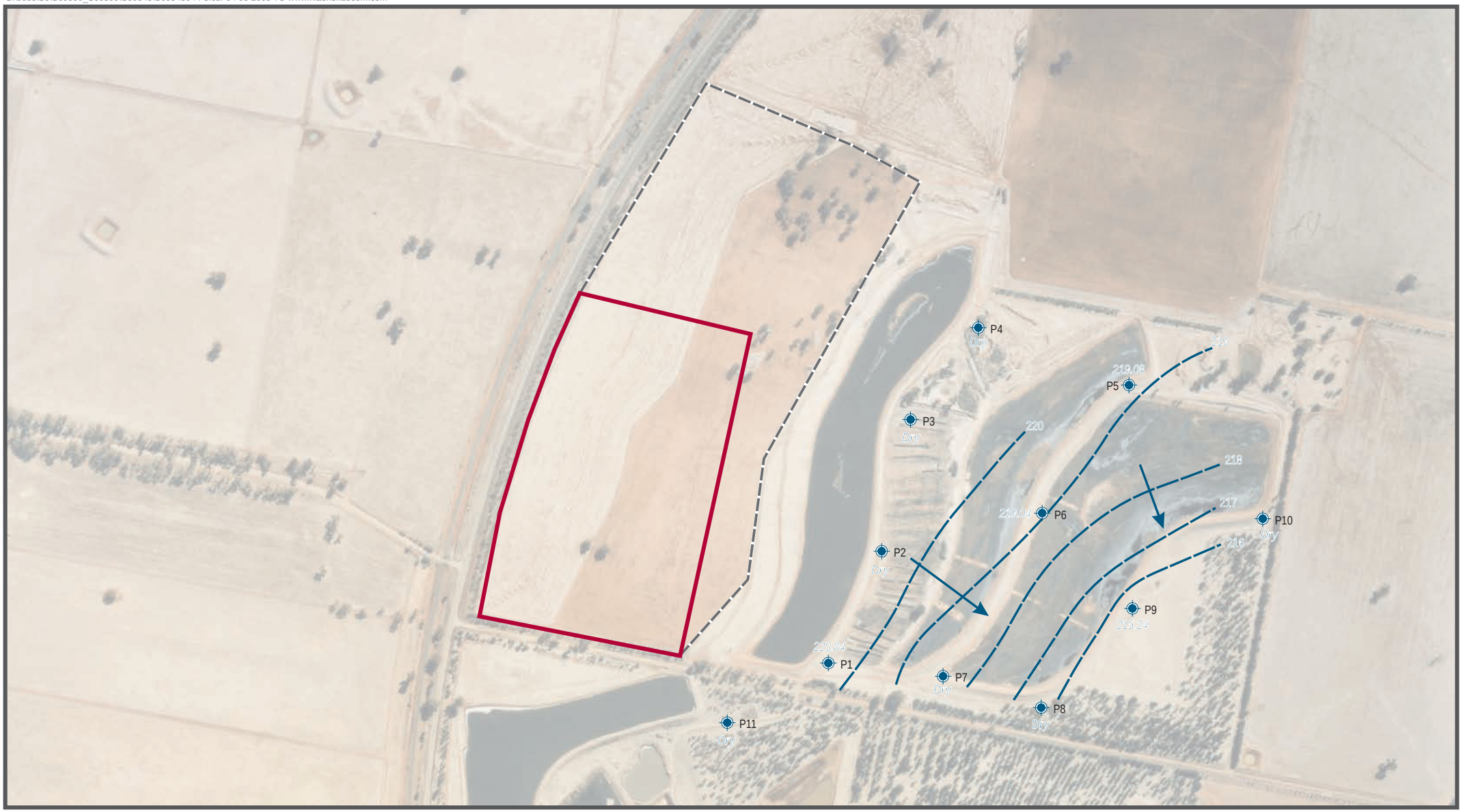

ENSR | AECOM

0 200m

Approximate project footprint
Property boundary
Inferred groundwater contour (mAHD)
Inferred groundwater flow direction
215.24 Standing water level

Note: P12 - P20b are located outside the study area

Figure 3 | **Goundwater Standing Water Levels: Deep Aquifer Summer 07/01/2004**

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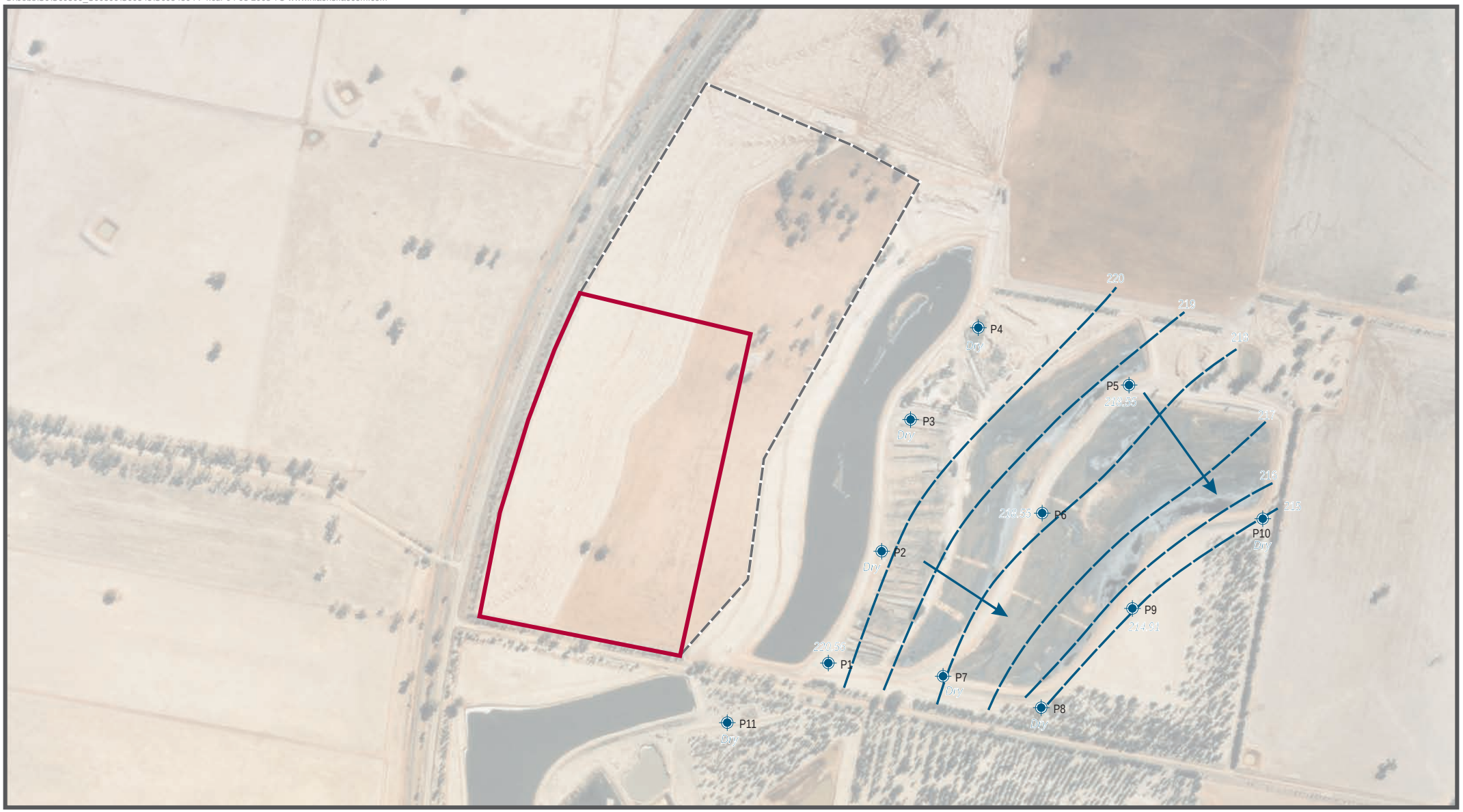

ENSR | AECOM

0 200m

Approximate project footprint
Property boundary
Inferred groundwater contour (mAHD)
Inferred groundwater flow direction
215.24 Standing water level

Note: P12 - P20b are located outside the study area

Figure 4 | **Goundwater Standing Water Levels: Deep Aquifer Winter 07/07/2004**

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Groundwater Review

Integrated Oilseed Processing and Biodiesel Plant

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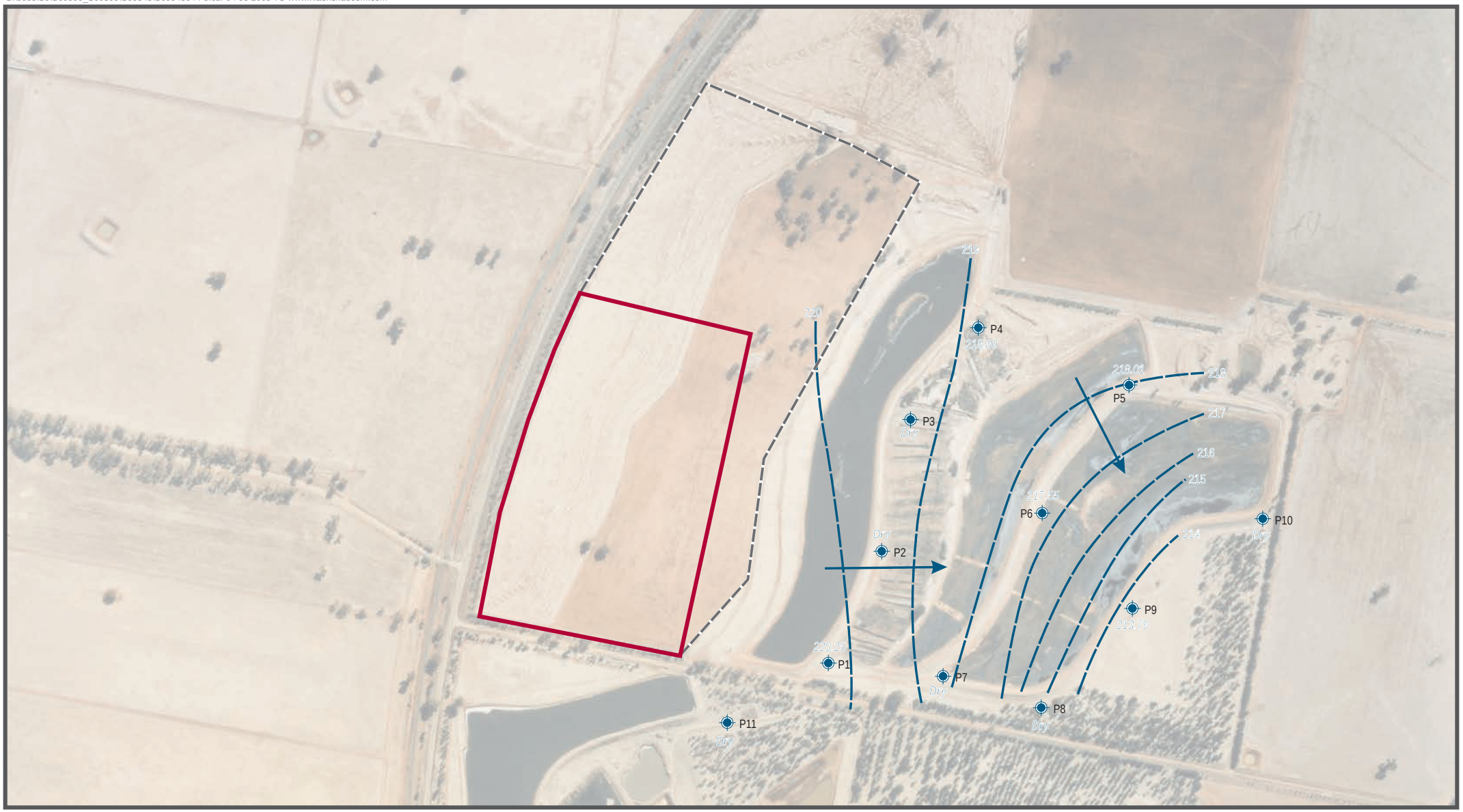

ENSR | AECOM

0 200m

Approximate project footprint
Property boundary
Inferred groundwater contour (mAHD)
Inferred groundwater flow direction
215.24 Standing water level

Note: P12 - P20b are located outside the study area

Figure 5 | **Goundwater Standing Water Levels: Deep Aquifer Summer 05/01/2006**

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Environmental Assessment

Integrated Oilseed Processing and Biodiesel Plant

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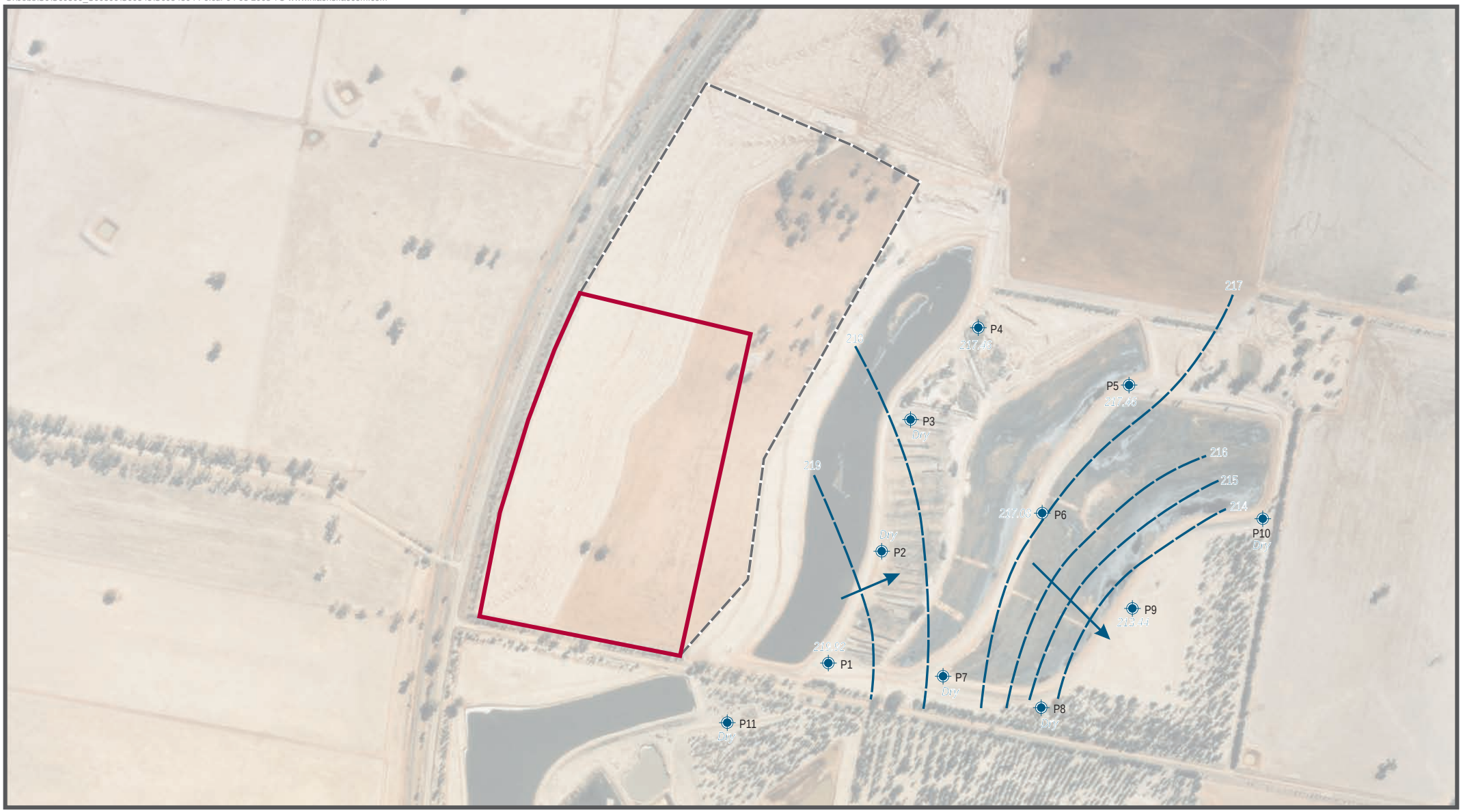

ENSR | AECOM

0 200m

Approximate project footprint
Property boundary
Inferred groundwater contour (mAHD)
Inferred groundwater flow direction
215.24 Standing water level

Note: P12 - P20b are located outside the study area

Figure 6 | **Goundwater Standing Water Levels: Deep Aquifer Winter 12/07/2006**

Riverina Oils and Bio Energy Pty Ltd

Groundwater Review

Integrated Oilseed Processing and Biodiesel Plant

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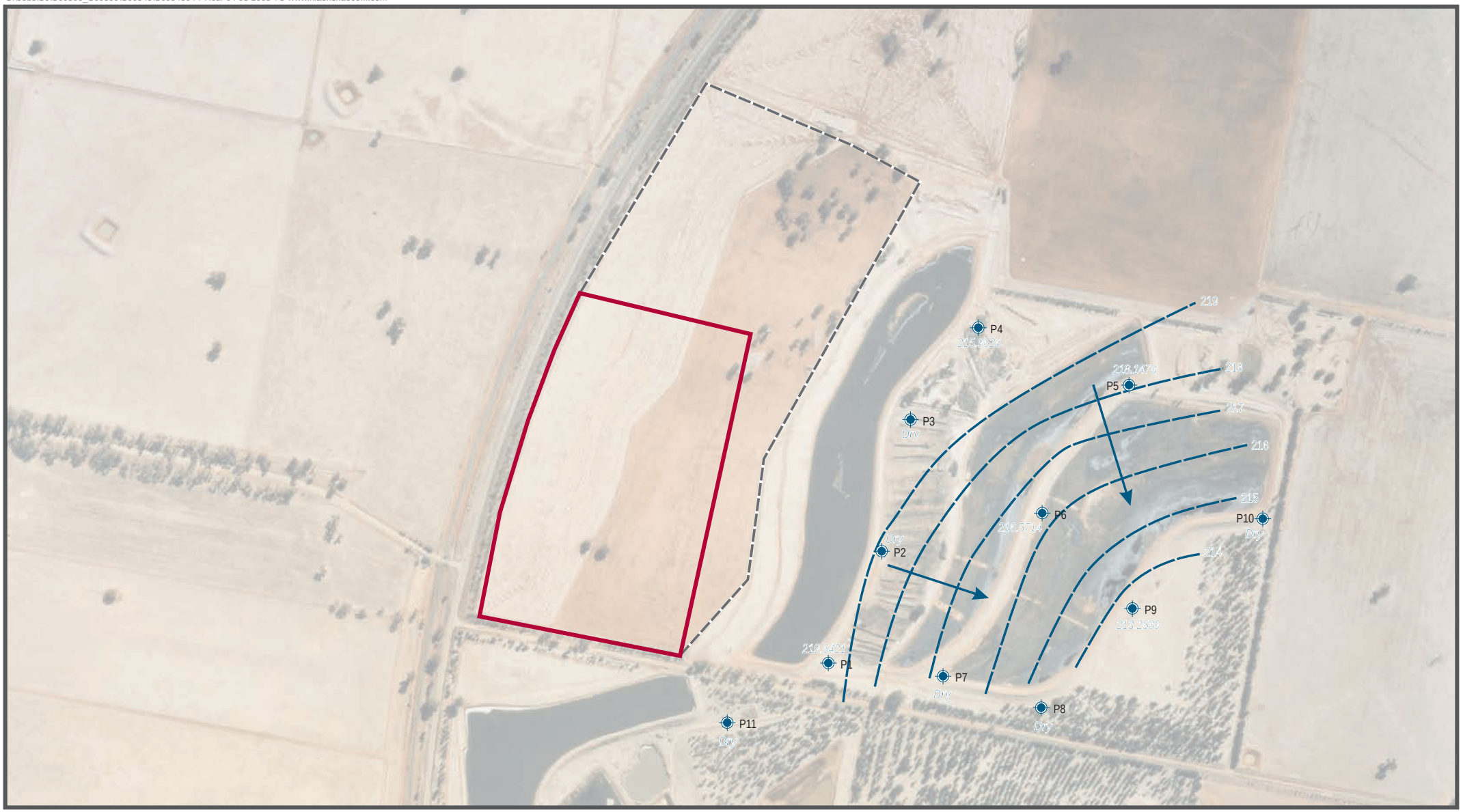

ENSR | AECOM

0 200m

Approximate project footprint
Property boundary
Inferred groundwater contour (mAHD)
Inferred groundwater flow direction
215.24 Standing water level

Note: P12 - P20b are located outside the study area

Figure 7 | **Goundwater Standing Water Levels: Deep Aquifer Summer 01/01/2007**

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Groundwater Review

Integrated Oilseed Processing and Biodiesel Plant

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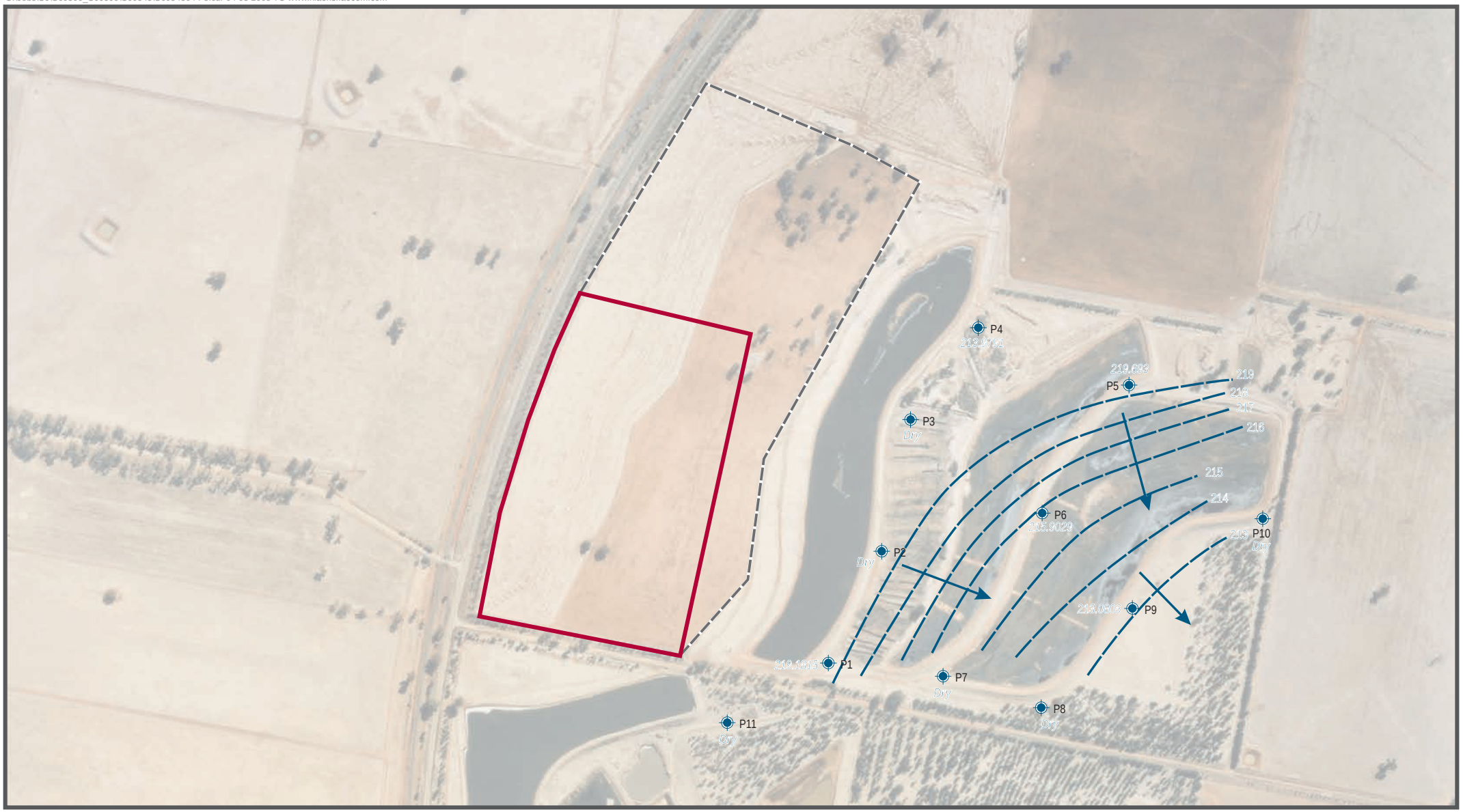

ENSR | AECOM

0 200m

Approximate project footprint
Property boundary
Inferred groundwater contour (mAHD)
Inferred groundwater flow direction
215.24 Standing water level

Note: P12 - P20b are located outside the study area

Figure 8 | **Goundwater Standing Water Levels: Deep Aquifer Winter 03/07/2007**

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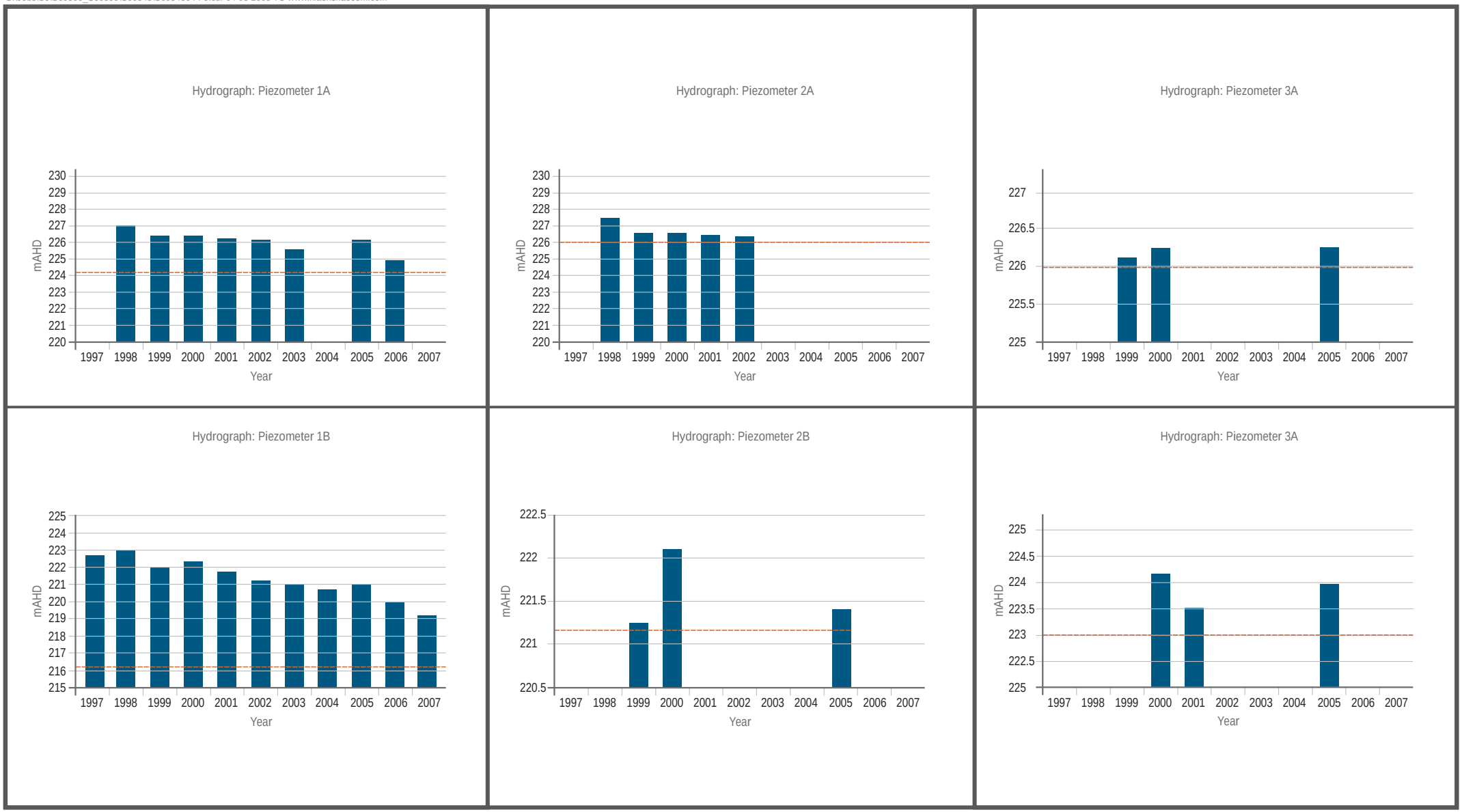
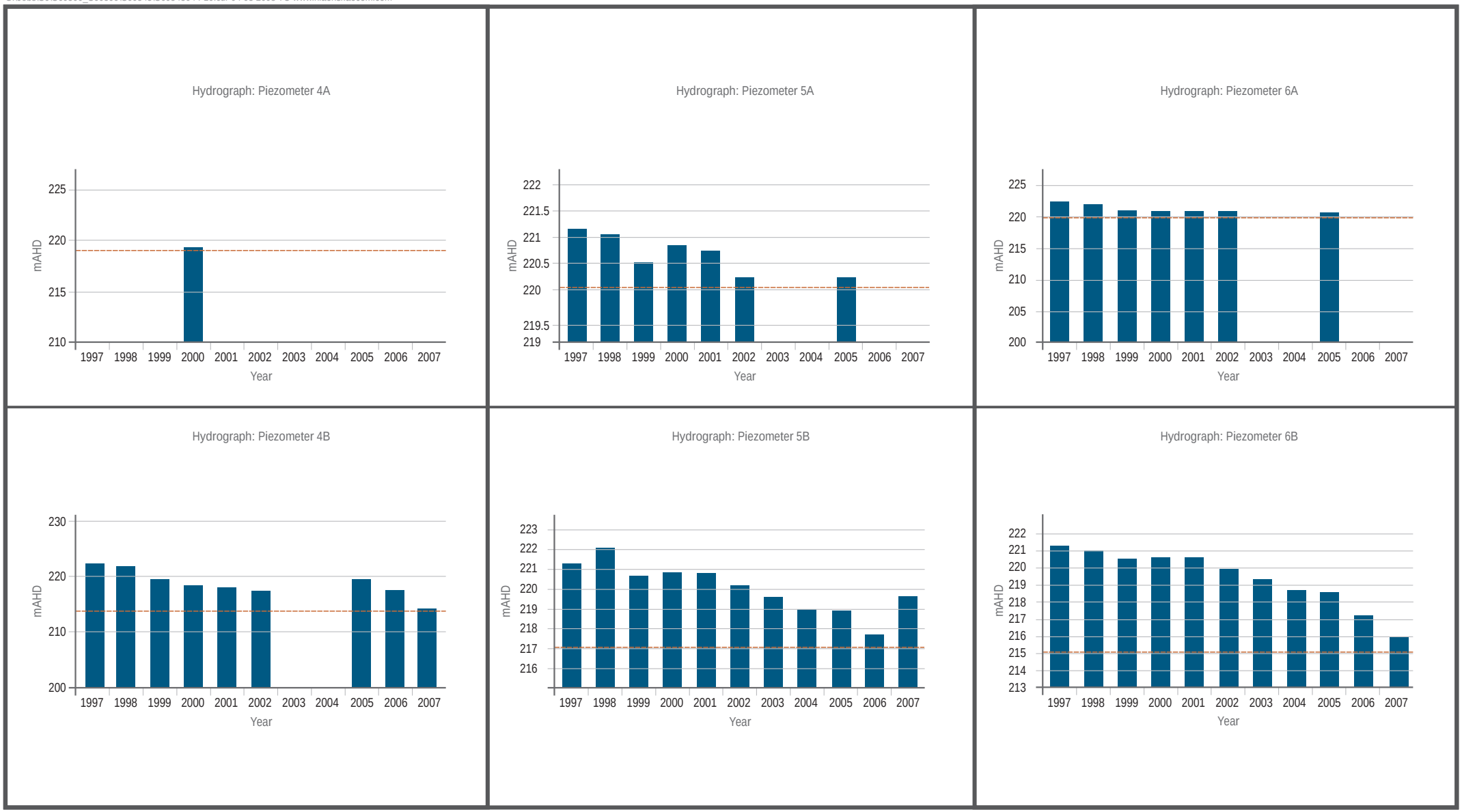
Groundwater Review

Integrated Oilseed Processing and Biodiesel Plant



ENSR | AECOM

Figure 9 | **Piezometer Hydrographs 1A - 3B**
Riverina Oils and Bio Energy Pty Ltd
Groundwater Review
Integrated Oilseed Processing and Biodiesel Plant



ENSR | AECOM

Figure 10 | **Piezometer Hydrographs 4A - 6B**

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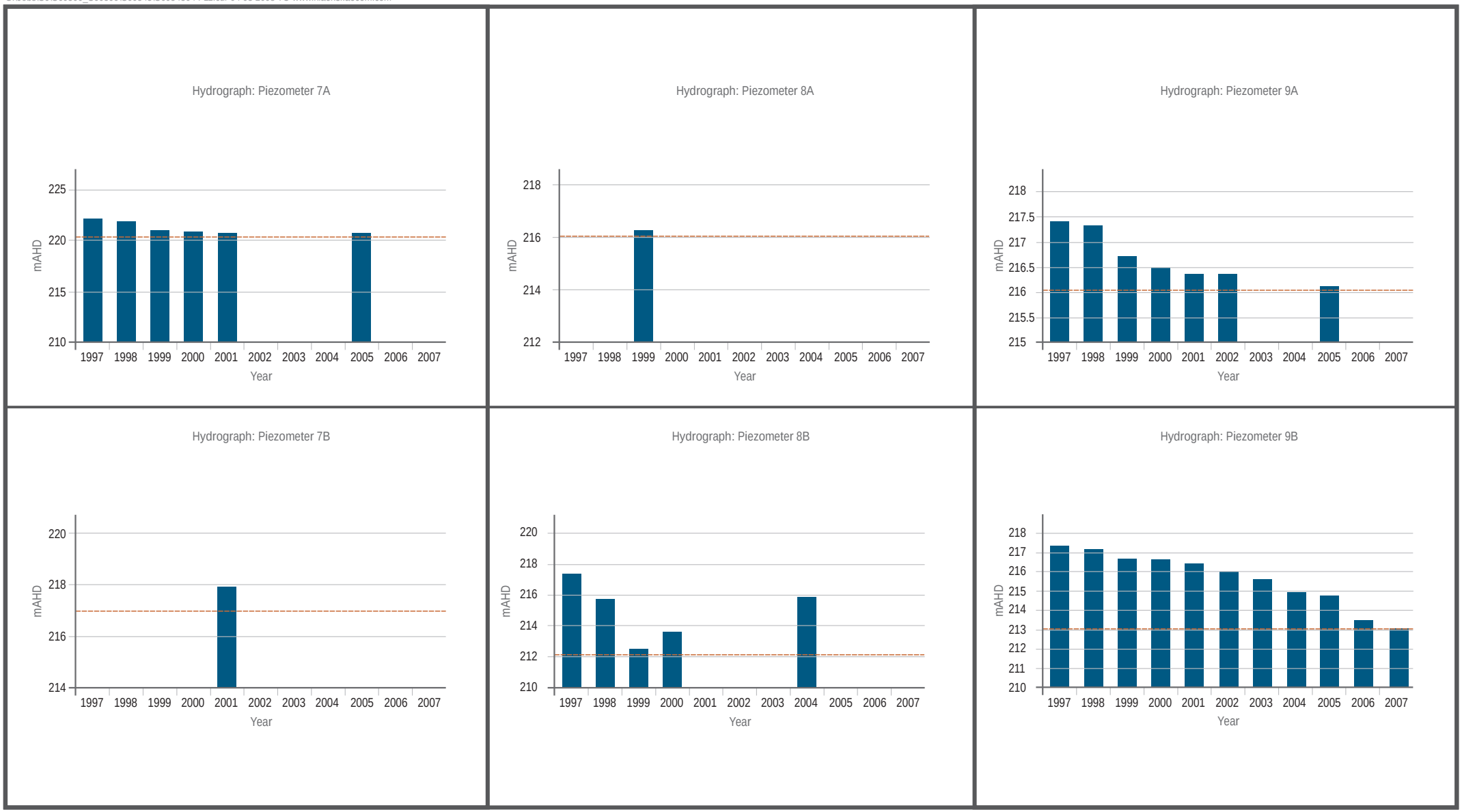
Integrated Oilseed Processing and Biodiesel Plant



ENSR | AECOM

Figure 11 | **Piezometer Hydrographs 7A - 9B**

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Groundwater Review

Integrated Oilseed Processing and Biodiesel Plant

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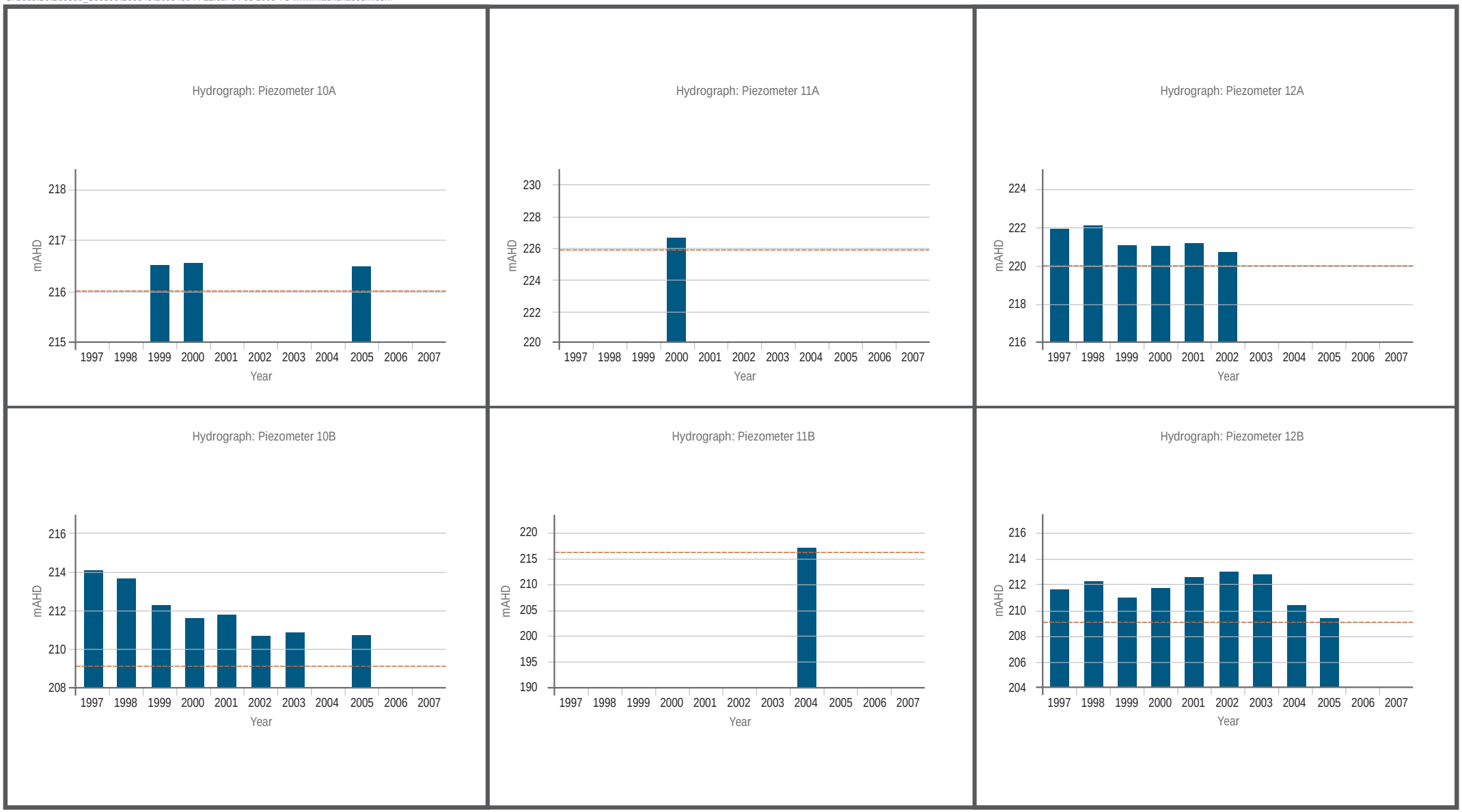

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Figure 12 | **Piezometer Hydrographs 10A - 12B**

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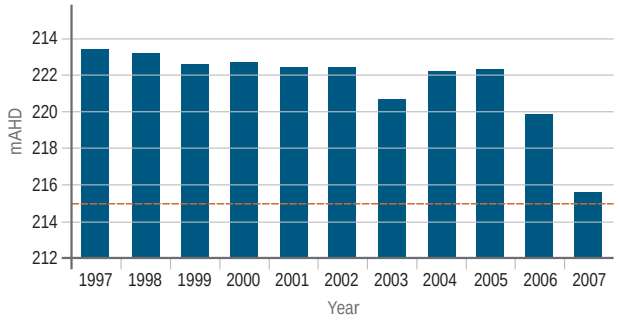
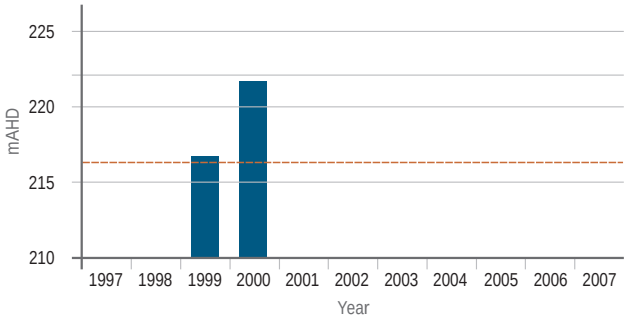
Integrated Oilseed Processing and Biodiesel Plant

Hydrograph: Piezometer 13



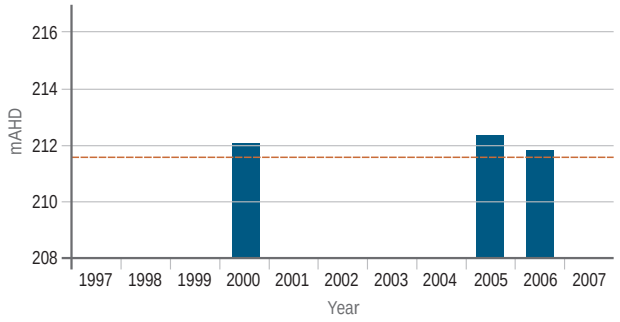
Hydrograph: Piezometer 14B



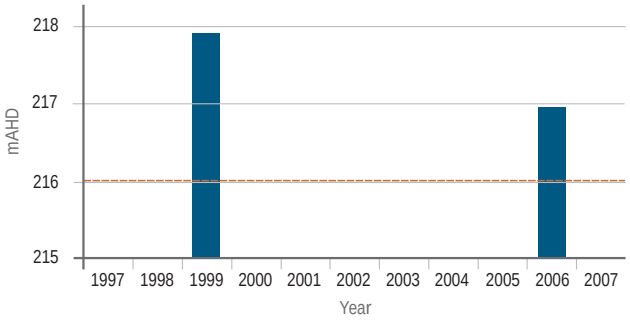
Hydrograph: Piezometer 15B

Monitoring Well 15B Was Dry During The Period 1997 - 2007

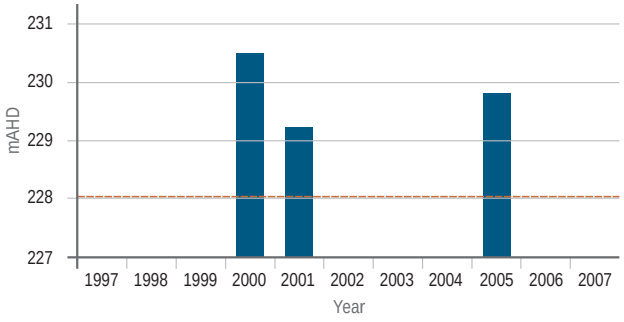
Hydrograph: Piezometer 14A



Hydrograph: Piezometer 15A



Hydrograph: Piezometer 16A



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Maximum well depth

Figure 13 | **Piezometer Hydrographs 13 - 16A**
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Groundwater Review
Integrated Oilseed Processing and Biodiesel Plant

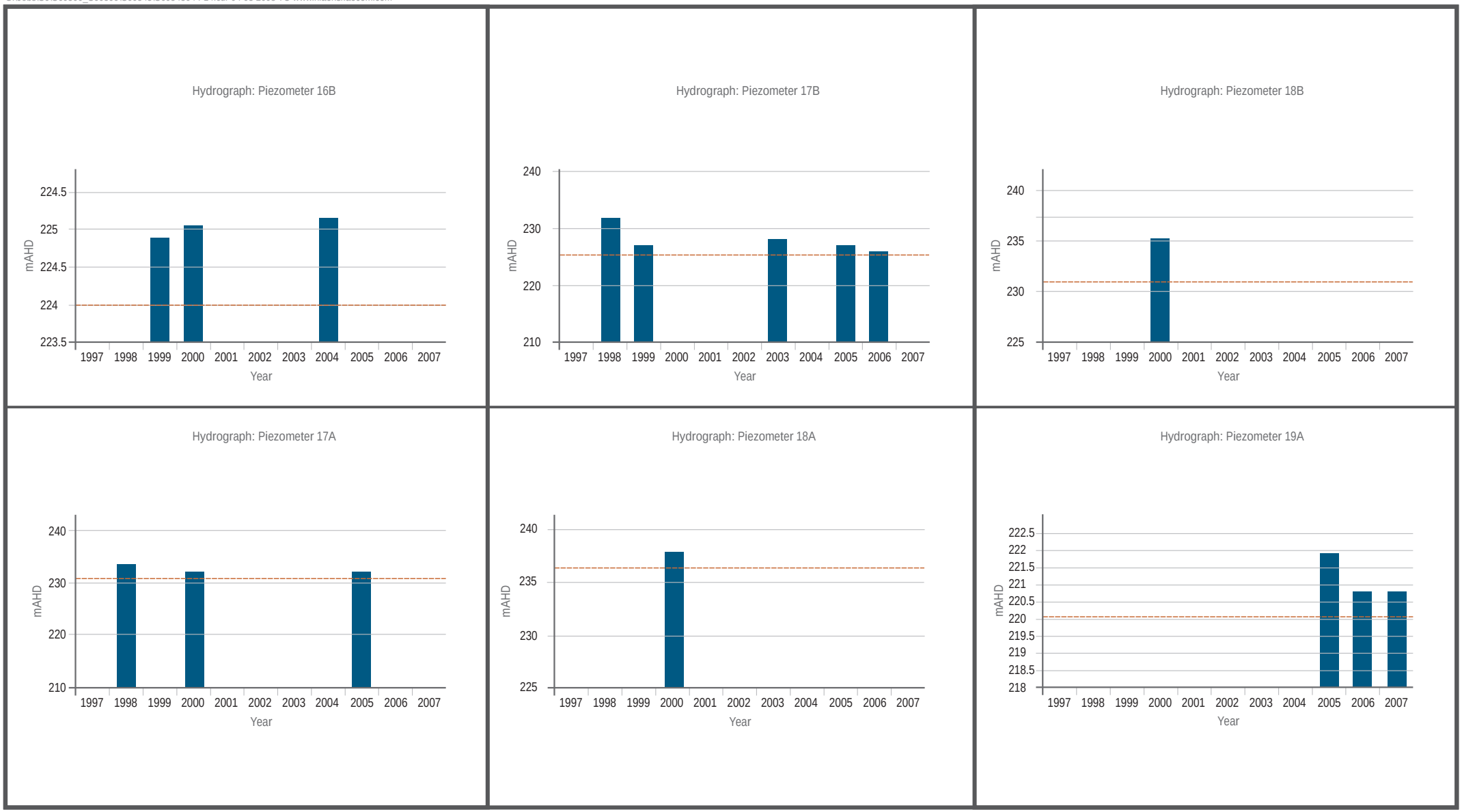

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Figure 14 | **Piezometer Hydrographs 16B - 19A**

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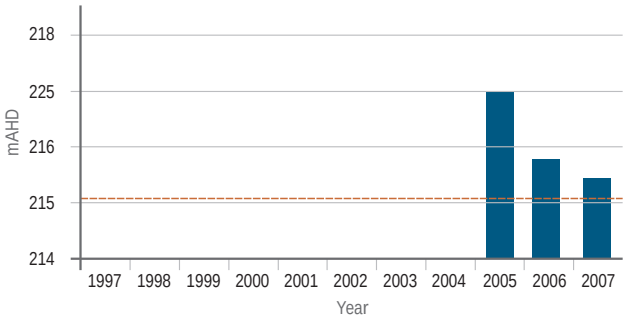
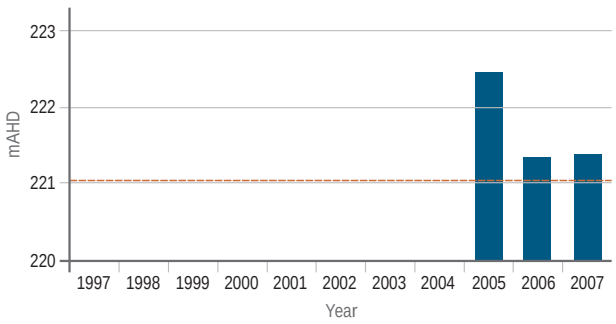
Groundwater Review

Integrated Oilseed Processing and Biodiesel Plant

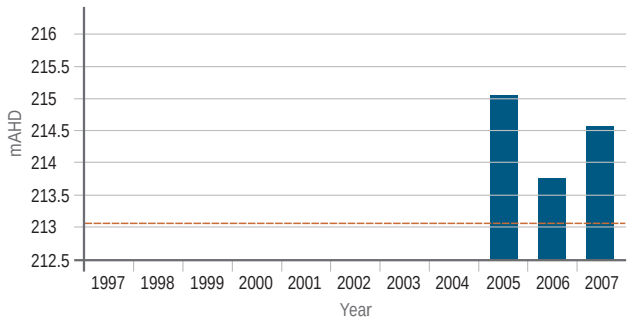
Hydrograph: Piezometer 19B



Hydrograph: Piezometer 20A



Hydrograph: Piezometer 20B



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Maximum well depth

Figure 15 | **Piezometer Hydrographs 19B - 20B**

Riverina Oils and Bio Energy Pty Ltd

Groundwater Review

Integrated Oilseed Processing and Biodiesel Plant

Worldwide Locations

Australia	+61-2-8484-8999
Azerbaijan	+994 12 4975881
Belgium	+32-3-540-95-86
Bolivia	+591-3-354-8564
Brazil	+55-21-3526-8160
China	+86-20-8130-3737
England	+44 1928-726006
France	+33(0)1 48 42 59 53
Germany	+49-631-341-13-62
Ireland	+353 1631 9356
Italy	+39-02-3180 77 1
Japan	+813-3541 5926
Malaysia	+603-7725-0380
Netherlands	+31 10 2120 744
Philippines	+632 910 6226
Scotland	+44 (0) 1224-624624
Singapore	+65 6295 5752
Thailand	+662 642 6161
Turkey	+90-312-428-3667
United States	+1 978-589-3200
Venezuela	+58-212-762-63 39

Australian Locations

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Canberra
Darwin
Mackay
Melbourne
Newcastle
Sydney
Singleton

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Singleton
Sydney

appendix F

GEOTECHNICAL REPORT

AITKEN ROWE TESTING LABORATORIES PTY LTD

14 December 2007 Reg. No.: S07-365

Riverina Oils & Bio-Energy Pty Ltd Australia
C/- Mr. Robert Kennedy
Industrial Contract Designers (Asia Pacific) Pty Ltd
P O Box 56
Parramatta NSW 2124

Dear Sir,

GEOTECHNICAL REPORT FOR PROPOSED INTEGRATED BIO-DIESEL PLANT, BOMEN, WAGGA WAGGA, NSW

We have completed the above report and forwarded to you for your perusal and use.

Should you have any queries, please contact us.

Yours truly,

TIN MAUNG
Senior Geotechnical Engineer

For: Aitken Rowe Testing Laboratories Pty Ltd

AITKEN ROWE TESTING LABORATORIES PTY LTD

PROPOSED INTEGRATED BIO-DIESEL PLANT

RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA

299 TRAHAIRS ROAD, BOMEN
WAGGA WAGGA
NEW SOUTH WALES

S07-365
DECEMBER 2007

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out at the location of Proposed Integrated Bio-Diesel Plant at No. 299 Trahairs Road, on the corner of Byrne Road in Bomen, Wagga Wagga, NSW. The investigation was commissioned by G. D. Daga, Representative of Riverina Oils & Bio-Energy Pty Ltd Australia with an advance payment on 15 November 2007 in response to our quotation, Q07-184, dated 9 November 2007.

It is noted that the proposed development includes construction of various plant buildings, silos and various tanks and its associated road works across the proposed site.

The purpose of the investigation was to determine the nature of the subsurface soils and groundwater conditions by augering, testing and sampling of 27 boreholes at the specified location of the development. Based upon the information obtained, comments and recommendations on geotechnical aspects for the proposed development are to be made as per client's geotechnical brief document, 015-C-010 Rev. 2.

It should be noted that four additional boreholes were drilled at the northern paddock on 30 November 2007 to assess the permeability of the underlying material for potential wastewater disposal created from plants.

2.0 SITE DESCRIPTION

The proposed development site is a 16 hectare block and is located at 299 Trahairs Road, corner of Byne Road in Bomen Industrial Area, Wagga Wagga. The site is an agricultural land and is currently vacant. The site has slight downward slopes from the mid peak area to all sides and is generally covered with vegetation and some tress.

3.0 TOPOGRAPHY AND GEOLOGY

The general topography of the area is extensive, gently undulating. The 1:250,000 scale Metallogenic Series Sheet (SI 55-15) for Wagga Wagga indicates that the proposed site area is underlain by Wantabadgery Granite of Mid Silurian Age. The borehole investigation revealed that the site is mainly underlain by alluvium, residual clays and granite bedrock.

4.0 CLIMATE AND HYDROGEOLOGY

The Bomen area has annual average rainfall of about 550mm. The underlying soil is generally moist during winter and spring but dry in summer and early autumn. Run-off is generally low within the tableland.

The subsurface materials encountered on site are considered generally poorly to moderately drained which may cause localised water-logging problems if land is used without proper drainage measures incorporated. Water table or seepage could not be

detected during the drilling of deep boreholes as water was used for the drilling. However, no groundwater seepage was detected within 6.0m in the boreholes, which were drilled with flight augers.

The closest piezometer located about 5km southwest from the site (Southern Oil Refineries in Bomen) indicated Standing Water Level (SWL) at about 15m below existing ground level and the bores located at Sewerage Treatment Plant in Bomen, which is located about 7km southwest from the subject site indicated SWL ranging from 11.4 to 12.0m below existing ground level.

It appears from the bores records that the regional groundwater is generally within weathered fractured granite bedrock.

5.0 EROSION

The site inspection indicated no sign of erosion on the surface at the time of the investigation. The 1:100,000 sheet of Soil Landscapes of the Wagga Wagga indicated erosion hazard as "slight to moderate" for urban development. This erosion hazard is determined by climate, topography and soil erodibility. This indicates no appreciable erosion damage is likely to occur during and after the development or continuation of a particular land use under consideration. This also means that the site may require soil conservation management practices such as rapid establishment of ground cover as soon as possible.

6.0 INVESTIGATION PROCEDURE

6.1 Fieldwork

The fieldwork for the investigation consisted of the logging, sampling and testing of twenty seven boreholes at the specified locations across the proposed development as shown in attached plan and they were augered, wash bored and cored with our utility-mounted drilling rig and hired trailer mounted drill rig down to the depths ranging from 1.5 to 13.0m. All the boreholes were augured except BH8, BH11 & BH18. BH8 was initially augered and then cored to the depth of 6.9m, BH11 was initially augered and then wash bored to 13.0m and BH18 was initially augered and then cored to 11.9m. The boreholes were augmented by carrying out Standard Penetration Test (SPT) and Dynamic Cone Penetrometer (DCP) test to assess the density and consistency of the subsurface profile.

Two (2) piezometers were installed at two locations across the site to the depths ranging from 11.0 to 13.0m below existing ground level. The boreholes were located at the locations using the site features.

Four additional boreholes to the depth of 2.0m were drilled at the northern paddock to assess the permeability of the underlying material for potential wastewater disposal created from plants.

The disturbed samples were recovered from the boreholes for relevant laboratory testing. It should be noted that no "undisturbed" tube samples were recovered due to its nature of very stif to hard consistency.

The fieldwork was carried out between 19 & 30 November 2007 under the close supervision by the Senior Geotechnical Engineer of Aitken Rowe Testing Laboratories Pty Ltd (ARTL). The detailed borehole logs incorporating SPT results with explanatory note are presented in Appendix A. The descriptions in the borehole logs are provided in accordance with "AS 1726 –1993 Geotechnical site investigation". The co-ordinates and levels of the boreholes are given in Table A1 in Appendix A. It should be noted that the levels (Reduced Levels) are also incorporated in the respective borehole logs.

6.2 Laboratory Testing

The laboratory tests including moisture content, particle size distribution, shrink-swell Index, Atterberg Limit, linear shrinkage, California Bearing Ratio (CBR), pH, Electrical Conductivity (EC) and Salinity, permeability, Emerson Class, chloride and sulphate content, resistivity tests were carried out on the disturbed samples recovered from the boreholes. All tests were undertaken at our NATA accredited testing laboratory in Wagga Wagga except chloride and sulphate content, resistivity, pH and EC tests, which were undertaken at the external NATA accredited laboratory, Sydney Environmental & Soil Laboratory (SESL) in Sydney.

The laboratory test reports are given in Appendix C.

7.0 SUBSURFACE CONDITIONS

The borehole investigation revealed that the subsurface soil profile is generally consisted of a reasonably uniform sequence of topsoil material to 0.1 to 0.15m overlying alluvium and residual material comprising medium to high plasticity silty clays and sandy clays, which in turn is underlain by extremely to highly weathered, extremely weak to medium strong Granite bedrock extending to the borehole termination depth. The SPT & DCP tests carried out throughout the profile indicated the underlying clay materials generally to be very stiff to hard consistency with strength increasing to hard consistency with depth in the soil profile. The underlying Granite rock is assessed to be extremely to highly weathered with varying strength from extremely weak to medium strong.

The moisture condition of the underlying material was generally less than plastic limit and dry to the depth of 6.0m. However, the groundwater condition could not be assessed beyond 6.0m as wash boring and coring drilling methods were used for the drilling beyond this depth. It should be noted that variations to the water table level could fluctuate with changes to the season, temperature and rainfall.

Details of the borehole logs with explanatory note are presented in Appendix A. SPT test results are incorporated in the respective borehole logs and DCP test reports are given in Appendix B. The photographs of the cores of BH8 & BH18 are given in Appendix D.

8.0 GROUNDWATER CONDITION

Groundwater or seepage was not encountered during the course of the drilling investigation within the investigated depth of 6.0m but it could not be established the occurrence of ground water between 6 & 13m depth as wash boring and coring drilling method was used. Two piezometers were installed at the locations given in Table A during field investigation.

Table A Piezometers

Location	Depth (m)	Remark
BH11	13.0	Some water remains in the piezometer from the wash boring.
BH18	11.0	Some water remains in the piezometer from the coring.

It should be noted that the attempt was made to pump the water out completely but some water still remains in the piezometers. It should be noted that groundwater sampling was not undertaken as the water was used for drilling and was remained in the piezometer at the time of the investigation. We recommend undertaking of groundwater sampling in 2-3 months time, if it is available, for relevant testing.

9.0 SITE PREPARATION AND EARTHWORKS

The topsoil materials are generally considered not suitable for use as subgrade or foundation of any structure and therefore needs to be removed where encountered.

In general, the following site preparation is recommended.

- Strip all topsoil and unsuitable clayey silt material, if encountered. Stripping to average depth of 0.15m is anticipated. Topsoil and silt material may be stockpiled for possible later use in site landscaping but away from the work areas to avoid possible contamination of other materials being used in these areas.
- Scarify the exposed subgrade material to a depth of about 200mm and re-compact in such a way that it achieves a minimum of 100% Standard Maximum Dry Density (SMDD) at 70 to 90% of Standard Optimum Moisture Content (SOMC). In this process, any soft material or heave area detected should be removed and replaced and re-compacted to 100% SMDD and 70 to 90% SOMC with approved material.
- Proof roll the compacted subgrade using a minimum of 10 passes of an 8 tonne dead weight roller to detect any soft or heaving areas.
- Any soft or heave areas should be excavated down and backfilled with appropriate approved excavated materials, compacted in 150mm thick layers to the minimum equivalent density of 100% of SMDD at 70 to 90% of SOMC.
- Any area of exposed subgrade, which exhibits shrinkage cracking and does not require re-compaction, should be watered and rolled until the shrinkage cracks

do not reappear. During this undertaking, care should be exercised to ensure the surface does not become soft.

Subsequent to the above subgrade preparation, clean fill preferably granular materials can be placed as required and compacted to the compaction requirements as given above. Bulk excavation if required would be within natural very stiff to hard medium to high plasticity silty clays, sandy clays and weathered granite rock. The excavated clay material may be used for the embankment filling but would not be appropriate to use under any structure, as the most of clay material encountered on site is considered "moderately to highly reactive". Weathered granite rock material may be used under the slab of any structure provided it is compacted to the specification. The general fill shall be compacted to 95% of SMDD at 70 to 90% of SOMC over the site this being increased to 100% SMDD at 70 to 90% SOMC for the compacted material in the top 0.6m of construction, particularly in areas of pavements, slabs and foundation using suitable granular select quality material. The degree of compaction of any fill placement should be verified by a NATA accredited testing authority to ensure that it achieves specified density in every 150mm thick compacted layers. As the fill is to be laid on the clay formation if required, the compaction should be carried out with minimum amount of water required to achieve the required density. The boundaries of the fill areas composed of site clay material should be sloped to a maximum batter of 1 Vertical to 2.0 Horizontal.

The structural fill supporting any structural element of the structures shall be prepared in such a way that it achieves a minimum of 100% of Standard Maximum Dry Density in every 150mm thick compacted layers and certified by a relevant NATA accredited testing laboratory for which a safe allowable bearing pressure of 100kPa may be adopted, provided proper drainage measures are incorporated in the design, during and after the construction.

10.0 EXCAVATION AND SUPPORT

It is understood that some excavation will be undertaken for the construction of the proposed development. It is not known the extent of excavation involved for the new development at the time of writing this report. However, based upon the subsurface conditions encountered in the boreholes, it is expected that the materials to be excavated will comprise layers of topsoil, natural clays and weathered granite bedrock if excavation/cut is required as part of the proposed development. It is therefore anticipated that all the required earthworks in the soil & rock within the investigated depth should be capable of being performed by conventional earth-moving plant such as scrapers, dozers, rollers and backhoes or excavator. However, the excavation within highly weathered medium strong rock, if required, is likely to be undertaken by a large tracked hydraulic excavator or medium weight tracked dozer, both fitted with a ripping tyne.

It would be essential to maintain drainage of the site area during any earthworks to prevent rainfall from adversely affecting the materials such that they become unsuitable for direct re-use. It should be noted that trafficability in the underlying medium to high

plasticity clay materials for wheeled vehicles can be expected to be difficult during and following rainfall.

The temporary batter slopes of 1(V): 1(H) and 1.5(V): 1(H) are recommended for unsupported cuts of up to 3.0m depth within natural soils and extremely weathered rock respectively.

The followings are recommended for permanent batter slopes for unsupported cuts of up to 3.0m depth in the various materials:

- Residual soils 1(V): 2(H)
- Extremely weathered Granite 1(V): 1.5 (H)
- Highly weathered Granite 1(V): 1(H)

The permanent batter slope of the unsupported structural fill of up to 3.0m height should not exceed 1(V): 2(H).

If vertical cut with equivalent retaining wall design option is to be adopted, the following characteristic earth pressure coefficients and subsoil parameters may be adopted for the design of the wall.

	Bulk Unit Weight **(kN/m^3)**	Earth Pressure Coefficients Active **(K_a)**	At rest **(K_o)**
Residual soil & Extremely weathered rock	20	0.3	0.5
Highly weathered rock	21	0.15	0.2

The walls should be designed to withstand full hydrostatic pressure unless special measures are taken to introduce complete and permanent drainage of the ground behind the wall.

It should be noted that surcharge loadings should not be placed within a distance equivalent to the excavation depth form the crest of a batter cut or fill.

Care would be required to ensure excavation faces are cleaned of loosened and remoulded debris as it may be exposed to residual soil and extremely weathered rock. The exposed subgrade base should be proof rolled to detect any soft, loose or heaving areas. Any soft, loose or heave areas should be removed. The excavation base should not be left exposed for prolonged periods as deterioration of bases may occur when subjected to wetting and drying processes. Care should be exercised during construction to ensure water ponding does not occur since this may lead to subsequent softening of the founding materials.

Although no groundwater seepage was observed within 6.0m depth in the boreholes during the site investigation, it would be prudent to expect some seepage, even at shallower depth, particularly if excavation is carried out after periods of prolonged extreme rainfall. Any such seepage should be readily controllable by conventional sump and pump dewatering systems installed at the base of the excavation.

The excavated alluvium and residual soil and weathered rock can be used as structural fill provided particles larger than 75mm in the weathered rock are broken down or excluded.

It should be noted that, no matter what method of excavation support is used, some ground displacement will occur within and immediately surrounding the excavation. We recommend that the risk of architectural and structural damage to nearby buildings and buried services as a result of such excavation-induced movements, be carefully evaluated. We believe it is unlikely that excavation induced movements will significantly affect structures situated back from the excavation perimeter a distance greater than the excavation depth.

11.0 LABORATORY TEST RESULTS AND DISCUSSION

Laboratory test reports for moisture content, particle size distribution (PSD), Atterberg Limit (AL), Linear Shrinkage (LS), shrink-swell index (SSI), CBR, permeability, pH, EC & salinity, chloride, sulphate content and resistivity test results are given in Appendix C.

11.1 Soil Classification Test

The soil classification tests (PSD, AL, LS & SSI) indicated the soil material is generally medium to high plasticity silty clays with sand and sandy clay with a trace fine gravel and they are assessed to be moderately to highly reactive.

11.2 Shrink-Swell Index Test

The shrink-swell index test was carried out on four remoulded samples at various depths across the site in the laboratory and the shrink-swell index values ranging from 1.1 to 2.3 were recorded on the silty clay materials tested. Shrink-swell index test results were used in the calculation of surface movement characteristic (y_s) value in accordance with "AS 2870 – 1996 Residential Slabs and Footings" and less than 40mm of y_s value is estimated.

11.3 California Bearing Ratio

Laboratory 4 day soaked CBR tests were carried out on the recovered samples from the boreholes, which were located along the proposed site access roads and future rail track. The laboratory tests indicate CBR values ranging from 7 to 8% for medium to high plasticity silty clays with sand and sandy clays, which were compacted at 95% of Standard maximum Dry Density.

It is assumed that Bomen area has an annual average rainfall of less than 1000mm and the subgrade would be prepared as discussed and specified in the section of "Site Preparation & Earthworks". Based on these evaluations, the design subgrade CBR value of 7.0% is recommended for the proposed access road works provided provision of proper drainage system and strict control on drainage measures is maintained throughout the pavement life.

11.4 Permeability and Dispersion of the Underlying Material

The permeability of the underlying clay material encountered at the adjacent site was assessed in the laboratory and the test results indicate permeability of $1.0x10^{-9}$ m/sec & $2.0x10^{-9}$ m/sec on medium to high plasticity silty clay with sand that were compacted at 95% of SMDD.

The Emerson Class tests carried out on the underlying clay material indicate "Emerson Class 2" which is considered "potentially highly dispersive". It should be noted that the permeability tests were carried out on the combined samples within 1.0m depth, which included low and medium plasticity silty clay with sand. However, medium to high plasticity silty clay material was encountered below 1.0m and extended to 1.8m or termination depth of 2.0m except in BH29.

Based on the test results, visual inspection of the material and subsurface profile as discussed above, the underlying clays are considered "impermeable". However, it should be noted that EPA NSW (Environmental Protection Authority) requires permeability of $1.0x10^{-9}$ m/sec for the disposal of wastewater. The groundwater level appears to be deeper than 2.0m (no seepage or groundwater level was detected in the boreholes drilled within 6.0m. Therefore, it is unlikely to impact the under groundwater system due to the extent of clay material. However, it is highly recommended to prepare the subgrade as specified in Section 9.0 above.

11.5 Soil Aggression

The underlying clay material was tested for the assessment of the corrosiveness. The samples were tested for pH, Electrical Conductivity (EC), Salinity, chloride, sulphate and resistivity. It should be noted that resistivity samples were recovered from the surface to 250mm at the specified locations.

The pH values ranging from 7.2 to 8.9 and Electrical Conductivity (EC) values ranging from 0.2 to 0.16mS/cm were recorded on the underlying natural clay material tested. The analysis showed chloride content ranging from 40 to 730mg/kg and sulphate content ranging from 370 to 390mg/kg.

The underlying clay materials are assessed to be alkaline. EC, Chloride and sulphate content recorded in the tested samples were low and therefore the soil materials are considered "non-aggressive" towards concrete and steel.

However, the designer is referred to the Cement and Concrete Association of Australia Technical Note 57 for any special precautionary measures required for buried concrete and steel into the clay material.

11.6 Resistivity Test

The resistivity test carried out on the selected recovered samples, R1 to R7 indicates resistivity values ranging from 15.6 to 18.1Ω.m in Sample R1 to R6, which assessed to be "medium resistivity" and 5.7Ω.m in Sample R7, which assessed to be "low resistivity".

11.7 Point Load Index Test

The Point Load Index test was carried out on the recovered rock core samples from BH8 & BH18. It should be noted that the test could only be carried out on the highly weathered rock cores. The test results show the highly weathered rock to be weak to medium strong. The test results are given in Appendix D with the core photographs. The test results are incorporated in the respective borehole logs.

12.0 FOUNDATION AND FOOTING SYSTEM

Based on the field and laboratory investigation, the site shall be classified as **"M-Moderately reactive"** in accordance with the Australian Standard AS 2870. The footings may be designed similar to those recommended for "Class M" in the Standard and shall be founded below topsoil into natural ground or prepared subgrade as specified above. The shallow footings such as deep edge beam or pad and strip footings may be adopted and they may be proportioned for a maximum allowable bearing pressure of 200kPa and a subgrade reaction modulus (k) of 50kPa/mm founded on natural very stiff clays at or below 0.3m depth from the existing ground surface provided proper drainage measures are incorporated during and after the construction. The allowable bearing pressure may be increased to 300kPa for the footings founded on hard clays at or below 1.0m.

The bored and cast-in-place pile footing system, if adopted, should be taken into the hard silty clay or underlying granite bedrock and the design parameters given in Table B may be adopted.

Table B: Geotechnical Design Parameters

BH Location	Depth (m)	Material Description	Undrained Shear Strength (kPa) - C_u	Drained Shear Strength (kPa) – C'	Angle of Friction (Degree) – φ'	Allowable Base Capacity, Q_b (kPa)	Allowable Skin Friction, Q_s (kPa)
BH8	0.15-0.6	Silty Clay	80	35*	24°*	250	25
	0.6-2.2	Granite	-	-	40°*	750	75
	2.2-6.9	Granite	-	-	42°*	1500	150
BH9	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-1.0	Silty Clay	150	60*	21°*	450	50
	Below 1.0m	Granite	-	-	40°*	750	75
BH10	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-1.0	Silty Clay	150	60*	21°*	450	50
	Below 1.0m	Granite	-	-	40°*	750	75
BH11	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-2.8	Silty Clay	150	60*	21°*	450	50
	2.8-8.5	Granite	-	-	40°*	750	75
	8.5-13.0	Granite	-	-	42°*	1500	150
BH12	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-1.6	Silty Clay	150	60*	21°*	450	50
	1.6-2.5	Granite	-	-	40°*	750	75
	Below 2.5m	Granite	-	-	42°*	1500	150
BH13	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-0.9	Silty Clay	150	60*	21°*	450	50
	0.9-3.5	Granite	-	-	40°*	750	75
	Below 3.5m	Granite	-	-	42°*	1500	150
BH14	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-1.6	Silty Clay	150	60*	21°*	450	50
	1.6-4.5	Granite	-	-	40°*	750	75
BH15	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-1.7	Silty Clay	150	60*	21°*	450	50
	1.7-2.5	Granite	-	-	40°*	750	75
	Below 2.5m	Granite	-	-	42°*	1500	150
BH16	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-1.4	Silty Clay	150	60*	21°*	450	50
	1.4-4.5	Granite	-	-	40°*	750	75
BH18	0.1-0.6	Silty Clay	80	35*	24°*	250	25
	0.6-3.5	Silty Clay	150	60*	21°*	450	50
	3.5-10.5	Granite	-	-	40°*	750	75
	10.5-11.9	Granite	-	-	41°*	1000	100

Table B: Geotechnical Design Parameters - Continues

BH19	0.1-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-1.7	Silty Clay	150	60*	21°*	450	50
	1.7-2.5	Granite	-	-	40°*	750	75
BH20	0.3-0.8	Silty Clay	50	20*	24°*	150	15
	0.8-2.0	Silty Clay	150	60*	21°*	450	50
	2.0-3.0	Granite	-	-	40°*	750	75
	Below 3.0m	Granite	-	-	42°*	1500	150
BH21	0.3-0.5	Silty Clay	50	20*	24°*	150	15
	0.5-2.1	Silty Clay	150	60*	21°*	450	50
	2.1-3.1	Granite	-	-	40°*	750	75
	Below 3.1m	Granite	-	-	42°*	1500	150
BH22	0.2-0.7	Silty Clay	50	20*	24°*	150	15
	0.7-4.5	Silty Clay	150	60*	21°*	450	50
BH24	0.2-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-4.5	Silty Clay	150	60*	21°*	450	50
BH25	0.2-0.5	Silty Clay	80	35*	24°*	250	25
	0.5-4.5	Silty Clay	150	60*	21°*	450	50
BH26	0.3-0.9	Silty Clay	50	20*	24°*	150	15
	0.9-4.5	Silty Clay	150	60*	21°*	450	50
BH27	0.3-0.6	Silty Clay	50	20*	24°*	150	15
	0.6-2.0	Silty Clay	150	60*	21°*	450	50
	2.0-4.5	Granite	-	-	40°*	750	75

Note: * - These values are estimated from the field SPT & DCP test results and laboratory tests completed.

The adhesion in the first 1.5m within clay material should be ignored. It is noted that some fill material will be placed below footing level. Depending on how the fill is placed, it may affect the consideration of negative skin friction. If it is placed initially and the piles placed following after redistribution of stresses due to it placement, then there may not have any problem. However, if the fill is placed and the piles installed before the redistribution of stresses in the lower natural materials has occurred, then there may have the problem of additional stresses on the pile and hence negative skin friction considerations.

The bases of the pile shafts and footings must be clean and free of soft and loose material and the sides of bored pile holes where side adhesion is adopted must be free of smear prior to concreting. To achieve this, bases of bored pile holes should be cleaned using a cleaning bucket and the sides of the pile holes should be roughed to remove the smear zone associated with drilling, or the side adhesion values given above Table B should be reduced by 50%.

The allowable bearing capacities should be reduced by a geotechnical strength reduction factor (φ_g) in the range of 0.45 to 0.85, depending on the design method and verification procedures adopted in accordance with "AS2159-1995 – Piling – Design and installation". The lower bound end of the range of geotechnical strength reduction factor (φ_g=0.45) is applicable to verification of pile capacities calculated by static design using the values given in Table B. The upper bound end of the range of geotechnical strength reduction factor (φ_g=0.85) may be used if pile capacities are verified by Dynamic load testing supported by signal matching.

With respect to skin friction in the clay material, as indicated the short-term is generally based on the undrained shear strength condition, that is, the $\Phi = 0$ condition and $c = c_u$. The adhesion value is obtained by applying the appropriate reduction factor to c_u. These reductions are related to outside influences, such as construction procedures and environmental considerations, which necessitate a reduction in adopted short-term values. The affects of smearing on the shaft have to be considered for bored piles in clays. Smearing may lead to a reduction in side shear, the degree of which may be dependent on the degree of smearing during construction, despite the fact that some of the remoulded strength may be regained over time in the clay material. Dusting may also be a problem where dry or drier clays are encountered in that it may prevent full contact between the pile shaft and side wall such that full adhesion is not mobilised, and, it may become a smear interface at a future time if groundwater or surface runoff permeates into the zone between the shaft and shaft wall. It may be necessary to include specific construction conditions into the construction procedures depending on the levels of side shear that are required. These conditions may include the cleaning and removal of dust and/or smear from the pile excavations prior to placement; supervision, inspection and certification of the pile excavations prior to placement by experienced geotechnical engineering staff; and, drainage measures designed to maintain a satisfactory moisture regime in the clays.

The footing excavations should not be left exposed for prolonged periods as deterioration of footing bases may occur when subjected to wetting and drying processes, particularly in the clay material. Care should be exercised during construction to ensure water ponding does not occur since this may lead to subsequent softening of the founding materials. Care shall be required to ensure footing excavation bases are cleaned of loosened and remoulded debris particularly in the clay and residual soil subgrade. Groundwater seepage may be encountered during the footing construction if construction is carried out after prolonged period of continuous rainfall. Any such seepage should be readily controllable by conventional sump and pump dewatering systems installed at the base of the footing excavation.

If water ponds in the base of footings or the base founding material is affected by moisture ingress, then this material should be excavated to expose the clay subgrade, which has not been exposed to moisture, and pour the concrete immediately. If a delay in pouring concrete is anticipated, then a blinding layer should be placed over the base of the footing to prevent softening of the footing base.

13.0 SETTLEMENT

We envisage that the total settlements should be minimal provided the design is made within the allowable design parameters recommended and the maintenance of the structures and proper drainage measures are adopted around the structures.

Shallow footings proportioned in accordance with design parameters recommended in Table B are estimated to have load induced settlements of no greater than 0.75% of the width of the footing.

Pile foundation designed in accordance with design parameters recommended in Table B are estimated to have load induced settlements of no greater than 0.75% of the diameter of the piles. It is anticipated that differential settlement is likely to be less than 50% of the total settlement provided the footings are designed in accordance with the design parameters given in Table B.

It should be noted that although the aforementioned design parameters given in Table B are in terms of allowable limit, their use must be checked against settlement, using deformation characteristics values of the underlying clay material given in Table C. It should be noted that differential settlement should not exceed 50% of the total settlement.

Table C Deformation Characteristics Values[1]

Parameters	Very Stiff Clay	Very Stiff to Hard Clay	Hard Clay	Extremely weathered Granite	Highly weathered Granite
Bulk Density (kN/m^3)	19.0	19.0	19.5	23.5	25.0
Elastic Modulus (Undrained) (MPa) -E_u	4.0	5.5	7.5	75.0	150.0
Elastic Modulus (Drained) - E'	3.6	4.7	6.5	-	-
Coefficient of Volume Compressibility - (m^2/MN) - m_v	0.07*	0.07*	0.07*	-	-

Note: 1 - These values are estimated from the field SPT & DCP test results and laboratory tests completed.

The formulas and figures for the calculation of settlement are given in Appendix E. The settlement can be calculated using those formulas, figures and relevant design parameter values given above.

14.0 SEISMIC SITE FACTOR

The site factor in accordance with Section 2.4 of AS1170.4-1993 “Minimum Design Loads on Structures, Part 4: Earthquake Loads”, is assessed to be 1.0.

15.0 PAVEMENT DESIGN

In adopting the design subgrade CBR value of 7.0% as discussed above and the design traffic of $1.0x10^6$ ESA for 20 years as recommended by the client, one of the following pavement designs, as a minimum, may be adopted.

15.1 Flexible Pavement

Design Option 1 - Granular Pavement (with DGB20 & DGS20)

7mm Primerseal followed by 14mm Seal
150mm RTA DGB 20 or equivalent (Modulus 350Mpa)
170mm RTA DGS20 or equivalent (Modulus 250Mpa)
Subgrade CBR 7.0%

The above pavement will give a design life of 25 years, according to Circly 5.0, using the given design parameters, provided proper drainage measures are incorporated at the site. It should be noted that this does not allow any tolerance on pavement layers.

Design Option 2 – Granular Pavement with Asphalt Concrete (DGB20 & DGS20)

40mm Asphalt (AC14) – 2800Mpa
150mm RTA DGB 20 or equivalent (Ev=350Mpa)
140mm RTA DGS 20 or equivalent (Ev=250Mpa)
Subgrade CBR 7.0%

The above pavement will give a design life of 23 years, according to Circly 5.0, using the given parameters. It should be noted that no tolerance is allowed on pavement layers.

Design Option 3 – Granular Pavement with Asphalt Concrete (DGB20)

40mm Asphalt (AC14) – 2800Mpa
280mm RTA DGB 20 or equivalent (Ev=350Mpa) (Construct in two equivalent layers)
Subgrade CBR 7.0%

The above pavement will give a design life of 23 years, according to Circly 5.0, using the given parameters. It should be noted that no tolerance is allowed on pavement layers.

The Circly design print-outs are given in Appendix F.

Design Option 4 – Concrete Pavement

170mm Reinforced Concrete (32Mpa)
150mm Crushed Rock or Gravel
Subgrade CBR 7.0%

It should be noted that the concrete specified in the above design should achieve the flexural strength of 3.5Mpa for 32Mpa compressive strength.

The provision of sub-base layer is to assist in controlling volume changes in moderately to highly expansive clay subgrade. The crushed rock or gravel material before addition of any additive should achieve a CBR of >25% and a PI (Plasticity Index) of <12%.

The material specified as base and sub-base material as per above designs may be used provided the material meets all criteria as shown in Table 242.3 and 242.4 of AusSpec for NGB20-2c, NGB20-2d & NGS20/NGS40 or RTA DGB20 & DGS20 specification. It is therefore highly recommended to use those similar quality materials and to undertake on-going quality control test to ensure that the material quality is maintained throughout the construction. The pavement materials shall be compacted to a minimum of 102% SMDD at 70 to 90 SOMC for base and 100% SMDD at 70 to 90% of SOMC for sub-base or as per Council Specification.

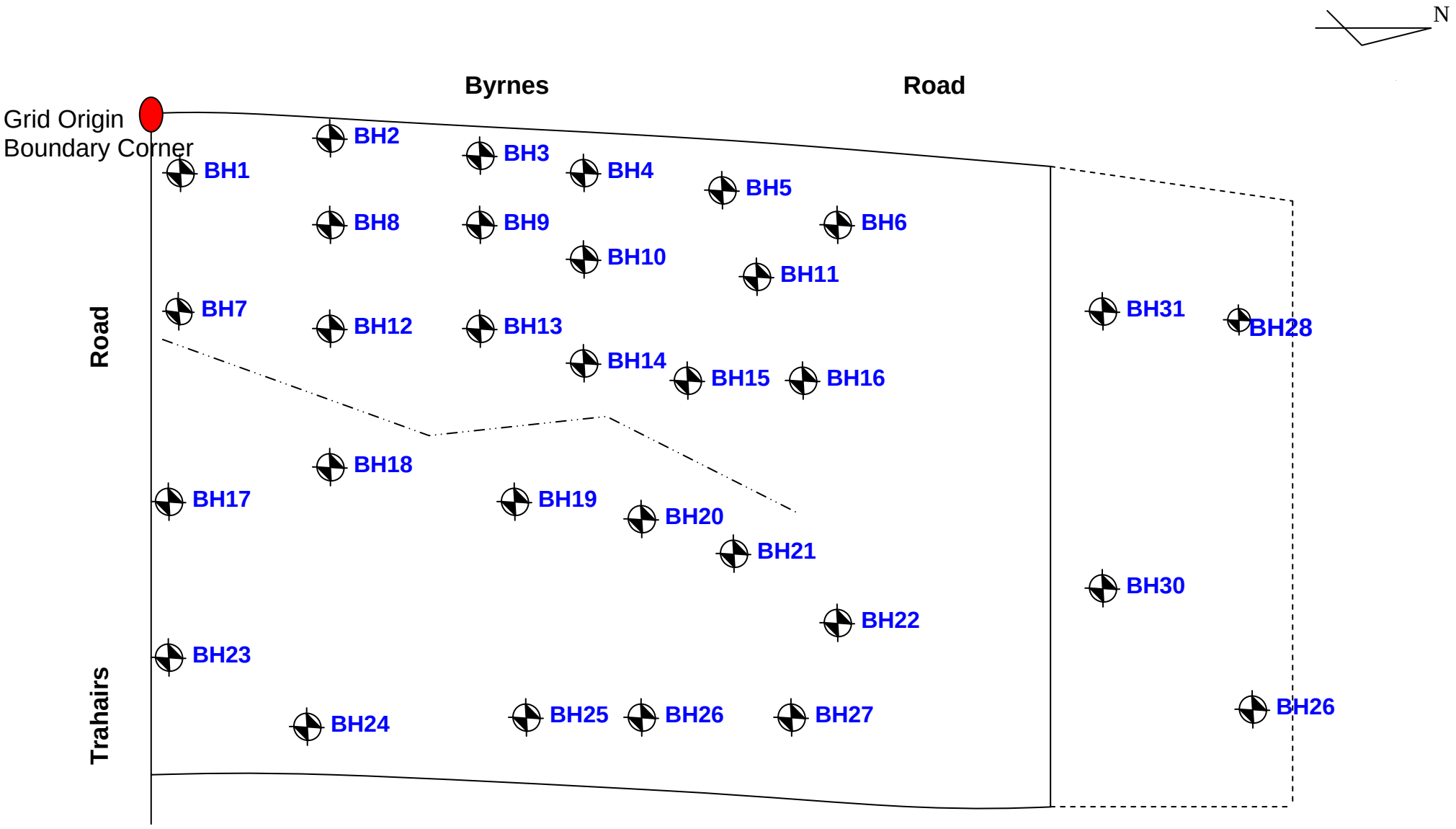
An adequate drainage system should be formed to maintain constant moisture conditions in the pavement and subgrade below the pavement. It is also highly recommended to place interface trench drain at the joints between new pavements if the subgrade in one of the new pavement is stabilized or existing pavement where new pavement is to be joined has a stabilized layer. The trench drain of 300x300mm shall be placed below bound layer and be extended to about 300mm.

16.0 GENERAL COMMENT

Occasionally, the subsurface soil conditions between the completed boreholes may be found different (or may be interpreted to be different) from those expected. This can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact us.

Yours Faithfully,

Tin Maung
Senior Geotechnical Engineer



AITKEN ROWE TESTING LABORATORIES PTY LTD
REGISTRATION NUMBER: S07-365

RIVERINA OILS AND BIO-ENERGY PTY LTD – AUSTRALIA
PROPOSED INTERGRATED BIO-DIESEL PLANT
BOMEN, WAGGA WAGGA
BOREHOLE LOCATION PLAN

APPENDIX A
BOREHOLE LOGS WITH EXPLANTORY NOTE

Table A1 : Schedule of Co-ordinates and Levels of the Boreholes			
Borehole No.	**X (m)**	**Y (m)**	**R.L. A.H.D. (m)**
1	39.3	13.7	237.8
2	26.1	152.9	241.2
3	38.4	215.2	241.8
4	42.9	276.9	242.1
5	61.6	381.1	242.5
6	89.0	488.0	241.6
7	116.5	13.5	239.1
8	91.9	140.7	242.7
9	99.0	214.2	243.3
10	111.0	298.1	242.8
11	122.4	412.9	242.9
12	135.9	131.3	242.7
13	153.7	203.9	243.1
14	168.6	286.6	242.0
15	176.2	351.2	241.9
16	192.5	425.4	242.2
17	251.9	13.7	237.1
18	219.6	124.0	241.1
19	243.3	227.5	240.4
20	268.2	302.7	238.9
21	299.7	392.2	238.6
22	331.3	455.7	239.1
23	343.1	13.5	234.8
24	386.5	98.5	235.4
25	398.3	238.5	234.9
26	394.6	320.1	234.9
27	411.7	432.1	235.4

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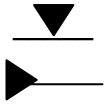
LOG SYMBOLS

LOG COLUMN	SYMBOLS	DEFINITION
Groundwater Record		Standing water level. Time delay following completion of drilling may be shown. Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	**D** **B** **U**	Small disturbed bag sample taken between the depths indicated by lines. Bulk disturbed sample taken between the depths indicated by lines. Undisturbed 50mm diameter tube sample taken between the depths indicated by lines
Field tests	**N=17** **4, 7, 10**	Standard Penetration Test (S.P.T.) performed between depths indicated by lines. Individual figures show blows per 150mm penetration driven by SPT hammer.
	N_c **5** **7** **3**	Dynamic Cone Penetration Test performed between depths indicated by lines. Individual figures show blows per 100mm penetration for 60 degree solid cone driven by 9 Kg hammer.
Moisture Condition (Cohesive Soils) (Cohensionless Soils)	**MC >PL** **MC=PL** **MC<PL** **D** **M** **W**	Moisture content estimated to be greater than plastic limit. Moisture content estimated to be approx. equal to plastic limit. Moisture content estimated to be less than plastic limit. DRY – runs freely through fingers. MOIST – does not run freely but no free water visible on soil surface. WET – free water visible on soil surface.
Consistency (Cohesive Soils)	**VS** **S** **F** **St.** **VSt.** **H**	VERY SOFT – unconfined compressive strength less than 25kPa. SOFT – unconfined compressive strength 25-50 kPa. FIRM – unconfined compressive strength 50-100kPa. STIFF – unconfined compressive strength 100-200kPa. VERY STIFF – unconfined compressive strength 200 – 400kPa. HARD – unconfined compressive strength greater than 400kPa.
Relative Density (Cohensionless Soils)	**VL** **L** **MD** **D** **VD**	ID – Density index Range % S.P.T. 'N' Value Range Blows/300mm Very Loose <15 0-4 Loose 15-35 4-10 Medium Dense 35-65 10-30 Dense 65-85 30-50 Very Dense >85 > 50
Hand Penetrometer Readings	**300** **250** **280**	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise.
Laboratory Test	**L.S. %** **I_{ss}**	Linear Shrinkage (As per RTA Method T113) Shrink-Swell Index (As per Australian Standard AS1289.7.1.1)
Remarks	**'V' bit** **'TC' bit** **T^{60}**	Hardened steel 'V' shaped bit. Tungsten Carbide wing bit. Penetration of auger string in mm under static load of rig rear axle without rotation of augers.

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Borehole No.: **BH1**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 20/11/07
R.L.: 237.8m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, red brown, with sand	0.5		VSt.-H	D	1A		
CI-CH	Silty CLAY; medium to high plasticity, brown yellow, with sand, trace gravel	1.0		H	D	1B		
CH	Silty CLAY; high plasticity, yellow, with sand, trace gravel	1.5			D	1C		
	End of Borehole (BH1) @ 1.5m	2.0						
		2.5						
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH2**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 241.2m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, brown red, with sand	0.5		VSt.-H	D	2A		
SC	Clayey SAND; fine to coarse grained, fines of low plasticity, trace fine gravel, brown	1.0	M	D-VD	D	2B		RESIDUAL (Decomposed Granite)
		1.5						
		2.0						
		2.5						
		3.0						
	End of Borehole (BH2) @ 3.0m	3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH3**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 241.8m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Sandy CLAY; medium plasticity, brown, trace fine gravel	0.5		VSt.-H	D	3A		
CI	Silty CLAY; medium plasticity, brown, with coarse grained sand, trace weathered rock	1.0		H	D	3B		RESIDUAL
	GRANITE: extremely weathered, extremely weak, brown	1.5	D					
		2.0			D	3B		
		2.5						
		3.0						
	End of Borehole (BH3) @ 3.0m	3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH4**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.1m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Sandy CLAY; medium plasticity, brown, trace fine gravel			St.				
				VSt.-H	D	4A		
		0.5						
CI	Silty CLAY; medium plasticity, yellow brown, with sand, trace weathered rocks			H				
					D	4B		
		1.0						
	GRANITE: extremely weathered, extremely weak, brown		D					
		1.5						
		2.0			D	4C		
		2.5						
		3.0						
	End of Borehole (BH4) @ 3.0m							
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH5**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.5m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Sandy CLAY; medium plasticity, brown, trace fine gravel	0.5		Vst.-H	D	5A		
CI	Silty CLAY; medium plasticity, yellow brown, with sand, trace weathered rock bands	1.0		H	D	5B		
	GRANITE: extremely weathered, extremely weak, brown	1.5	D		D	5C		
	End of Borehole (BH5) @ 2.0m	2.0						REFUSAL ON ROCK
		2.5						
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH6**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 241.6m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Sandy CLAY; medium plasticity, brown, trace fine gravel	0.5		VSt.-H	D	6A		
CI	Silty CLAY; medium plasticity, yellow brown, with sand and weathered rock bands	1.0		H	D	6B		
	GRANITE:extremely to highly weathered, extremely to very weak, brown	1.5	D		D	6C		
	End of Borehole (BH6) @ 2.3m	2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5						REFUSAL ON ROCK

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH7**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 20/11/07
R.L.: 239.1m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, red brown, with fine to coarse sand	0.5		VSt.-H	D	7A		
CI-CH	Silty CLAY; medium to high plasticity, red brown, with sand	1.0		H	D	7B		
CH	Silty CLAY; high plasticity, yellow, with sand	1.5			D	7C		
	End of Borehole (BH7) @ 1.5m	2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH8**
Sheet No.: 1 of 3

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 19/11/07
R.L.: 242.7m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Sandy SILT; low plasticity, light brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, brown, with sand	0.5		VSt. / H				
	GRANITE: extremely weathered, extremely weak, brown, grey, with clay bands	1.0	D-M		D	18A		
	End of Augering @ 1.2m Continued Cored Borehole log	1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: N.M.
Scale: As shown

AITKEN ROWE TESTING LABORATORIES PTY LTD

CORED BOREHOLE LOG

Client:	RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA	Borehole No.: BH8
Project:	PROPOSED INTERGRATED BIO-DIESEL PLANT	Page 2 of 3
Location:	BOMEN, WAGGA WAGGA	

Job No.:	S07-365	Core Size:	N, M, L, C	R.L.Surface: 242.7m
Date Drilled:	19 & 20/11/07	Inclination:	90°	Datum: AHD
Drill Type:	GEMCO210D	Casing:	1.2m	

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type,grain characteristics, colour,structure,minor components	Weathering	Strength	POINT LOAD INDEX STRENGTH $I_S(50)$ EW VW W MS S VS ES	DEFECT DETAILS: DEFECT SPACING (mm) 500 300 100 50 30 10	DEFECT DETAILS: DESCRIPTION Type,inclination,thickness,planarity,roughness,coating
				START CORING @ 1.2m					
30% POLYMER LOSS		1.5		CORE LOSS 0.53m					
		2.0		GRANITE: medium to coarse grained, yellow brown	EW	XW			
		2.4		GRANITE: medium to coarse grained, light yellow grey	HW	MS	*		D.B.
		2.5		GRANITE: medium to coarse grained, light yellow grey	HW	MS			- JT, 45°, PR, RF - JT, 0°, PR, RF JT, 70°, PR, SM (interbedded with Quartzite) - D.B.
		3.0					*		- D.B. JT, 65°, PR, RF (Fractured around joint) JT, 45°, PR, RF - JT, 10°, PR, RF
		3.5					*		JT, 10°, PR, RF, Fe
		3.9							- JT, 75°, PR, RF, Fe
		4.0		CORE LOSS 0.1m					JT, 60°, CU, RF, Fe (fractured around joint) JT,
				GRANITE: medium to coarse grained, grey, minor iron staining	HW	MS	*		- 0°, CU, RF - D.B.
		4.5		Continued on page 3 of 3					

AITKEN ROWE TESTING LABORATORIES PTY LTD

CORED BOREHOLE LOG

Client:	RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA	Borehole No.: BH8
Project:	PROPOSED INTERGRATED BIO-DIESEL PLANT	Page 3 of 3
Location:	BOMEN, WAGGA WAGGA	

Job No.:	S07-365	Core Size:	N, M, L, C	R.L.Surface: 242.7m
Date Drilled:	19 & 20/11/07	Inclination:	90°	Datum: AHD
Drill Type:	GEMCO210D	Casing:	1.2m	

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type,grain characteristics, colour,structure,minor components	Weathering	Strength	POINT LOAD INDEX STRENGTH $I_S(50)$ EW VW W MS S VS ES	DEFECT DETAILS: DEFECT SPACING (mm) 500 300 100 50 30 10	DEFECT DETAILS: DESCRIPTION Type,inclination,thickness,planarity,roughness,coating
		4.5		Continued from page 2 of 3					
30% POLYMER LOSS		5.0		GRANITE: medium to coarse grained, grey, minor iron staining	HW	MS			EW band, 10°, 40mm Interbedded Quartzite JT, 15°, PR, RF
		5.4							
		5.5		GRANITE: medium to coarse grained, light white grey	MW	MS	*		JT, 5°, PR, RF
		6.0							JT, 60°, PR, RF Remnant Quartzite JT, 25°, PR, SM
		6.5		GRANITE: medium to coarse grained, yellow orange grey	HW	MS	*		HW Band, 20°, 150mm, Fe Crush zone, 20°, 10mm JT's, 10°, 25°, PR, RE, Fe JT 20°, PR, RF Fe JT 25°, PR, RF, Fe JT 90°, CU, RF
		7.0		End of Borehole (BH8) @ 6.9m					

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH9**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 243.3m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Sandy CLAY; medium plasticity, brown, trace fine gravel			VSt.-H	D	9A		
		0.5						
CH	Silty CLAY; high plasticity, yellow brown, with sand, trace weathered rock bands			H	D	9B		RESIDUAL (Decomposed Granite)
		1.0						
	GRANITE: extremely weathered, extremely weak, brown		D					
		1.5						
					D	9C		
		2.0						
		2.5						
		3.0						
	End of Borehole (BH9) @ 3.0							
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH10**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.8m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Sandy CLAY; medium plasticity, brown, trace gravel			H	D	10A		
		0.5						
CI	Silty CLAY; medium plasticity, yellow, with sand, weathered rock bands				D	10B		
		1.0						
	GRANITE: extremely weatherd, extremely weak, brown		D					
		1.5			D	10C		
	GRANITE: highly weatherd, very weak, grey							
		2.0						
		2.5						
		3.0			D	10D		
		3.5						
		4.0						
		4.5						
	End of Borehole (BH10) @ 4.5m							
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH11**
Sheet No.: 1 of 3

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.9m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Field Test	Remarks & Field Records
ML	TOPSOIL: Sandy SILT; low plasticity, brown		MC<PL	F				Augering
CI	Silty CLAY; medium plasticity, brown, with sand	0.5	MC≥PL	St.				
CI	Silty CLAY; medium plasticity, orange brown, with sand	1.0	MC<PL	H			1.0	
CH	Silty CLAY; high plasticity, mottled orange grey brown, with fine to coarse sand	1.5			D	11A	SPT 21,35/150mm N>35	RESIDUAL REFUSAL - Bounce on hard Clay
CH	Silty CLAY; high plasticity, pink brown, with fine to coarse sand, with extremely weathered rock bands	2.0					1.3	
		2.5			D	11B	2.5 SPT 16,17,30 N=47	← Wash boring commences casing to 3.5m
	GRANITE: extremely weathered, extremely weak, orange, with clay bands	3.0	D-M				2.95	
		3.5						
		4.0			D	11C	4.0 SPT 10,16,22 N=38	
		4.5					4.45	
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: N.M.
Scale: As shown

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH11**
Sheet No.: 2 of 3

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.9m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Field Test	Remarks & Field Records
	GRANITE: extremely weathered, extremely weak, light yellow brown, with clay bands		D		D	11D	SPT 13,27,37 N=64	
		6.0					5.95	
		6.5						
		7.0						
		7.5						
		8.0						
		8.5					8.5	
	GRANITE: highly weathered, very weak to weak, yellow brown				D	11E	SPT 25/150mm	REFUSAL
							8.65	
		9.0						
		9.5						
		10.0						
		10.5						
		11.0						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: N.M.
Scale: As shown

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH11**
Sheet No.: 3 of 3

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.9m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Field Test SPT	Remarks & Field Records
	GRANITE: highly weathered, very weak to weak, yellow		D					
		11.5						SPT attempted
	GRANITE: highly weathered, weak, yellow							REFUSAL
		12.0						
		12.5						
		13.0						
	End of Borehole (BH11) @ 13.0m							Piezometer installed to 13.0m on 21/11/07
		13.5						
		13.5						
		14.0						
		14.5						
		15.0						
		15.5						
		16.0						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: N.M.
Scale: As shown

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH12**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.7m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CH	Gravelly Silty CLAY; high plasticity, brown, with sand and gravel	0.5		VSt.	D	12A		RESIDUAL
				H				
		1.0						
	GRANITE: extremely weathered, extremely weak, brown		D					
		1.5			D	12B		
	GRANITE: highly weathered, very weak, grey							
		2.0			D	12C		
		2.5			D	12D		
	End of Borehole (BH12) @ 2.5m	3.0						REFUSAL ON GRANITE
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH13**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 243.1m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	VSt.				
CI	Sandy CLAY; medium plasticity, brown, trace gravel	0.5		H	D	13A		
CI	Silty CLAY; medium plasticity, yellow, with sand				D	13B		
	GRANITE: extremely weathered, extremely weak, brown	1.0	D		D	13C		
	GRANITE: highly weathered, very weak, grey	1.5 2.0 2.5 3.0 3.5			D	13D		
	End of Borehole (BH13) @ 3.5m	4.0 4.5 5.0 5.5						REFUSAL ON ROCK

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH14**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.0m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Sandy CLAY; medium plasticity, brown, trace gravel	0.5		H	D	14A		
CI	Silty CLAY; medium plasticity, yellow, with sand, trace weathered rock bands	1.0			D	14B		RESIDUAL
	GRANITE:extremely to highly weathered, extremely weak to very weak, brown	1.5	D					
		2.0						
		2.5						
		3.0			D	14C		
		3.5						
		4.0						
		4.5						
	End of Borehole (BH14) @ 4.5m	5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH15**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 241.9m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Sandy CLAY; medium plasticity, brown, trace gravel			H	D	15A		
		0.5						
CI	Silty CLAY; medium plasticity, yellow, with sand and extremely weathered rock bands							RESIDUAL
		1.0			D	15B		
		1.5						
	GRANITE: highly weathered, very weak, brown		D					
		2.0						
					D	15C		
		2.5						
	End of Borehole (BH15) @ 2.5m							REFUSAL ON ROCK
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH16**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 242.2m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Sandy CLAY; medium plasticity, brown, trace gravel	0.5		H	D	16A		
CI	Silty CLAY; medium plasticity, yellow, with sand, with extremely weathered rock bands	1.0			D	16B		RESIDUAL
	GRANITE: highly weathered, very weak, yellow	1.5	D		D	16C		
	GRANITE: highly weathered, very weak, brown	2.0 2.5 3.0 3.5 4.0 4.5						
	End of Borehole (BH16) @ 4.5m	5.0 5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH17**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 20/11/07
R.L.: 237.1m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, red brown, with sand	0.5		VSt.-H	D	17A		
CI-CH	Silty CLAY; medium to high plasticity, yellow brown, with sand, trace gravel			H	D	17B		
CH	Silty CLAY; high plasticity, yellow, with sand	1.0						
		1.5			D	17C		
	End of Borehole (BH17) @ 1.5m	2.0						
		2.5						
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH18**
Sheet No.: 1 of 4

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 20/11/07
R.L.: 241.1m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Field Test	Remarks & Field Records
							SPT	
ML	TOPSOIL: Sandy SILT; low plasticity, light brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, red brown, with sand	0.5		VSt.				
CI	Silty CLAY; medium plasticity, red brown, with sand, trace gravel	1.0		VSt.-H			1.0	
CI-CH	Silty CLAY; medium to high plasticity, mottled yellow red, with sand, trace gravel	1.5		H	D	18A	SPT 18,23,36 N=59	
		2.0					1.45	
		2.5					2.5	
CI	Silty CLAY; medium plasticity, mottled yellow red grey, with fine sand, with fine gravel	3.0			D	18B	SPT 18,27,30 N=57	RESIDUAL
		3.5					2.95	
	GRANITE: extremely weathered, extremely weak, light yellow brown	4.0	D					
	End of Augering @ 4.0m Continued Cored Borehole log	4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: N.M.
Scale: As shown

AITKEN ROWE TESTING LABORATORIES PTY LTD

CORED BOREHOLE LOG

Client:	RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA	Borehole No.: BH18
Project:	PROPOSED INTERGRATED BIO-DIESEL PLANT	Page 2 of 4
Location:	BOMEN, WAGGA WAGGA	

Job No.:	S07-365	Core Size:	N, M, L, C	R.L.Surface: 241.1m
Date Drilled:	20 & 21/11/07	Inclination:	90°	Datum: AHD
Drill Type:	GEMCO210D	Casing:	4.0m	

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type,grain characteristics, colour,structure,minor components	Weathering	Strength	POINT LOAD INDEX STRENGTH $I_S(50)$ EW VW W MS S VS ES	DEFECT DETAILS: DEFECT SPACING (mm) 500 300 100 50 30 10	DEFECT DETAILS: DESCRIPTION (Type,inclination,thickness,planarity,roughness,coating)
		4.0		START CORING @ 4.0m					
50% POLYMER LOSS				CORE LOSS @ 0.15m					
				GRANITE: medium to coarse grained, light yellow brown	HW	VW			JT, 90°, CU, RF 2 JT's, 10°, PR, RF, Fe DB
		4.5				W			JT, 45°, PR, SM, Fe DB
							*		JT, 15°, PR, SM, Fe EW Band, 5°, Clay
		4.9							
		5.0							JT, 0°, PR, SM, Fe 2 JT's , 5°, PR, SM, Fe
		5.5							JT, 70°, PR, SM, Fe DB
							*		DB
					EW	XW			
		6.0		CORE LOSS 1.75m					
		6.4							
		6.5							
		7.0							
				Continued on page 3 of 4					

AITKEN ROWE TESTING LABORATORIES PTY LTD

CORED BOREHOLE LOG

Client:	RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA	Borehole No.: BH18
Project:	PROPOSED INTERGRATED BIO-DIESEL PLANT	Page 3 of 4
Location:	BOMEN, WAGGA WAGGA	

Job No.:	S07-365	Core Size:	N, M, L, C	R.L.Surface: 241.1m
Date Drilled:	20 & 21/11/07	Inclination:	90°	Datum: AHD
Drill Type:	GEMCO210D	Casing:		

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type,grain characteristics, colour,structure,minor components	Weathering	Strength	POINT LOAD INDEX STRENGTH $I_S(50)$ EW VW W MS S VS ES	DEFECT DETAILS: DEFECT SPACING (mm) 500 300 100 50 30 10	DEFECT DETAILS: DESCRIPTION (Type,inclination,thickness,planarity,roughness,coating)
		7.0		Continued from Page 2 of 4					
50% POLYMER LOSS		7.5		GRANITE: medium to coarse grained, yellow brown, iron-stained	EW	XW			
		7.9							
		8.0		CORE LOSS 1.0m					- Attempted SPT @ 7.9m - SPT REFUSAL
		8.5							
		9.0		GRANITE: medium to coarse grained, yellow brown, iron-stained	EW	XW			
		9.5		CORE LOSS 0.1m					
				GRANITE: medium to coarse grained, yellow brown, iron-stained	HW	VW-W			JT, 70°, PR, SM, Fe (Fractured around the joint) JT, 15°, PR, RF EW Band, 10°, 40mm EW Band, 10°, 30mm
		10.0		Continued on page 4 of 4					

AITKEN ROWE TESTING LABORATORIES PTY LTD

CORED BOREHOLE LOG

Client:	RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA	Borehole No.: BH18
Project:	PROPOSED INTERGRATED BIO-DIESEL PLANT	Page 4 of 4
Location:	BOMEN, WAGGA WAGGA	

Job No.:	S07-365	Core Size:	N, M, L, C	R.L.Surface:	241.1m
Date Drilled:	20 & 21/11/07	Inclination:	90°	Datum:	AHD
Drill Type:	GEMCO210D	Casing:	4.1m		

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type,grain characteristics, colour,structure,minor components	Weathering	Strength	POINT LOAD INDEX STRENGTH $I_S(50)$ EW VW W MS S VS ES	DEFECT SPACING (mm) 500 300 100 50 30 10	DEFECT DETAILS DESCRIPTION Type,inclination,thickness,planarity,roughness,coating
		10.0		Continued from page 3 of 4					
30% POLYMER LOSS		10.5		CORE LOSS 0.35m					
				GRANITE: medium to coarse grained, brown, iron stained	HW	W	*		JT, 45°, PR, RF DB JT, 35°, PR, SM, Clay, Organic matter DB JT, 50o, PR, SM, Clay
		11.0							EW band, 0°, Clay, 120mm
				GRANITE: medium to coarse Grained light speckled grey minor iron staining	HW	W	*		JT, 50°, PR,SM, (fractured around joint) EW band, 5°, 10mm, Fe JT, 30°, PR, SM, Fe
		11.5							JT, 30°, PR, SM JT, 30°, PR, SM JT, 5°, PR ,RF (fractured around joint) DB JT, 60° , PR, RF (fractured around joint) EW band, 0°, 30mm, Fe
		12.0		End of borehole (BH18) @ 11.9m					Pizometer Installed on 21/11/07
		12.5							

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH19**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 21/11/07
R.L.: 240.4m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, light brown, with sand	0.5		VSt.-H	D	19A		
CI	Silty CLAY; medium plasticity, yellow brown, with sand	1.0		H	D	19B		
CI	Silty CLAY; medium plasticity, brown, trace weathered rock bands	1.5 2.0			D	19C		Slight Moisture RESIDUAL
	GRANITE: extremely weathered, extremely wesk, grey	2.5 3.0 3.5 4.0 4.5	D-M					
	End of Borehole (BH19) @ 4.5m	5.0 5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH20**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 27/11/07
R.L.: 238.9m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Silty CLAY; medium plasticity, red brown, with sand		MC>PL	S	D	20A		
		0.5		St.				
CI	Silty CLAY; medium plasticity, yellow brown, with sand, trace extremely weathered rock bands							RESIDUAL
			MC<PL	H	D	20B		
		1.0						
CI	Silty CLAY; medium plasticity, brown, with sand, trace weathered rock bands							
		1.5			D	20C		
		2.0						
	GRANITE: extremely weathered, extremely weak, with clay bands, light yellow brown		D		D	20D		
		2.5						
		3.0			D	20E		
	End of Borehole (BH20) @ 3.0m							REFUSAL ON ROCK
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH21**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 27/11/07
R.L.: 238.6m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Silty CLAY; medium plasticity, brown, with sand				D	21A		
		0.5		VSt.				
CI	Silty CLAY; medium plasticity, yellow brown, with sand, trace weathered rock bands			H				
		1.0			D	21B		
		1.5			D	21C		
		2.0						
	GRANITE: extremely weathered, extremely weak, brown		D					
		2.5			D	21D		
		3.0						
	End of Borehole (BH21) @ 3.1m							REFUSAL ON GRANITE
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH22**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 27/11/07
R.L.: 239.1m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Silty CLAY; medium plasticity, red brown, with sand	0.5			D	22A		
CI	Silty CLAY; medium plasticity, yellow, with sand	1.0		VSt.-H				
		1.5		H	D	22B		
		2.0			D	22C		
CI-CH	Silty CLAY; medium to high plasticity, brown, with sand				D	22D		
CI	Silty CLAY; medium plasticity, brown, with sand and extremely weathered rock bands	2.5						RESIDUAL
		3.0			D	22E		
		3.5						
		4.0						
		4.5						
	End of Borehole (BH22) @ 4.5m	5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH23**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 20/11/07
R.L.: 234.8m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Silty CLAY; medium plasticity, red brown, with sand	0.5		VSt.				
CI	Silty CLAY; medium plasticity, yellow brown, with sand	1.0		H				
CI-CH	Silty CLAY; medium to high plasticity, brown yellow, with sand							
CH	Silty CLAY; high plasticity, yellow, with sand	1.5						
	End of Borehole (BH23) @ 1.5m	2.0						
		2.5						
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH24**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 27/11/07
R.L.: 235.4m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Silty CLAY; medium plasticity, brown, with sand	0.5		H	D	24A		
CH	Silty CLAY; high plasticity, brown, trace sand	1.0			D	24B		
		1.5						
		2.0			D	24C		
CI	Silty CLAY; medium plasticity, brown, with sand, with weathered rock bands	2.5						
		3.0						RESIDUAL
		3.5						
		4.0						
		4.5						
	End of Borehole (BH24) @ 4.5m	5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH25**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 27/11/07
R.L.: 234.9m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, red brown, with sand	0.5		H	D	25A		
CI	Silty CLAY; medium plasticity, yellow, with sand	1.0			D	25B		
		1.5						
		2.0						
CI	Silty CLAY; medium plasticity, brown, with sand	2.5			D	25C		
		3.0						
CI	Silty CLAY; medium plasticity, brown, with sand and extremely weathered rock bands	3.5						RESIDUAL
		4.0			D	25D		
		4.5						
	End of Borehole (BH25) @ 4.5m	5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH26**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 27/11/07
R.L.: 234.9m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CI	Silty CLAY; medium plasticity, brown, with sand	0.5		VSt.	D	26A		
CI	Silty CLAY; medium plasticity, yellow brown, with sand	1.0		H	D	26B		
CI-CH	Silty CLAY; medium to high plasticity, brown, with sand	1.5			D	26C		
		2.0						
CI	Silty CLAY; medium plasticity, brown, with sand and weathered rock bands	2.5			D	26D		
		3.0						
CI	Silty CLAY; medium plasticity, yellow brown, with sand, trace weathered rock bands	3.5			D	26E		
		4.0						
		4.5						
	End of Borehole (BH26) @ 4.5m	5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH27**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 27/11/07
R.L.: 235.4m AHD

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	F				
CI	Silty CLAY; medium plasticity, brown, with sand	0.5		St.	D	27A		
		1.0		H				
CI	Silty CLAY; medium plasticity, yellow brown, with fine to coarse sand	1.5			D	27B		
		2.0	D					
	GRANITE: extremely weathered, extremely weak, with clay bands, yellow brown	2.5			D	27C		
		3.0						
		3.5			D	27D		
		4.0						
		4.5						
	End of Borehole (BH27) @ 4.5m	5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH28**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 30/11/07

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CL	Silty CLAY; low plasticity, brown, with fine sand				D	28A		
CI	Silty CLAY; medium plasticity, brown, with fine sand	0.5		VSt.				
					D	28B		
CI	Silty CLAY; medium plasticity, brown, trace fine sand			H				
					D	28C		
		1.0						
CI-CH	Silty CLAY; medium to high plasticity, brown, trace fine sand							
					D	28D		
		1.5						
CI-CH	Silty CLAY; medium to high plasticity, light brown, with fine to coarse sand	2.0			D	28E		
	End of Borehole (BH28) @ 2.0m	2.5						
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.B.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH29**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 30/11/07

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CL	Silty CLAY; low plasticity, brown, with fine sand				D	29A		
CI	Silty CLAY; medium plasticity, orange brown, with sand	0.5		VSt.				
					D	29B		
CI	Silty CLAY; medium plasticity, orange brown	1.0		VSt.-H				
					D	29C		
		1.5						
	GRANITE: extremely weathered, extremely weak, with clay bands	2.0	D-M		D	29D		
	End of Borehole (BH29) @ 2.0m	2.5						
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH30**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 30/11/07

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CL	Silty CLAY; low plasticity, brown, with fine sand				D	30A		
CI	Silty CLAY; medium plasticity, orange brown, with sand	0.5		VSt.				
					D	30B		
CI	Silty CLAY; medium plasticity, orange brown, with fine sand			VSt.-H				
		1.0			D	30C		
CI-CH	Silty CLAY; medium to high plasticity, orange brown, with sand			H				
		1.5			D	30D		
	GRANITE: extremely weathered, extremely weak, with clay bands	2.0	D-M		D	30E		
	End of Borehole (BH30) @ 2.0m	2.5						
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **BH31**
Sheet No.: 1 of1

Ground Level: Existing
Method: Auger Drilling with TC Bit

Date: 30/11/07

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test M.C. %	Remarks & Field Records
ML	TOPSOIL: Clayey SILT; low plasticity, brown		MC<PL	St.				
CL	Silty CLAY; low plasticity, brown, with sand			VSt.	D	31A		
CI-CH	Silty CLAY; medium plasticity, orange brown, with fine sand	0.5			D	31B		
CI-CH	Silty CLAY; medium to high plasticity, orange brown, with sand	1.0		VSt.-H	D	31C		
Ci-CH	Silty CLAY; medium to high plasticity, brown, with sand	1.5		H	D	31D		
	End of Borehole (BH31) @ 2.0m	2.0						
		2.5						
		3.0						
		3.5						
		4.0						
		4.5						
		5.0						
		5.5						

Registration No.: S07-365
Project / Location: Proposed Intergrated Bio-Diesel Plant, Bomen, Wagga Wagga
Client: Riverina Oils and Bio-Energy Pty Ltd Australia

Logged By: D.C.
Scale: As shown
Dry on completion

APPENDIX B
DYNAMIC CONE PENETROMETER TEST REPORTS

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 1 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 20 & 21/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH1

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	7	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	12	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	15	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	20+	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	END	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	*	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	*	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH3

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	3	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	9	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	20+	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	END	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	*	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	*	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	*	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

NATA
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APPROVED SIGNATORY: .....

B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Form R13 Revised 29/6/06

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 2 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 21/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH5

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	2	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	4	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	8	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	12	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	11	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	13	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	15	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	20+	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	END	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH9

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	3	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	11	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	13	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	10	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	12	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	12	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	20+	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	END	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

REMARKS *

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APPROVED SIGNATORY: .....

B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Form R13 Revised 29/6/06

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 3 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 21/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH10

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	6	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	15	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	20+	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	END	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	*	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	*	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	*	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH13

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	4	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	10	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	17	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	16	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	16	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	20+	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	END	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

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APPROVED SIGNATORY: .....

B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 4 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 21/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH14

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	8	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	14	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	16	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	14	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	15	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	20+	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	END	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH15

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	6	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	18	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	20+	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	END	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	*	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	*	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	*	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

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APPROVED SIGNATORY: .....

S. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Form R13 Revised 29/6/06

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 5 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 21 & 27/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH16

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	7	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	15	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	15	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	13	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	17	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	19	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	20+	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	END	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH19

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	2	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	9	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	14	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	14	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	14	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	9	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	10	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	14	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	14	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	16	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	18	3.0 - 3.1	*		
1.1 - 1.2	20+	3.1 - 3.2	*		
1.2 - 1.3	END	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

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APPROVED SIGNATORY: .....

S. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Form R13 Revised 29/6/06

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 6 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 27/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH20

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	8	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	3	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3		2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	6	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	6	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	2	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	5	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	8	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	16	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	18	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	20+	3.0 - 3.1	*		
1.1 - 1.2	END	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH21

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	11	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	7	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	5	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	10	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	14	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	12	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	16	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	20	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	END	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

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APPROVED SIGNATORY: .....
B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Form R13 Revised 29/6/06

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 7 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 20 & 27/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH22

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	5	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	5	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	9	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	7	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	3	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	5	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	8	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	11	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	18	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	20+	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	END	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH23

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	5	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	7	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	16	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	16	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	13	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	11	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	10	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	12	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	21	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	END	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

REMARKS *

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APPROVED SIGNATORY: .....

B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 8 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 27/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH24

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	5	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	12	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	16	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	16	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	19	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	20+	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	END	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH25

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	6	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	15	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	18	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	20+	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	END	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	*	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	*	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

REMARKS *

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B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 9 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 27/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH26

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	9	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	11	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	8	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	3	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	3	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	8	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	8	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	11	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	16	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	20+	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	END	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. BH27

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	6	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	6	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	4	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	4	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	6	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	8	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	17	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	20+	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	END	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

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B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Form R13 Revised 29/6/06

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

DYNAMIC CONE PENETROMETER REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT

LOCATION: 299 TRAHAIRS ROAD, BOMEN - WAGGA WAGGA

PAGE: 10 OF: 10

REGISTRATION NO: **S07-365**

DATE OF TEST: 27/11/07

DEPTH BELOW SURFACE (mm):

DEPTH OF GROUND WATER TABLE IF INTERSECTED: *

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. BH12

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	4	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	10	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	7	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	9	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	13	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	15	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	18	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	20+	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	END	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	*	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	*	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	*	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	*	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	*	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	*	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	*	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

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B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

Form R13 Revised 29/6/06

APPENDIX C
LABORATORY TEST REPORTS

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT

PROPOSED USE : DESIGN

MATERIAL TYPE : VARIOUS

LOT No.: *

*

ORDER No.: *

PAGE: 1

OF: 9

SUBMITTED BY : ARTL

DATE SUBMITTED : 30/11/07

NO OF SAMPLES : 22

QUANTITY REP.: *

SAMPLING METHOD: AS1289.1.2.1

CLAUSE: 6.5.3

SPECIFICATION: *

REGISTRATION No : **S07-365**

				SAMPLE NUMBER :	1B	2B	6A	7A	7B
				SITE or LOCATION :	BH1	BH2	BH6	BH7	BH7
				DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):	0.7-1.0	0.7-1.5	0.2-0.5	0.2-0.5	0.7-1.0
				SPECIFIED LIMITS LISTED BELOW FOR :	*	*	*	*	*	*
TESTS				PRETREATMENT :	*	*	*	*	*	*
AS1289.3.6.1				PASS 19.0mm SIEVE %	*		*	*	*	*
				PASS 13.2mm SIEVE %	*	*	*	*	*	*
				PASS 9.50mm SIEVE %	*	*	*	*	*	*
				PASS 6.70mm SIEVE %	*	*	*	*	*	*
				PASS 4.75mm SIEVE %	*	*	*	100	100	*
				PASS 2.36mm SIEVE %	*	*	*	95	97	100
				PASS 1.18mm SIEVE %	*	*	*	75	86	97
				PASS 600um SIEVE %	*	*	*	57	77	93
				PASS 425um SIEVE %	*	*	*	50	74	91
				PASS 300um SIEVE %	*	*	*	44	71	90
				PASS 212um SIEVE %	*	*	*	39	68	88
				PASS 150um SIEVE %	*	*	*	35	66	87
				PASS 75um SIEVE %	*	*	*	29	62	84
T107	WHOLE SAMPLE			PASS 425 um SIEVE %	*	*	*	*	*	*
				PASS 75 um SIEVE %	*	*	*	*	*	*
				LESS THAN 13.5 um %	*	*	*	*	*	*
T107	-2.36mm			PASS 425 um SIEVE %	*	*	*	*	*	*
				PASS 75 um SIEVE %	*	*	*	*	*	*
				LESS THAN 13.5 um %	*	*	*	*	*	*
RATIOS		A -		PASS 425 um %	*	*	*	*	*	*
		B -		PASS 75/425 um %	*	*	*	*	*	*
		C -		BELOW 13.5/75 um %	*	*	*	*	*	*
AS1289.3.1.2				LIQUID LIMIT %	*	*	*	32	45	39	*
AS1289.3.2.1				PLASTIC LIMIT %	*	*	*	14	15	18	*
AS1289.3.3.1				PLASTICITY INDEX %	*	*	*	18	30	21	*
				PREPARATION METHOD	*	*	*	AS1289.1.1-5.3	AS1289.1.1-5.3	AS1289.1.1-5.3	*
T111				MAX. DRY DENSITY t/m3	*	*	*	*	*	*	*
				OPTIMUM MOISTURE CONTENT %	*	*	*	*	*	*	*
				METHOD A or B	*	*	*	*	*	*	*
T114				M.D.C.S. Mpa	*	*	*	*	*	*	*
				MOISTURE CONTENT %	*	*	*	*	*	*	*
				DRY DENSITY t/m3	*	*	*	*	*	*	*
T211				LOOSE UNIT MASS t/m3	*	*	*	*	*	*	*
T213				PARTICLE SHAPE (2:1) % MISSHAPEN	*	*	*	*	*	*	*
T213				PARTICLE SHAPE (3:1) % MISSHAPEN	*	*	*	*	*	*	*
T215				SIZE OF TEST PORTION (mm)	*	*	*	*	*	*	*
				DRY STRENGTH kN	*	*	*	*	*	*	*
				WET STRENGTH kN	*	*	*	*	*	*	*
				WET/DRY STRENGTH VARIATION %	*	*	*	*	*	*	*
T113				LINEAR SHRINKAGE %	*	*	*	*	*	*	*
T120				MOISTURE CONTENT %	*	*	9.6	4.5	10.0	*	10.1

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APPROVED SIGNATORY : .....

B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT

PROPOSED USE : DESIGN

MATERIAL TYPE : VARIOUS

LOT No.: *

*

ORDER No.: *

PAGE: 2

OF: 9

SUBMITTED BY : ARTL

DATE SUBMITTED : 30/11/07

NO OF SAMPLES : 22

QUANTITY REP.: *

SAMPLING METHOD: AS1289.1.2.1

CLAUSE: 6.5.3

SPECIFICATION: *

REGISTRATION No : **S07-365**

				SAMPLE NUMBER :	9B	9C	10A	11C	11D
				SITE or LOCATION :	BH9	BH9	BH10	BH11	BH11
				DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):	0.6-0.9	1.5-2.0	0.2-0.5	4.0-4.45	3.5-5.95
				SPECIFIED LIMITS LISTED BELOW FOR :	* *	*	*	*	*
TESTS				PRETREATMENT :	* *	*	*	*	*
AS1289.3.6.1			PASS 19.0mm SIEVE %	*		*	*	*	*
			PASS 13.2mm SIEVE %	*	*	*	*	*	*
			PASS 9.50mm SIEVE %	*	*	*	*	*	*
			PASS 6.70mm SIEVE %	*	*	*	*	*	*
			PASS 4.75mm SIEVE %	*	*	100	*	*	*
			PASS 2.36mm SIEVE %	*	*	98	*	*	*
			PASS 1.18mm SIEVE %	*	*	90	*	*	*
			PASS 600um SIEVE %	*	*	85	*	*	*
			PASS 425um SIEVE %	*	*	83	*	*	*
			PASS 300um SIEVE %	*	*	81	*	*	*
			PASS 212um SIEVE %	*	*	79	*	*	*
			PASS 150um SIEVE %	*	*	78	*	*	*
			PASS 75um SIEVE %	*	*	75	*	*	*
T107	WHOLE SAMPLE		PASS 425 um SIEVE %	*	*	*	*	*	*
			PASS 75 um SIEVE %	*	*	*	*	*	*
			LESS THAN 13.5 um %	*	*	*	*	*	*
T107	-2.36mm		PASS 425 um SIEVE %	*	*	*	*	*	*
			PASS 75 um SIEVE %	*	*	*	*	*	*
			LESS THAN 13.5 um %	*	*	*	*	*	*
RATIOS		A -	PASS 425 um %	*	*	*	*	*	*
		B -	PASS 75/425 um %	*	*	*	*	*	*
		C -	BELOW 13.5/75 um %	*	*	*	*	*	*
AS1289.3.1.2			LIQUID LIMIT %	*	*	60	*	*	*
AS1289.3.2.1			PLASTIC LIMIT %	*	*	17	*	*	*
AS1289.3.3.1			PLASTICITY INDEX %	*	*	43	*	*	*
			PREPARATION METHOD	*	*	AS1289.1.1-5.3	*	*	*
T111			MAX. DRY DENSITY t/m3	*	*	*	*	*	*
			OPTIMUM MOISTURE CONTENT %	*	*	*	*	*	*
			METHOD A or B	*	*	*	*	*	*
T114			M.D.C.S. Mpa	*	*	*	*	*	*
			MOISTURE CONTENT %	*	*	*	*	*	*
			DRY DENSITY t/m3	*	*	*	*	*	*
T211			LOOSE UNIT MASS t/m3	*	*	*	*	*	*
T213			PARTICLE SHAPE (2:1) % MISSHAPEN	*	*	*	*	*	*
T213			PARTICLE SHAPE (3:1) % MISSHAPEN	*	*	*	*	*	*
T215			SIZE OF TEST PORTION (mm)	*	*	*	*	*	*
			DRY STRENGTH kN	*	*	*	*	*	*
			WET STRENGTH kN	*	*	*	*	*	*
			WET/DRY STRENGTH VARIATION %	*	*	*	*	*	*
T113			LINEAR SHRINKAGE %	*	*	*	*	*	*
T120			MOISTURE CONTENT %	*	*	*	12.5	6.7	11.8	11.3

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NATA

WORLD RECOGNISED ACCREDITATION

Number: 4679

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APPROVED SIGNATORY : ..... B. M. ROWE Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT

PROPOSED USE : DESIGN

MATERIAL TYPE : VARIOUS

LOT No.: *

*

ORDER No.: *

SUBMITTED BY : ARTL

DATE SUBMITTED : 30/11/07

NO OF SAMPLES : 22

QUANTITY REP.: *

SAMPLING METHOD: AS1289.1.2.1

CLAUSE: 6.5.3

SPECIFICATION: *

REGISTRATION No : **S07-365**

				SAMPLE NUMBER :	11E	12A	14A	14B	18B
				SITE or LOCATION :	BH11	BH12	BH14	BH14	BH18
				DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):	8.5-8.65	0.3-0.8	0.1-0.4	0.7-1.2	2.5-2.95
			SPECIFIED LIMITS LISTED BELOW FOR :	* *	*	*	*	*	*
TESTS			PRETREATMENT :	* *	*	*	*	*	*
AS1289.3.6.1			PASS 19.0mm SIEVE %	*	*	*	*	*	*
			PASS 13.2mm SIEVE %	* *	*	*	*	*	100
			PASS 9.50mm SIEVE %	* *	*	*	*	*	99
			PASS 6.70mm SIEVE %	* *	*	100	*	*	98
			PASS 4.75mm SIEVE %	* *	*	98	*	*	97
			PASS 2.36mm SIEVE %	* *	*	75	*	*	89
			PASS 1.18mm SIEVE %	* *	*	59	*	*	77
			PASS 600um SIEVE %	* *	*	55	*	*	72
			PASS 425um SIEVE %	* *	*	54	*	*	70
			PASS 300um SIEVE %	* *	*	53	*	*	68
			PASS 212um SIEVE %	* *	*	52	*	*	66
			PASS 150um SIEVE %	* *	*	51	*	*	64
			PASS 75um SIEVE %	* *	*	48	*	*	60
T107		WHOLE	PASS 425 um SIEVE %	* *	*	*	*	*	*
		SAMPLE	PASS 75 um SIEVE %	* *	*	*	*	*	*
			LESS THAN 13.5 um %	* *	*	*	*	*	*
T107			PASS 425 um SIEVE %	* *	*	*	*	*	*
		-2.36mm	PASS 75 um SIEVE %	* *	*	*	*	*	*
			LESS THAN 13.5 um %	* *	*	*	*	*	*
		A -	PASS 425 um %	* *	*	*	*	*	*
RATIOS		B -	PASS 75/425 um %	* *	*	*	*	*	*
		C -	BELOW 13.5/75 um %	* *	*	*	*	*	*
AS1289.3.1.2			LIQUID LIMIT %	* *	*	52	*	*	35
AS1289.3.2.1			PLASTIC LIMIT %	* *	*	16	*	*	14
AS1289.3.3.1			PLASTICITY INDEX %	* *	*	36	*	*	21
			PREPARATION METHOD	* *	*	AS1289.1.1-5.3	*	*	AS1289.1.1-5.3
T111			MAX. DRY DENSITY t/m3	* *	*	*	*	*	*
			OPTIMUM MOISTURE CONTENT %	* *	*	*	*	*	*
			METHOD A or B	* *	*	*	*	*	*
T114			M.D.C.S. Mpa	* *	*	*	*	*	*
			MOISTURE CONTENT %	* *	*	*	*	*	*
			DRY DENSITY t/m3	* *	*	*	*	*	*
T211			LOOSE UNIT MASS t/m3	* *	*	*	*	*	*
T213			PARTICLE SHAPE (2:1) % MISSHAPEN	* *	*	*	*	*	*
T213			PARTICLE SHAPE (3:1) % MISSHAPEN	* *	*	*	*	*	*
T215			SIZE OF TEST PORTION (mm)	* *	*	*	*	*	*
			DRY STRENGTH kN	* *	*	*	*	*	*
			WET STRENGTH kN	* *	*	*	*	*	*
			WET/DRY STRENGTH VARIATION %	* *	*	*	*	*	*
T113			LINEAR SHRINKAGE %	* *	*	*	*	*	*
T120			MOISTURE CONTENT %	* *	*	10.3	8.9	6.5	7.0	*

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Number: 4679

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APPROVED SIGNATORY : B. M. ROWE Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT

PROPOSED USE : DESIGN

MATERIAL TYPE : VARIOUS

LOT No.: *

*

ORDER No.: *

SUBMITTED BY : ARTL

DATE SUBMITTED : 30/11/07

NO OF SAMPLES : 22

QUANTITY REP.: *

SAMPLING METHOD: AS1289.1.2.1

CLAUSE: 6.5.3

SPECIFICATION: *

REGISTRATION No : **S07-365**

				SAMPLE NUMBER :	19A	21A	21B	22A	24B
				SITE or LOCATION :	BH19	BH21	BH21	BH22	BH24
				DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):	0.3-0.6	0.2-0.4	0.7-1.1	0.3-0.6	1.2-1.5
			SPECIFIED LIMITS LISTED BELOW FOR :	* *	*	*	*	*	*
TESTS			PRETREATMENT :	* *	*	*	*	*	*
AS1289.3.6.1			PASS 19.0mm SIEVE %	*	*	*	*	*	*
			PASS 13.2mm SIEVE %	* *	*	*	*	*	*
			PASS 9.50mm SIEVE %	* *	*	*	*	*	*
			PASS 6.70mm SIEVE %	* *	*	100	*	*	*
			PASS 4.75mm SIEVE %	* *	100	99	*	*	*
			PASS 2.36mm SIEVE %	* *	99	96	*	*	100
			PASS 1.18mm SIEVE %	* *	87	88	*	*	97
			PASS 600um SIEVE %	* *	80	82	*	*	94
			PASS 425um SIEVE %	* *	77	80	*	*	94
			PASS 300um SIEVE %	* *	75	78	*	*	93
			PASS 212um SIEVE %	* *	74	76	*	*	92
			PASS 150um SIEVE %	* *	72	74	*	*	91
			PASS 75um SIEVE %	* *	69	70	*	*	89
T107		WHOLE SAMPLE	PASS 425 um SIEVE %	* *	*	*	*	*	*
			PASS 75 um SIEVE %	* *	*	*	*	*	*
			LESS THAN 13.5 um %	* *	*	*	*	*	*
T107		-2.36mm	PASS 425 um SIEVE %	* *	*	*	*	*	*
			PASS 75 um SIEVE %	* *	*	*	*	*	*
			LESS THAN 13.5 um %	* *	*	*	*	*	*
RATIOS		A -	PASS 425 um %	* *	*	*	*	*	*
		B -	PASS 75/425 um %	* *	*	*	*	*	*
		C -	BELOW 13.5/75 um %	* *	*	*	*	*	*
AS1289.3.1.2			LIQUID LIMIT %	* *	*	*	*	*	56
AS1289.3.2.1			PLASTIC LIMIT %	* *	*	*	*	*	15
AS1289.3.3.1			PLASTICITY INDEX %	* *	*	*	*	*	41
			PREPARATION METHOD	* *	*	*	*	*	AS1289.1.1-5.3
T111			MAX. DRY DENSITY t/m3	* *	*	*	*	*	*
			OPTIMUM MOISTURE CONTENT %	* *	*	*	*	*	*
			METHOD A or B	* *	*	*	*	*	*
T114			M.D.C.S. Mpa	* *	*	*	*	*	*
			MOISTURE CONTENT %	* *	*	*	*	*	*
			DRY DENSITY t/m3	* *	*	*	*	*	*
T211			LOOSE UNIT MASS t/m3	* *	*	*	*	*	*
T213			PARTICLE SHAPE (2:1) % MISSHAPEN	* *	*	*	*	*	*
T213			PARTICLE SHAPE (3:1) % MISSHAPEN	* *	*	*	*	*	*
T215			SIZE OF TEST PORTION (mm)	* *	*	*	*	*	*
			DRY STRENGTH kN	* *	*	*	*	*	*
			WET STRENGTH kN	* *	*	*	*	*	*
			WET/DRY STRENGTH VARIATION %	* *	*	*	*	*	*
T113			LINEAR SHRINKAGE %	* *	*	*	*	*	*
T120			MOISTURE CONTENT %	* *	6.8	5.7	8.1	12.1	*

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APPROVED SIGNATORY : ..... B. M. ROWE Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

SUBMITTED BY : ARTL
DATE SUBMITTED : 30/11/07
NO OF SAMPLES : 22
QUANTITY REP.: *
SAMPLING METHOD: AS1289.1.2.1
CLAUSE: 6.5.3
SPECIFICATION: *

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA
JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT
PROPOSED USE : DESIGN
MATERIAL TYPE : VARIOUS

LOT No.: *
*
ORDER No.: *

REGISTRATION No : **S07-365**

				SAMPLE NUMBER :	25B	27B	15A	24A	*
				SITE or LOCATION :	BH25	BH27	BH15	BH24	*
				DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):	1.0-1.4	1.2-1.5	0.2-0.4	0.5-0.8	*
			SPECIFIED LIMITS LISTED BELOW FOR :	*	*	*	*	*	*
TESTS			PRETREATMENT :	*	*	*	*	*	*
AS1289.3.6.1			PASS 19.0mm SIEVE %	*		*	*	*	*
			PASS 13.2mm SIEVE %	*	*	*	*	*	*
			PASS 9.50mm SIEVE %	*	*	*	*	*	*
			PASS 6.70mm SIEVE %	*	*	*	*	*	*
			PASS 4.75mm SIEVE %	*	*	*	100	*	*
			PASS 2.36mm SIEVE %	*	*	*	99	*	*
			PASS 1.18mm SIEVE %	*	*	*	96	*	*
			PASS 600um SIEVE %	*	*	*	93	*	*
			PASS 425um SIEVE %	*	*	*	91	*	*
			PASS 300um SIEVE %	*	*	*	89	*	*
			PASS 212um SIEVE %	*	*	*	88	*	*
			PASS 150um SIEVE %	*	*	*	86	*	*
			PASS 75um SIEVE %	*	*	*	83	*	*
T107		WHOLE SAMPLE	PASS 425 um SIEVE %	*	*	*	*	*	*
			PASS 75 um SIEVE %	*	*	*	*	*	*
			LESS THAN 13.5 um %	*	*	*	*	*	*
T107		-2.36mm	PASS 425 um SIEVE %	*	*	*	*	*	*
			PASS 75 um SIEVE %	*	*	*	*	*	*
			LESS THAN 13.5 um %	*	*	*	*	*	*
RATIOS		A -	PASS 425 um %	*	*	*	*	*	*
		B -	PASS 75/425 um %	*	*	*	*	*	*
		C -	BELOW 13.5/75 um %	*	*	*	*	*	*
AS1289.3.1.2			LIQUID LIMIT %	*	*	*	46	44	48	*
AS1289.3.2.1			PLASTIC LIMIT %	*	*	*	16	15	16	*
AS1289.3.3.1			PLASTICITY INDEX %	*	*	*	30	29	32	*
			PREPARATION METHOD	*	*	*	AS1289.1.1-5.3	AS1289.1.1-5.3	AS1289.1.1-5.3	*
T111			MAX. DRY DENSITY t/m3	*	*	*	*	*	*	*
			OPTIMUM MOISTURE CONTENT %	*	*	*	*	*	*	*
			METHOD A or B	*	*	*	*	*	*	*
T114			M.D.C.S. Mpa	*	*	*	*	*	*	*
			MOISTURE CONTENT %	*	*	*	*	*	*	*
			DRY DENSITY t/m3	*	*	*	*	*	*	*
T211			LOOSE UNIT MASS t/m3	*	*	*	*	*	*	*
T213			PARTICLE SHAPE (2:1) % MISSHAPEN	*	*	*	*	*	*	*
T213			PARTICLE SHAPE (3:1) % MISSHAPEN	*	*	*	*	*	*	*
T215			SIZE OF TEST PORTION (mm)	*	*	*	*	*	*	*
			DRY STRENGTH kN	*	*	*	*	*	*	*
			WET STRENGTH kN	*	*	*	*	*	*	*
			WET/DRY STRENGTH VARIATION %	*	*	*	*	*	*	*
T113			LINEAR SHRINKAGE %	*	*	*	*	*	*	*
T120			MOISTURE CONTENT %	*	*	8.4	10.2	*	*	*

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Number: 4679

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APPROVED SIGNATORY : B. M. ROWE Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT

PROPOSED USE : DESIGN

MATERIAL TYPE : VARIOUS

LOT No.: *

*

ORDER No.: *

SUBMITTED BY : ARTL

DATE SUBMITTED : 30/11/07

NO OF SAMPLES : 22

QUANTITY REP.: *

SAMPLING METHOD: AS1289.1.2.1

CLAUSE: 6.5.3

SPECIFICATION: *

REGISTRATION No : **S07-365**

				SAMPLE NUMBER :	3E	4A	4B	4C	4D
				SITE or LOCATION :	BH4	BH4	BH4	BH4	BH4
				DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):	1.8-2.0	0.1-0.3	0.4-0.6	0.8-1.0	1.6-1.9
				SPECIFIED LIMITS LISTED BELOW FOR :	* *	*	*	*	*
TESTS				PRETREATMENT :	* *	*	*	*	*
AS1289.3.6.1			PASS 19.0mm SIEVE %		*	*	*	*	*
			PASS 13.2mm SIEVE %		* *	*	*	*	*
			PASS 9.50mm SIEVE %		* *	*	*	*	*
			PASS 6.70mm SIEVE %		* *	*	*	*	*
			PASS 4.75mm SIEVE %		* *	*	*	*	*
			PASS 2.36mm SIEVE %		* *	*	*	*	*
			PASS 1.18mm SIEVE %		* *	*	*	*	*
			PASS 600um SIEVE %		* *	*	*	*	*
			PASS 425um SIEVE %		* *	*	*	*	*
			PASS 300um SIEVE %		* *	*	*	*	*
			PASS 212um SIEVE %		* *	*	*	*	*
			PASS 150um SIEVE %		* *	*	*	*	*
			PASS 75um SIEVE %		* *	*	*	*	*
T107		WHOLE SAMPLE	PASS 425 um SIEVE %		* *	*	*	*	*
			PASS 75 um SIEVE %		* *	*	*	*	*
			LESS THAN 13.5 um %		* *	*	*	*	*
T107		-2.36mm	PASS 425 um SIEVE %		* *	*	*	*	*
			PASS 75 um SIEVE %		* *	*	*	*	*
			LESS THAN 13.5 um %		* *	*	*	*	*
RATIOS		A -	PASS 425 um %		* *	*	*	*	*
		B -	PASS 75/425 um %		* *	*	*	*	*
		C -	BELOW 13.5/75 um %		* *	*	*	*	*
AS1289.3.1.2			LIQUID LIMIT %		* *	*	*	*	*
AS1289.3.2.1			PLASTIC LIMIT %		* *	*	*	*	*
AS1289.3.3.1			PLASTICITY INDEX %		* *	*	*	*	*
			PREPARATION METHOD		* *	*	*	*	*
T111			MAX. DRY DENSITY t/m3		* *	*	*	*	*
			OPTIMUM MOISTURE CONTENT %		* *	*	*	*	*
			METHOD A or B		* *	*	*	*	*
T114			M.D.C.S. Mpa		* *	*	*	*	*
			MOISTURE CONTENT %		* *	*	*	*	*
			DRY DENSITY t/m3		* *	*	*	*	*
T211			LOOSE UNIT MASS t/m3		* *	*	*	*	*
T213			PARTICLE SHAPE (2:1) % MISSHAPEN		* *	*	*	*	*
T213			PARTICLE SHAPE (3:1) % MISSHAPEN		* *	*	*	*	*
T215			SIZE OF TEST PORTION (mm)		* *	*	*	*	*
			DRY STRENGTH kN		* *	*	*	*	*
			WET STRENGTH kN		* *	*	*	*	*
			WET/DRY STRENGTH VARIATION %		* *	*	*	*	*
T113			LINEAR SHRINKAGE %		* *	5.5	5.0	7.5	12.5	12.0
T120			MOISTURE CONTENT %		* *	*	*	*	*

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APPROVED SIGNATORY : B. M. ROWE Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT

PROPOSED USE : DESIGN

MATERIAL TYPE : VARIOUS

LOT No.: *

*

ORDER No.: *

SUBMITTED BY : ARTL

DATE SUBMITTED : 30/11/07

NO OF SAMPLES : 22

QUANTITY REP.: *

SAMPLING METHOD: AS1289.1.2.1

CLAUSE: 6.5.3

SPECIFICATION: *

REGISTRATION No : **S07-365**

				SAMPLE NUMBER :	28A	28B	28C	28D	28E
				SITE or LOCATION :	BH28	BH28	BH28	BH28	BH28
				DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):	0.1-0.3	0.4-0.6	0.7-0.9	1.1-1.5	1.8-2.0
				SPECIFIED LIMITS LISTED BELOW FOR :	* *	*	*	*	*
TESTS				PRETREATMENT :	* *	*	*	*	*
AS1289.3.6.1			PASS 19.0mm SIEVE %		*	*	*	*	*
			PASS 13.2mm SIEVE %		* *	*	*	*	*
			PASS 9.50mm SIEVE %		* *	*	*	*	*
			PASS 6.70mm SIEVE %		* *	*	*	*	*
			PASS 4.75mm SIEVE %		* *	*	*	*	*
			PASS 2.36mm SIEVE %		* *	*	*	*	*
			PASS 1.18mm SIEVE %		* *	*	*	*	*
			PASS 600um SIEVE %		* *	*	*	*	*
			PASS 425um SIEVE %		* *	*	*	*	*
			PASS 300um SIEVE %		* *	*	*	*	*
			PASS 212um SIEVE %		* *	*	*	*	*
			PASS 150um SIEVE %		* *	*	*	*	*
			PASS 75um SIEVE %		* *	*	*	*	*
T107	WHOLE SAMPLE		PASS 425 um SIEVE %		* *	*	*	*	*
			PASS 75 um SIEVE %		* *	*	*	*	*
			LESS THAN 13.5 um %		* *	*	*	*	*
T107	-2.36mm		PASS 425 um SIEVE %		* *	*	*	*	*
			PASS 75 um SIEVE %		* *	*	*	*	*
			LESS THAN 13.5 um %		* *	*	*	*	*
RATIOS		A -	PASS 425 um %		* *	*	*	*	*
		B -	PASS 75/425 um %		* *	*	*	*	*
		C -	BELOW 13.5/75 um %		* *	*	*	*	*
AS1289.3.1.2			LIQUID LIMIT %		* *	*	*	*	*
AS1289.3.2.1			PLASTIC LIMIT %		* *	*	*	*	*
AS1289.3.3.1			PLASTICITY INDEX %		* *	*	*	*	*
			PREPARATION METHOD		* *	*	*	*	*
T111			MAX. DRY DENSITY t/m3		* *	*	*	*	*
			OPTIMUM MOISTURE CONTENT %		* *	*	*	*	*
			METHOD A or B		* *	*	*	*	*
T114			M.D.C.S. Mpa		* *	*	*	*	*
			MOISTURE CONTENT %		* *	*	*	*	*
			DRY DENSITY t/m3		* *	*	*	*	*
T211			LOOSE UNIT MASS t/m3		* *	*	*	*	*
T213			PARTICLE SHAPE (2:1) % MISSHAPEN		* *	*	*	*	*
T213			PARTICLE SHAPE (3:1) % MISSHAPEN		* *	*	*	*	*
T215			SIZE OF TEST PORTION (mm)		* *	*	*	*	*
			DRY STRENGTH kN		* *	*	*	*	*
			WET STRENGTH kN		* *	*	*	*	*
			WET/DRY STRENGTH VARIATION %		* *	*	*	*	*
T113			LINEAR SHRINKAGE %		* *	4.5	7.0	8.5	12.0	12.0
T120			MOISTURE CONTENT %		* *	*	*	*	*

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NATA

WORLD RECOGNISED ACCREDITATION

Number: 4679

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APPROVED SIGNATORY : B. M. ROWE Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT

PROPOSED USE : DESIGN

MATERIAL TYPE : VARIOUS

LOT No.: *

*

ORDER No.: *

SUBMITTED BY : ARTL

DATE SUBMITTED : 30/11/07

NO OF SAMPLES : 22

QUANTITY REP.: *

SAMPLING METHOD: AS1289.1.2.1

CLAUSE: 6.5.3

SPECIFICATION: *

REGISTRATION No : **S07-365**

		SAMPLE NUMBER :		29A	29B	29B	29D	30A
		SITE or LOCATION :		BH29	BH29	BH29	BH29	BH30
		DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):		0.1-0.3	0.5-0.7	1.1-1.4	1.8-2.0	0.1-0.3
		SPECIFIED LIMITS LISTED BELOW FOR :	*	*	*	*	*	*	*
TESTS		PRETREATMENT :	*	*	*	*	*	*	*
AS1289.3.6.1		PASS 19.0mm SIEVE %	*		*	*	*	*	*
		PASS 13.2mm SIEVE %	*	*	*	*	*	*	*
		PASS 9.50mm SIEVE %	*	*	*	*	*	*	*
		PASS 6.70mm SIEVE %	*	*	*	*	*	*	*
		PASS 4.75mm SIEVE %	*	*	*	*	*	*	*
		PASS 2.36mm SIEVE %	*	*	*	*	*	*	*
		PASS 1.18mm SIEVE %	*	*	*	*	*	*	*
		PASS 600um SIEVE %	*	*	*	*	*	*	*
		PASS 425um SIEVE %	*	*	*	*	*	*	*
		PASS 300um SIEVE %	*	*	*	*	*	*	*
		PASS 212um SIEVE %	*	*	*	*	*	*	*
		PASS 150um SIEVE %	*	*	*	*	*	*	*
		PASS 75um SIEVE %	*	*	*	*	*	*	*
T107	WHOLE SAMPLE	PASS 425 um SIEVE %	*	*	*	*	*	*	*
		PASS 75 um SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5 um %	*	*	*	*	*	*	*
T107	-2.36mm	PASS 425 um SIEVE %	*	*	*	*	*	*	*
		PASS 75 um SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5 um %	*	*	*	*	*	*	*
RATIOS	A -	PASS 425 um %	*	*	*	*	*	*	*
	B -	PASS 75/425 um %	*	*	*	*	*	*	*
	C -	BELOW 13.5/75 um %	*	*	*	*	*	*	*
AS1289.3.1.2		LIQUID LIMIT %	*	*	*	*	*	*	*
AS1289.3.2.1		PLASTIC LIMIT %	*	*	*	*	*	*	*
AS1289.3.3.1		PLASTICITY INDEX %	*	*	*	*	*	*	*
		PREPARATION METHOD	*	*	*	*	*	*	*
T111		MAX. DRY DENSITY t/m3	*	*	*	*	*	*	*
		OPTIMUM MOISTURE CONTENT %	*	*	*	*	*	*	*
		METHOD A or B	*	*	*	*	*	*	*
T114		M.D.C.S. Mpa	*	*	*	*	*	*	*
		MOISTURE CONTENT %	*	*	*	*	*	*	*
		DRY DENSITY t/m3	*	*	*	*	*	*	*
T211		LOOSE UNIT MASS t/m3	*	*	*	*	*	*	*
T213		PARTICLE SHAPE (2:1) % MISSHAPEN	*	*	*	*	*	*	*
T213		PARTICLE SHAPE (3:1) % MISSHAPEN	*	*	*	*	*	*	*
T215		SIZE OF TEST PORTION (mm)	*	*	*	*	*	*	*
		DRY STRENGTH kN	*	*	*	*	*	*	*
		WET STRENGTH kN	*	*	*	*	*	*	*
		WET/DRY STRENGTH VARIATION %	*	*	*	*	*	*	*
T113		LINEAR SHRINKAGE %	*	*	*	*	*	*	*
T120		MOISTURE CONTENT %	*	*	*	*	*	*	*

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Number: 4679

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APPROVED SIGNATORY : .....

B. M. ROWE
Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

PAVEMENT MATERIALS, FILL, SUBGRADE AND SOILS

SUBMITTED BY : ARTL
DATE SUBMITTED : 30/11/07
NO OF SAMPLES : 22
QUANTITY REP.: *
SAMPLING METHOD: AS1289.1.2.1
CLAUSE: 6.5.3
SPECIFICATION: *

CLIENT : RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA
JOB DESCRIPTION : PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

MATERIAL SOURCE : BOMEN BIO-DIESEL PLANT
PROPOSED USE : DESIGN
MATERIAL TYPE : VARIOUS

LOT No.: *
*
ORDER No.: *

REGISTRATION No : **S07-365**

		SAMPLE NUMBER :		30B	30C	30D	*	*
		SITE or LOCATION :		BH30	BH30	BH30	*	*
		DEPTHS BETWEEN WHICH SAMPLES TAKEN (m):		0.4-0.6	0.8-1.1	1.3-1.6	*	*
		SPECIFIED LIMITS LISTED BELOW FOR :	*	*	*	*	*	*	*
TESTS		PRETREATMENT :	*	*	*	*	*	*	*
AS1289.3.6.1		PASS 19.0mm SIEVE %	*		*	*	*	*	*
		PASS 13.2mm SIEVE %	*	*	*	*	*	*	*
		PASS 9.50mm SIEVE %	*	*	*	*	*	*	*
		PASS 6.70mm SIEVE %	*	*	*	*	*	*	*
		PASS 4.75mm SIEVE %	*	*	*	*	*	*	*
		PASS 2.36mm SIEVE %	*	*	*	*	*	*	*
		PASS 1.18mm SIEVE %	*	*	*	*	*	*	*
		PASS 600um SIEVE %	*	*	*	*	*	*	*
		PASS 425um SIEVE %	*	*	*	*	*	*	*
		PASS 300um SIEVE %	*	*	*	*	*	*	*
		PASS 212um SIEVE %	*	*	*	*	*	*	*
		PASS 150um SIEVE %	*	*	*	*	*	*	*
		PASS 75um SIEVE %	*	*	*	*	*	*	*
T107	WHOLE SAMPLE	PASS 425 um SIEVE %	*	*	*	*	*	*	*
		PASS 75 um SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5 um %	*	*	*	*	*	*	*
T107	-2.36mm	PASS 425 um SIEVE %	*	*	*	*	*	*	*
		PASS 75 um SIEVE %	*	*	*	*	*	*	*
		LESS THAN 13.5 um %	*	*	*	*	*	*	*
RATIOS	A -	PASS 425 um %	*	*	*	*	*	*	*
	B -	PASS 75/425 um %	*	*	*	*	*	*	*
	C -	BELOW 13.5/75 um %	*	*	*	*	*	*	*
AS1289.3.1.2		LIQUID LIMIT %	*	*	*	*	*	*	*
AS1289.3.2.1		PLASTIC LIMIT %	*	*	*	*	*	*	*
AS1289.3.3.1		PLASTICITY INDEX %	*	*	*	*	*	*	*
		PREPARATION METHOD	*	*	*	*	*	*	*
T111		MAX. DRY DENSITY t/m3	*	*	*	*	*	*	*
		OPTIMUM MOISTURE CONTENT %	*	*	*	*	*	*	*
		METHOD A or B	*	*	*	*	*	*	*
T114		M.D.C.S. Mpa	*	*	*	*	*	*	*
		MOISTURE CONTENT %	*	*	*	*	*	*	*
		DRY DENSITY t/m3	*	*	*	*	*	*	*
T211		LOOSE UNIT MASS t/m3	*	*	*	*	*	*	*
T213		PARTICLE SHAPE (2:1) % MISSHAPEN	*	*	*	*	*	*	*
T213		PARTICLE SHAPE (3:1) % MISSHAPEN	*	*	*	*	*	*	*
T215		SIZE OF TEST PORTION (mm)	*	*	*	*	*	*	*
		DRY STRENGTH kN	*	*	*	*	*	*	*
		WET STRENGTH kN	*	*	*	*	*	*	*
		WET/DRY STRENGTH VARIATION %	*	*	*	*	*	*	*
T113		LINEAR SHRINKAGE %	*	*	7.5	10.0	12.0	*	*
T120		MOISTURE CONTENT %	*	*	*	*	*	*	*

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APPROVED SIGNATORY : B. M. ROWE Lab Manager

DATE: 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

4/2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

CALIFORNIA BEARING RATIO OF SOILS AND GRAVELS

SUBMITTED BY : ARTL
NO OF SAMPLES : 4
DATE RECEIVED : 30/11/07
TEST METHODS : T111
T117
T120
*

CLIENT: RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA
JOB DESCRIPTION: PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN WAGGA WAGGA
*
ORDER No.: *

SOURCE OF MATERIAL : BOMEN BIO-DIESEL PLANT LOT NO: *

SAMPLING PROCEDURE: AS1289.1.2.1

PROPOSED USE: DESIGN

REGISTRATION NO : **S07-365**

SAMPLE NO (SPECIMENS A & B)	BH1 - A/B		BH17 - A/B/C		BH2A	
SITE OR LOCATION	BH1		BH17		BH2	
DEPTHS BETWEEN WHICH SAMPLES TAKEN (mm)	200-1000		200-1500		300-500	
ADDITIVE IF STABILISED	*		*		*	
AMOUNT OF ADDITIVE (%)	*		*		*	
TYPE OF COMPACTION (Standard/modified)	STANDARD		STANDARD		STANDARD	
MATERIAL RETAINED ON THE 19.0mm SIEVE (%)	NIL		NIL		NIL	
OPTIMUM MOISTURE CONTENT (%)	22.9		24.0		15.8	
MAXIMUM DRY DENSITY (t/m3)	1.64		1.62		1.80	
MOULDING MOISTURE CONTENT (%)	22.8	*	24.0	*	15.6	*
DRY DENSITY OF TEST SPECIMEN (t/m3)	1.56	*	1.54	*	1.72	*
SPECIFIED % OF MDD (t/m3)	95	*	95	*	95	*
ACTUAL % OF MDD (t/m3)	95	*	95	*	95.5	*
MOISTURE CONTENTS : TOP 30 mm	24.8	*	26.3	*	17.8	*
WHOLE SAMPLE	23.8	*	26.0	*	16.2	*
ABSORBTION (%)	1.0	*	2.0	*	0.6	*
NUMBER OF DAYS SOAKING	4		4		4	
SWELL (%)	0.0	*	0.0	*	0.2	*
CBR OBTAINED FROM PENETRATION (mm)	2.5	*	2.5	*	2.5	*
CALIFORNIA BEARING RATIO (%)	8.0	*	8.0	*	7.0	*

COMMENTS: *
*

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APPROVED SIGNATORY : B. M. ROWE Lab Manager

DATE : 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

4/2 Riedell St. Wagga Wagga N.S.W. 2650

PAGE: 2
OF: 2

TEST REPORT

CALIFORNIA BEARING RATIO OF SOILS AND GRAVELS

SUBMITTED BY : ARTL
NO OF SAMPLES : 4
DATE RECEIVED : 30/11/07
TEST METHODS : T111
T117
T120
*

CLIENT: RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA
JOB DESCRIPTION: PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN WAGGA WAGGA
*
ORDER No.: *

SOURCE OF MATERIAL : BOMEN BIO-DIESEL PLANT LOT NO: *
SAMPLING PROCEDURE: AS1289.1.2.1

PROPOSED USE: DESIGN
REGISTRATION NO : **S07-365**

SAMPLE NO (SPECIMENS A & B)	BH3A		*		*	
SITE OR LOCATION	BH3		*		*	
DEPTHS BETWEEN WHICH SAMPLES TAKEN (mm)	300-500		*		*	
ADDITIVE IF STABILISED	*		*		*	
AMOUNT OF ADDITIVE (%)	*		*		*	
TYPE OF COMPACTION (Standard/modified)	STANDARD		*		*	
MATERIAL RETAINED ON THE 19.0mm SIEVE (%)	NIL		*		*	
OPTIMUM MOISTURE CONTENT (%)	19.8		*		*	
MAXIMUM DRY DENSITY (t/m3)	1.67		*		*	
MOULDING MOISTURE CONTENT (%)	19.2	*	*	*	*	*
DRY DENSITY OF TEST SPECIMEN (t/m3)	1.59	*	*	*	*	*
SPECIFIED % OF MDD (t/m3)	95	*	*	*	*	*
ACTUAL % OF MDD (t/m3)	95.5	*	*	*	*	*
MOISTURE CONTENTS : TOP 30 mm	22.0	*	*	*	*	*
WHOLE SAMPLE	21.9	*	*	*	*	*
ABSORBTION (%)	2.7	*	*	*	*	*
NUMBER OF DAYS SOAKING	4		*		*	
SWELL (%)	0.1	*	*	*	*	*
CBR OBTAINED FROM PENETRATION (mm)	2.5	*	*	*	*	*
CALIFORNIA BEARING RATIO (%)	7.0	*	*	*	*	*

COMMENTS: *
*

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DATE : 14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

4/ 2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

SUBMITTED BY : ARTL

SOIL REACTIVITY- DETERMINATION OF THE SHRINKAGE INDEX OF A SOIL
SHRINK SWELL INDEX
REMOULDED

DATE SUBMITTED: 30/11/07

NO OF SAMPLES : 4

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN WAGGA WAGGA

TEST METHODS: AS1289.7.1.1
AS1289.2.1.1.

REGISTRATION NO : **S07-365**

SAMPLE NO:	10A
BOREHOLE No:	BH10
DEPTH (m) :	0.2-0.5
SHRINK SWELL INDEX (ISS)	2.25
INITIAL SWELL M.C. %	23.1
FINAL SWELL M.C. %	25.0
DESCRIPTION OF SOIL:	Silty CLAY; medium plasticity, brown
ESTIMATED PERCENTAGE OF INERT INCLUSIONS:	15.2
EXTENT OF SOIL CRUMBLING DURING SHRINKAGE:	Circumferential
EXTENT OF CRACKING OF SHRINKAGE SPECIMEN:	Throughout the sample
DENSITY OF SPECIMEN (t/m^3)	1.99
MOISTURE ADDED TO ACHIEVE OMC (%)	5
COMPACTIVE EFFORT (BLOWS/ LAYER)	STANDARD
*	
*	
*	
*	
*	
*	
*	
*	

B. M. ROWE
Lab Manager

14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

4/ 2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

SUBMITTED BY : ARTL

SOIL REACTIVITY- DETERMINATION OF THE SHRINKAGE INDEX OF A SOIL

SHRINK SWELL INDEX

REMOULDED

DATE SUBMITTED: 30/11/07

NO OF SAMPLES : 4

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN WAGGA WAGGA

TEST METHODS: AS1289.7.1.1
AS1289.2.1.1.

REGISTRATION NO : **S07-365**

SAMPLE NO:	14B
BOREHOLE No:	BH14
DEPTH (m) :	0.7-1.2
SHRINK SWELL INDEX (ISS)	1.12
INITIAL SWELL M.C. %	16.3
FINAL SWELL M.C. %	20.7
DESCRIPTION OF SOIL:	Silty CLAY; medium plasticity, yellow
ESTIMATED PERCENTAGE OF INERT INCLUSIONS:	15.2
EXTENT OF SOIL CRUMBLING DURING SHRINKAGE:	Circumferential
EXTENT OF CRACKING OF SHRINKAGE SPECIMEN:	Throughout the samples
DENSITY OF SPECIMEN (t/m^3)	2.09
MOISTURE ADDED TO ACHIEVE OMC (%)	5
COMPACTIVE EFFORT (BLOWS/ LAYER)	STANDARD
*	
*	
*	
*	
*	
*	
*	
*	

B. M. ROWE
Lab Manager

14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

4/ 2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

SUBMITTED BY : ARTL

SOIL REACTIVITY- DETERMINATION OF THE SHRINKAGE INDEX OF A SOIL

SHRINK SWELL INDEX

REMOULDED

DATE SUBMITTED: 30/11/07

NO OF SAMPLES : 4

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN WAGGA WAGGA

TEST METHODS: AS1289.7.1.1
AS1289.2.1.1.

REGISTRATION NO : **S07-365**

SAMPLE NO:	21B
BOREHOLE No:	BH21
DEPTH (m) :	0.7-1.1
SHRINK SWELL INDEX (ISS)	1.23
INITIAL SWELL M.C. %	16.9
FINAL SWELL M.C. %	0.8
DESCRIPTION OF SOIL:	Silty CLAY; medium plasticity, yellow brown
ESTIMATED PERCENTAGE OF INERT INCLUSIONS:	15.2
EXTENT OF SOIL CRUMBLING DURING SHRINKAGE:	Circumferential
EXTENT OF CRACKING OF SHRINKAGE SPECIMEN:	Throughout the sample
DENSITY OF SPECIMEN (t/m^3)	1.989
MOISTURE ADDED TO ACHIEVE OMC (%)	5
COMPACTIVE EFFORT (BLOWS/ LAYER)	STANDARD
*	
*	
*	
*	
*	
*	
*	
*	

B. M. ROWE
Lab Manager

14 DEC 2007

AITKEN ROWE Testing Laboratories Pty Ltd

4/ 2 Riedell St. Wagga Wagga N.S.W. 2650

TEST REPORT

SUBMITTED BY : ARTL

SOIL REACTIVITY- DETERMINATION OF THE SHRINKAGE INDEX OF A SOIL

SHRINK SWELL INDEX

REMOULDED

DATE SUBMITTED: 30/11/07

NO OF SAMPLES : 4

CLIENT: RIVERINA OILS AND BIO-ENERGY PTY LTD AUSTRALIA

JOB DESCRIPTION PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN WAGGA WAGGA

TEST METHODS: AS1289.7.1.1
AS1289.2.1.1.

REGISTRATION NO : **S07-365**

SAMPLE NO:	25B
BOREHOLE No:	BH25
DEPTH (m) :	1.0-1.4
SHRINK SWELL INDEX (ISS)	1.88
INITIAL SWELL M.C. %	20.7
FINAL SWELL M.C. %	0
DESCRIPTION OF SOIL:	Silty CLAY; medium plasticity, yellow
ESTIMATED PERCENTAGE OF INERT INCLUSIONS:	5.1
EXTENT OF SOIL CRUMBLING DURING SHRINKAGE:	Circumferential
EXTENT OF CRACKING OF SHRINKAGE SPECIMEN:	Throughout the sample
DENSITY OF SPECIMEN (t/m^3)	2.045
MOISTURE ADDED TO ACHIEVE OMC (%)	0
COMPACTIVE EFFORT (BLOWS/ LAYER)	STANDARD
*	
*	
*	
*	
*	
*	
*	
*	

S. M. ROWE
Lab Manager

14 DEC 2007

Form R27 Revised 15/12/05

Aitken Rowe Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

PERMEABILITY / DISPERSION REPORT

CLIENT: RIVERINA OILS AND BIO-ENERGY P/L
PROJECT: PROPOSED INTERGRATED BIO-DIESEL PLANT - BOMEN - WAGGA WAGGA

PAGE: 1
OF: 1
DATE SUBMITTED: 30/11/07
SUBMITTED BY: ARTL
No.OF SAMPLES: 4
ORDER No.: *
TEST METHODS: AS1289.6.7.2
T111
T120
*
REGISTRATION No: **S07-365**

MATERIAL TYPE: VARIOUS
SOURCE OF MATERIAL: BOMEN BIO-DIESEL PLANT
PORTION OF STRUCTURE: *
SURCHARGES ADDED: NIL
PRESSURE APPLIED: *
% RETAINED ON NOMINAL SIEVE: NIL
NOMINAL SIEVE SIZE: 20mm

SAMPLE No.	BOREHOLE No.	DEPTH (m)	MAX. DRY DENSITY (t/m3)	OPTIMUM MOISTURE (%)	DRY DENSITY OF SPECIMEN (t/m3)	MOULDING MOISTURE (%)	ACTUAL % OF MDD	PERMEABILITY m / sec AS1289.6.7.2	EMERSON CLASS AS1289.3.8.1
28A	BH28	*	1.58	24.3	1.50	24.4	95	1×10^{-9}	2
29A	BH29	*	1.65	21.5	1.57	21.5	95	2×10^{-9}	2
30A	BH30	*	1.60	22.3	1.52	22.2	95	1×10^{-9}	2
31A	BH31	*	1.60	23.1	1.53	22.9	95	1×10^{-9}	2
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*

NATA
WORLD RECOGNISED ACCREDITATION
Number: 4679

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REMARKS: *

APPROVED SIGNATORY: ..... B. M. ROWE Lab Manager

DATE: 14 DEC 2007

Form R23 Revised 29/6/06

Corrosion & Scaling Assessment:
Soil Reporting Profile

CLIENT: **Aitken Rowe Testing Laboratories Pty Limited**
PO Box 5158
WAGGA WAGGA NSW 2650
Attn: Tin Maung

PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **1**
Name: **11A**
Test Type: **pHEC, Sol Cl + SO4**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water (1:5)	8.6	Strong Alkalinity
EC mS/cm (1:5)	.09	Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	370	Low Sulphate
Chloride (1:5) mgCl / kg	250	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows strong alkalinity, low salinity, low sulphate and low chloride levels.

The strong alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. Keep in mind that even a low salinity can relate to a resistivity that can provide a corrosive environment for unprotected steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Aitken Rowe Testing Laboratories Pty Limited**
PO Box 5158
WAGGA WAGGA NSW 2650
Attn: Tin Maung

PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **2**
Name: **11B**
Test Type: **pHEC, Sol Cl + SO4**

Quality System
Quality Endorsed Company
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Sydney Environmental and Soil Laboratory
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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water (1:5)	8.9	Strong Alkalinity
EC mS/cm (1:5)	.16	Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	380	Low Sulphate
Chloride (1:5) mgCl / kg	60	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows strong alkalinity, low salinity, low sulphate and low chloride levels.

The strong alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. Keep in mind that even a low salinity can relate to a resistivity that can provide a corrosive environment for unprotected steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Aitken Rowe Testing Laboratories Pty Limited**
PO Box 5158
WAGGA WAGGA NSW 2650
Attn: Tin Maung

PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **3**
Name: **13A**
Test Type: **pHEC, Sol Cl + SO4**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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TEST	RESULT	COMMENTS
pH in water (1:5)	8.7	Strong Alkalinity
EC mS/cm (1:5)	.11	Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	370	Low Sulphate
Chloride (1:5) mgCl / kg	390	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows strong alkalinity, low salinity, low sulphate and low chloride levels.

The strong alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. Keep in mind that even a low salinity can relate to a resistivity that can provide a corrosive environment for unprotected steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment: Soil Reporting Profile

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PO Box 5158
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Attn: Tin Maung

PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **4**
Name: **18A**
Test Type: **pHEC, Sol Cl + SO4**

Quality System
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AS/NZS ISO 9001: 2000 QEC 21650

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TEST	RESULT	COMMENTS
pH in water (1:5)	7.6	Slight Alkalinity
EC mS/cm (1:5)	.02	Very Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	370	Low Sulphate
Chloride (1:5) mgCl / kg	130	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alkalinity, very low salinity, low sulphate and low chloride levels.

The slight alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. Keep in mind that even a low salinity can relate to a resistivity that can provide a corrosive environment for unprotected steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Aitken Rowe Testing Laboratories Pty Limited**
PO Box 5158
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Attn: Tin Maung

PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **5**
Name: **19B**
Test Type: **pHEC, Sol Cl + SO4**

Quality System
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TEST	RESULT	COMMENTS
pH in water (1:5)	7.7	Slight Alkalinity
EC mS/cm (1:5)	.16	Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	390	Low Sulphate
Chloride (1:5) mgCl / kg	210	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alkalinity, low salinity, low sulphate and low chloride levels.

The slight alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. Keep in mind that even a low salinity can relate to a resistivity that can provide a corrosive environment for unprotected steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment: Soil Reporting Profile

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Attn: Tin Maung

PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **6**
Name: **21C**
Test Type: **pHEC, Sol Cl + SO4**

Quality System
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TEST	RESULT	COMMENTS
pH in water (1:5)	8.1	Moderate Alkalinity
EC mS/cm (1:5)	.09	Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	370	Low Sulphate
Chloride (1:5) mgCl / kg	730	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows moderate alkalinity, low salinity, low sulphate and low chloride levels.

The moderate alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. Keep in mind that even a low salinity can relate to a resistivity that can provide a corrosive environment for unprotected steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment: Soil Reporting Profile

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PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **7**
Name: **27A**
Test Type: **pHEC, Sol Cl + SO4**

Quality System
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TEST	RESULT	COMMENTS
pH in water (1:5)	7.2	Near Neutral pH
EC mS/cm (1:5)	.09	Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	390	Low Sulphate
Chloride (1:5) mgCl / kg	40	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows near neutral pH, low salinity, low sulphate and low chloride levels.

The near neutral pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. Keep in mind that even a low salinity can relate to a resistivity that can provide a corrosive environment for unprotected steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment:
Soil Reporting Profile

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Attn: Tin Maung

PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **8**
Name: **R1**
Test Type: **Resistivity**

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TEST	RESULT	COMMENTS
pH in water (1:5)		
EC mS/cm (1:5)		
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg		
Chloride (1:5) mgCl / kg		
* Resistivity Ω.m	15.9	Medium Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows medium resistivity.

The medium resistivity is considered to provide a mild to moderately corrosive environment towards unprotected steel, determined by permeability class. If the permeability is high then the risk is increased.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment:
Soil Reporting Profile

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PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **9**
Name: **R2**
Test Type: **Resistivity**

Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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TEST	RESULT	COMMENTS
pH in water (1:5)		
EC mS/cm (1:5)		
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg		
Chloride (1:5) mgCl / kg		
* Resistivity Ω.m	17.3	Medium Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows medium resistivity.

The medium resistivity is considered to provide a mild to moderately corrosive environment towards unprotected steel, determined by permeability class. If the permeability is high then the risk is increased.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Aitken Rowe Testing Laboratories Pty Limited**
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PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **10**
Name: **R3**
Test Type: **Resistivity**

Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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TEST	RESULT	COMMENTS
pH in water (1:5)		
EC mS/cm (1:5)		
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg		
Chloride (1:5) mgCl / kg		
* Resistivity Ω.m	18.1	Medium Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows medium resistivity.

The medium resistivity is considered to provide a mild to moderately corrosive environment towards unprotected steel, determined by permeability class. If the permeability is high then the risk is increased.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

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Corrosion & Scaling Assessment:
Soil Reporting Profile

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PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **11**
Name: **R4**
Test Type: **Resistivity**

Quality Endorsed Company
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TEST	RESULT	COMMENTS
pH in water (1:5)		
EC mS/cm (1:5)		
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg		
Chloride (1:5) mgCl / kg		
* Resistivity Ω.m	17.9	Medium Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows medium resistivity.

The medium resistivity is considered to provide a mild to moderately corrosive environment towards unprotected steel, determined by permeability class. If the permeability is high then the risk is increased.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

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Corrosion & Scaling Assessment: Soil Reporting Profile

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PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **12**
Name: **R5**
Test Type: **Resistivity**

Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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TEST	RESULT	COMMENTS
pH in water (1:5)		
EC mS/cm (1:5)		
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg		
Chloride (1:5) mgCl / kg		
* Resistivity Ω.m	16.2	Medium Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows medium resistivity.

The medium resistivity is considered to provide a mild to moderately corrosive environment towards unprotected steel, determined by permeability class. If the permeability is high then the risk is increased.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

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Corrosion & Scaling Assessment:
Soil Reporting Profile

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PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **13**
Name: **R6**
Test Type: **Resistivity**

Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water (1:5)		
EC mS/cm (1:5)		
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg		
Chloride (1:5) mgCl / kg		
* Resistivity Ω.m	15.6	Medium Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows medium resistivity.

The medium resistivity is considered to provide a mild to moderately corrosive environment towards unprotected steel, determined by permeability class. If the permeability is high then the risk is increased.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

Corrosion & Scaling Assessment:
Soil Reporting Profile

CLIENT: **Aitken Rowe Testing Laboratories Pty Limited**
PO Box 5158
WAGGA WAGGA NSW 2650
Attn: Tin Maung

PROJECT: Name: **S07-365**
Location: **Bomen**
SESL Quote N°: Client Job N°: **S07-365** Order N°: **M1035A**
Date Received: **04/12/2007**

SAMPLE: Batch N°: **5105** Sample N°: **14**
Name: **R7**
Test Type: **Resistivity**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water (1:5)		
EC mS/cm (1:5)		
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg		
Chloride (1:5) mgCl / kg		
* Resistivity Ω.m	5.7	Low Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows low resistivity.

The low resistivity is considered to provide a moderate to severely corrosive environment towards unprotected steel, determined by permeability class. If the permeability is high then the risk is increased.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by: Simon Leake

Consultant: Ryan Jacka

Date of Report 12/12/2007

APPENDIX D
CORE PHOTOGRAPHS AND POINT LOAD INDEX TEST RESULTS

PROPOSED INTEGRATED BIO-DIESEL PLANT
299 TRAHAIRS ROAD, BOMEN, WAGGA WAGGA

S07-365 BH8: Start 1.2m – 6.9m

S07-365 BH18: Start 4.0m – 11.9m

AITKEN ROWE TESTING LABORATORIES P/L REGISTRATION NUMBER: S07-365	RIVERINA OILS & BIO-ENERGY PTY LTD AUSTRALIA PROPOSED INTEGRATED BIO-DIESEL PLANT, BOMEN, WAGGA WAGGA CORE BOX PHOTOS of BH8 and BH18

AITKEN ROWE Testing Laboratories Pty Ltd

4/2 Riedell Street, Wagga Wagga 2650

POINT LOAD TEST REPORT

CLIENT : Riverina Oils & Bio - Energy Pty Ltd Australia

JOB DESCRIPTION : Proposed Intedgrated Bio - Diesel Plant, Bomen, Wagga Wagga

MATERIAL SOURCE : Proposed Intedgrated Bio - Diesel Plant, Bomen, Wagga Wagga

PROPOSED USE : Design

MATERIAL TYPE : Granite

PAGE: 1

OF: 1

SUBMITTED BY : ARTL

DATE SUBMITTED : 3/12/2007

NO OF SAMPLES : 10

QUANTITY REP.: *

SAMPLING METHOD: N.M.L.C. Coring

CLAUSE: *

TEST METHOD: T223

REGISTRATION No : **S07-365**

Location	Sample No.	Description	Depth (m)	$I_{S(50)}$ Mpa	Remarks
BH8	8a	Granite	2.29-2.35	0.37	Assessed to be "medium strong"
	8b	"	3.15-3.21	0.87	"
	8c	"	3.70-3.77	0.70	"
	8d	"	4.15-4.23	0.67	"
	8e	"	5.47-5.54	0.82	"
	8f	"	6.55-6.63	0.44	"
BH18	18a	"	4.70-4.79	0.24	Assessed to be "weak"
	18b	"	5.68-5.75	0.18	"
	18c	"	10.72-10.80	0.22	"
	18d	"	11.40-11.50	0.24	"

*
*
*

APPROVED SIGNATORY : ..... B. M. ROWE Lab Manager

DATE: 14 DEC 2007

Form R25 Revised 15/12/05

APPENDIX E
SETTLEMENT ANALYSIS – FORMULAS AND FIGURES

Settlement Analysis For Clay Foundations

Immediate Settlement, P_i

$$P_i = \frac{\mu_1 \mu_0 q_n B}{E}$$

Where,

q_n = Net foundation pressure

B = Width of foundation

E = Deformation modulus

μ_1 μ_0 = Coefficients (See Figure 1)

Consolidation Settlement, P_c

$$P_c = \mu_g, m_v, \sigma_z, H$$

Where,

μ_g = A coefficient which depends on the type of clay – A value of 0.7 may be adopted for the clay material encountered on site.

m_v = Average coefficient of volume compressibility obtained for the effective pressure increment in the particular layer under consideration

σ_z = Average effective vertical stress imposed on the particular layer resulting from the net foundation pressure q_n,

H = Thickness of the particular layer under consideration

Settlement Analysis For Rock Foundations

Settlement, P

$$P = q(B/E_f)\, I'_p F_B F_D,$$

Where,

E_f = deformation of modulus at foundation level

I'_p = Influence factor (See Figure 2)

F_B = correction factor for roughness of base (See Figure 3)

F_D = correction factor of Depth of embedment (See Figure 4)

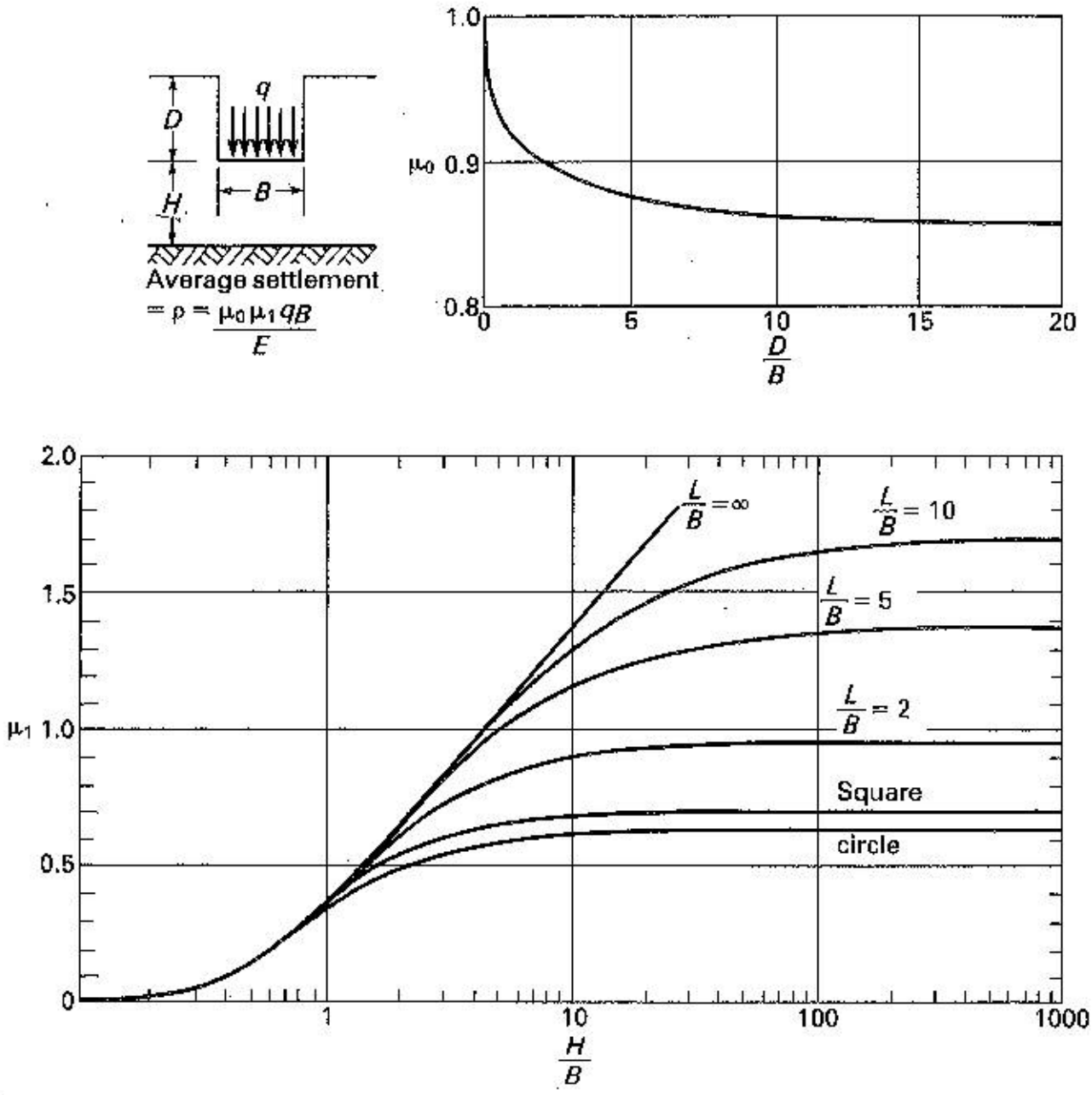

Figure. 1 Factors for calculating the average immediate settlement of a loaded area (after Christian and Carrier).

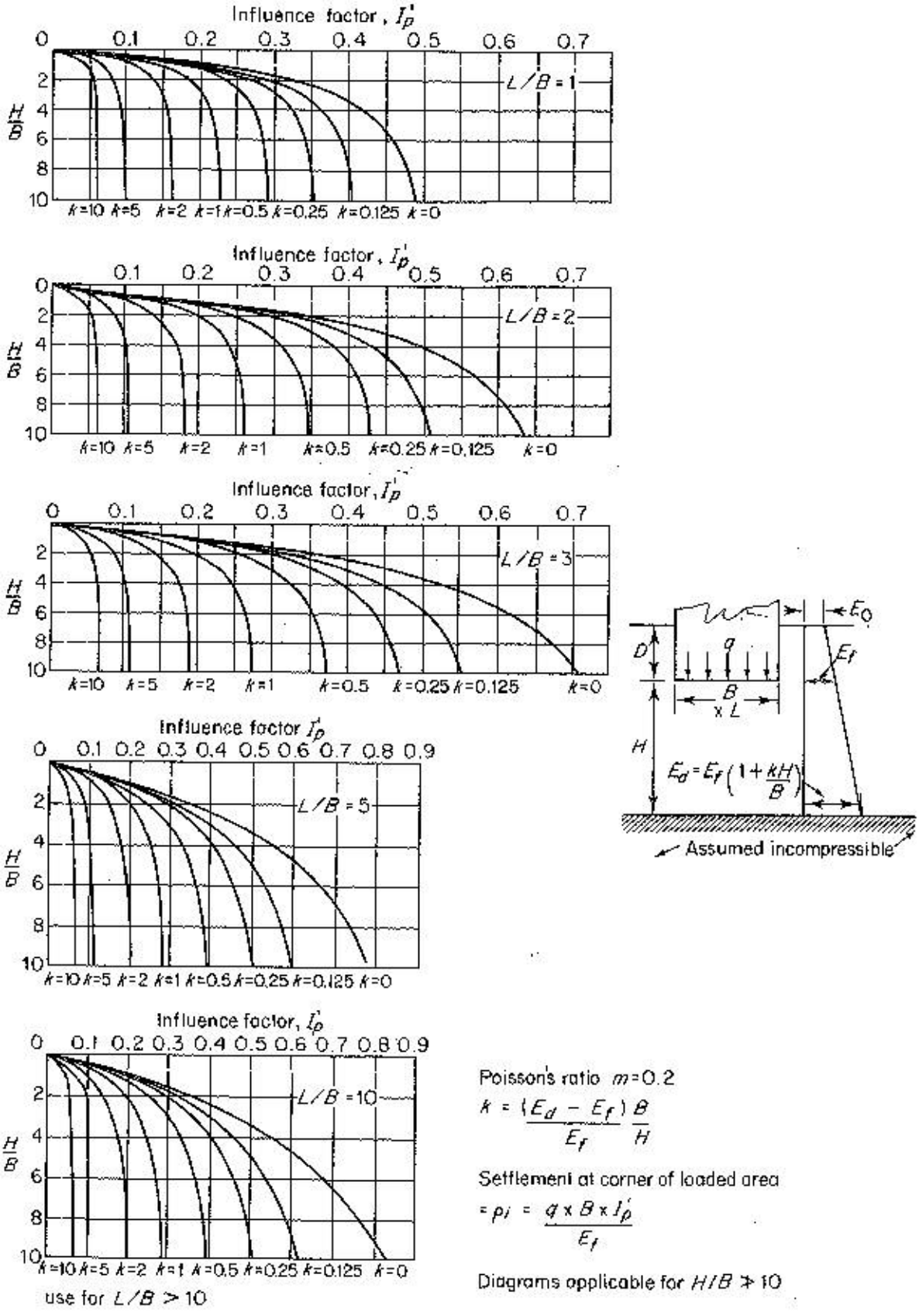

Figure. 2 Values of influence factor I_p for deformation modulus increasing linearly with depth and modular ratio of 0.2 (after Meigh).

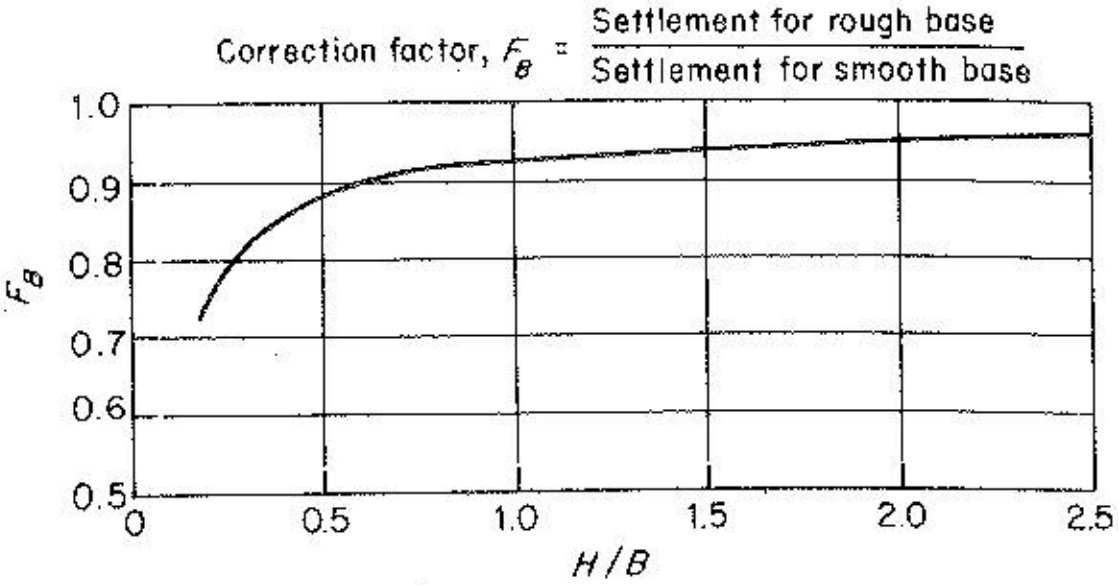

Figure. 3 Correction factors for roughness of base of foundation.

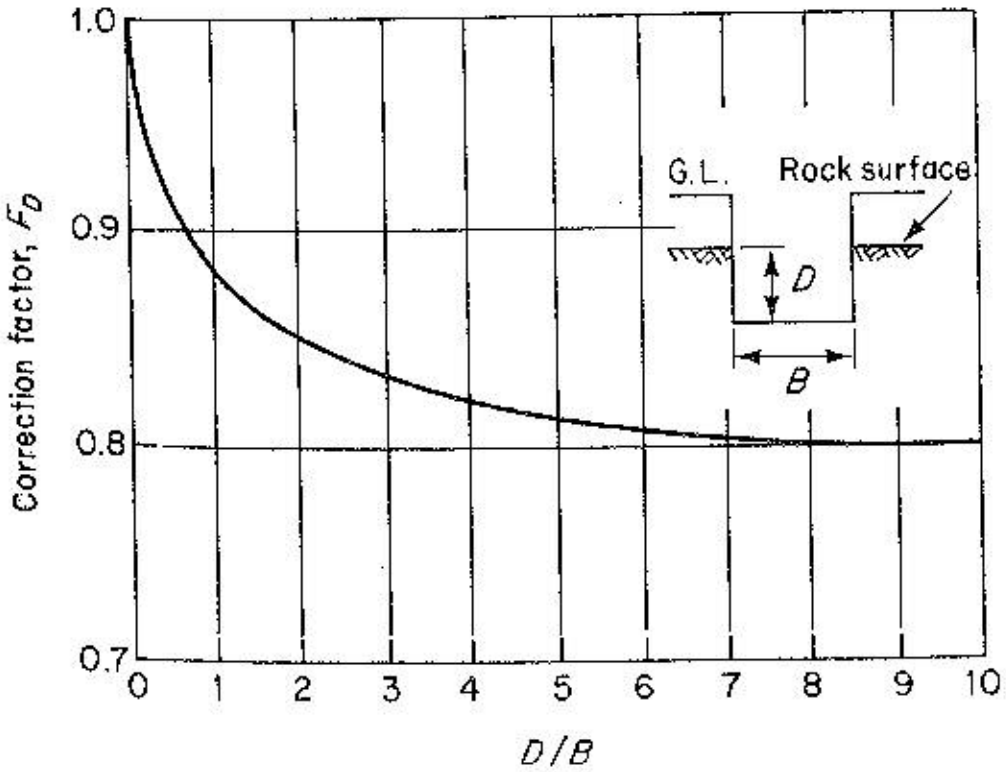

Figure. 4 Correction factors for depth of embedment of foundation below surface of rock.

APPENDIX F
CIRCLY DESIGN PRINT-OUTS

CIRCLY Version 5.01 (10 October 2006)

Job Title: S07-365 Proposed Integrated Bio-Diesel Plant, Bomen, Wagga Wagga

Damage Factor Calculation

Assumed number of damage pulses per movement:
One pulse per axle (i.e. use NROWS)

Traffic Spectrum Details:

ID: S07-365 Title: Proposed Bio-Diesel Plant, Bomen

Load No.	Load ID	Movements
1	ESA75-Full	1.00E+06

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA75-Full	SA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA75-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA75-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA75-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA75-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 10
Y: 0

Details of Layered System:

ID: S07-365 Title: Proposed Bio-Diesel Plant, Bomen

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Gran_350	Aniso.	3.50E+02	0.35	2.60E+02	1.75E+02	0.35
2	rough	Gran_250	Aniso.	2.50E+02	0.35	1.90E+02	1.25E+02	0.35
3	rough	Sub_CBR7	Aniso.	7.00E+01	0.45	4.83E+01	3.50E+01	0.45

Performance Relationships:

Layer No.	Location	Performance ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
3	top	Sub_2004	EZZ	0.009300	7.000	1.000

Reliability Factors:
Project Reliability: Austroads 90%

Layer No.	Reliability Factor	Material Type
3	1.00	Subgrade (Austroads 2004)

Details of Layers to be sublayered:
Layer no. 1: Austroads (2004) sublayering
Layer no. 2: Austroads (2004) sublayering

Results:

Layer No.	Thickness	Material ID	Load ID	Critical Strain	CDF
1	150.00	Gran_350		n/a	n/a
2	170.00	Gran_250		n/a	n/a
3	0.00	Sub_CBR7	ESA75-Full	1.25E-03	7.98E-01

CIRCLY Version 5.0i (10 October 2006)

Job Title: S07-365 Proposed Integrated Bio-Diesel Plant, Bomen, Wagga Wagga

Damage Factor Calculation

Assumed number of damage pulses per movement:
One pulse per axle (i.e. use NROWS)

Traffic Spectrum Details:

ID: S07-365 Title: Proposed Bio-Diesel Plant, Bomen

Load No.	Load ID	Movements
1	ESA75-Full	1.00E+06

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA75-Full	SA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA75-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA75-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA75-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA75-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 10
Y: 0

Details of Layered System:

ID: S07-365 Title: Proposed Bio-Diesel Plant, Bomen

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Asph2800	Iso.	2.80E+03	0.40			
2	rough	Gran_350	Aniso.	3.50E+02	0.35	2.60E+02	1.75E+02	0.35
3	rough	Gran_250	Aniso.	2.50E+02	0.35	1.90E+02	1.25E+02	0.35
4	rough	Sub_CBR7	Aniso.	7.00E+01	0.45	4.83E+01	3.50E+01	0.45

Performance Relationships:

Layer No.	Location	Performance ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
1	bottom	Shell12.9	ETH	0.005869	5.000	1.000
4	top	Sub_2004	EZZ	0.009300	7.000	1.000

Reliability Factors:
Project Reliability: Austroads 90%

Layer No.	Reliability Factor	Material Type
1	1.50	Asphalt
4	1.00	Subgrade (Austroads 2004)

Details of Layers to be sublayered:
Layer no. 2: Austroads (2004) sublayering
Layer no. 3: Austroads (2004) sublayering

Results:

Layer No.	Thickness	Material ID	Load ID	Critical Strain	CDF
1	40.00	Asph2800	ESA75-Full	-3.93E-04	8.78E-01
2	150.00	Gran_350		n/a	n/a
3	140.00	Gran_250		n/a	n/a
4	0.00	Sub_CBR7	ESA75-Full	9.93E-04	1.58E-01

CIRCLY Version 5.0i (10 October 2006)

Job Title: S07-365 Proposed Integrated Bio-Diesel Plant, Bomen, Wagga Wagga

Damage Factor Calculation

Assumed number of damage pulses per movement:
One pulse per axle (i.e. use NROWS)

Traffic Spectrum Details:

ID: S07-365 Title: Proposed Bio-Diesel Plant, Bomen

Load No.	Load ID	Movements
1	ESA75-Full	1.00E+06

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA75-Full	SA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA75-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA75-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA75-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA75-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 10
Y: 0

Details of Layered System:

ID: S07-365 Title: Proposed Bio-Diesel Plant, Bomen

Layer No.	Lower 1/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Asph2800	Iso.	2.80E+03	0.40			
2	rough	Gran_350	Aniso.	3.50E+02	0.35	2.60E+02	1.75E+02	0.35
3	rough	Sub_CBR7	Aniso.	7.00E+01	0.45	4.83E+01	3.50E+01	0.45

Performance Relationships:

Layer No.	Location	Performance ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
1	bottom	Shell812.9	ETH	0.005889	5.000	1.000
3	top	Sub_2004	EZZ	0.009300	7.000	1.000

Reliability Factors:
Project Reliability: Austroads 90%

Layer No.	Reliability Factor	Material Type
1	1.50	Asphalt
3	1.00	Subgrade (Austroads 2004)

Details of Layers to be sublayered:
Layer no. 2: Austroads (2004) sublayering

Results:

Layer No.	Thickness	Material ID	Load ID	Critical Strain	CDF
1	40.00	Asph2800	ESA75-Full	-3.93E-04	8.80E-01
2	280.00	Gran_350		n/a	n/a
3	0.00	Sub_CBR7	ESA75-Full	1.02E-03	1.86E-01

appendix G

SOIL SUITABILITY ASSESSMENT

ENSR | AECOM

Prepared for:

Riverina Oils and Bio Energy

19 Grey Street
Balwyn, Victoria
3103

Soil Suitability Assessment

Use of Effluent by Irrigation - Riverina Oils and Bio Energy

Final

HLA-Envirosciences Pty Limited (HLA ENSR)

12 December 2007

Document No.: S6054304_RPTFinal_12Dec07.doc

HLA Merged with ENSR in 2007

Distribution

Soil Suitability Assessment
Use of Effluent by Irrigation - Riverina Oils and Bio Energy

12 December 2007

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By
HLA-Envirosciences Pty Limited (HLA ENSR)
ABN: 34 060 204 702
Level 5, 828 Pacific Highway Gordon NSW 2072
PO Box 726 Pymble NSW 2073

Anthony Davis
Senior Environmental Scientist

Technical Peer Reviewer:	**Date:**
A.D Mitchell	12 Dec 07
Tony Mitchell Senior Principal Environmental Chemist	

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List of Plates

List of Appendices

Executive Summary

INTRODUCTION

HLA-Envirosciences Pty Limited (HLA ENSR), a subsidiary of ENSR Corporation, an AECOM company, were engaged by Riverina Oils and Bio Energy Pty Ltd (ROBE) to undertake an Environmental Assessment (EA) for the proposed construction and operation of an integrated oilseed processing and bio-diesel plant (IOPBP) in the City of Wagga Wagga, located in the south western region of New South Wales (NSW). As part of the EA, an assessment of soil conditions was undertaken within the proposed effluent irrigation area associated with the IOBP.

OBJECTIVE

The assessment was undertaken to evaluate the suitability of soils within the proposed effluent irrigation area associated with the IOBP for the storage of waste effluent.

SCOPE OF WORK

The scope of work for the soil assessment involved the following:

- A review of published data on the soil landscapes of the study area;
- Completion of a soil survey at six selected locations within the study area;
- Collection of soil samples (topsoil and subsoil) for analysis by an accredited laboratory (Sydney Environmental and Soil Laboratory);
- Comparison of results against the adopted criteria to evaluate the suitability of soils within the study area for effluent irrigation; and
- Preparation of this report discussing the methodologies used, the results of the investigation and providing conclusions regarding the suitability of soil conditions for irrigation purposes.

RESULTS

The Site has been assessed generally following the guidelines endorsed by NSW DECC. Based on the reported results, two sample locations were identified on the Site which present severe limitations for effluent irrigation. All other reported results indicated the soils at the locations analysed presented nil to slight or moderate limitations for effluent irrigation. The severe limitations were based on elevated exchangeable sodium percentages at both surface and depth at locations HA05 and HA06, which are located to the north east and generally down gradient of the proposed irrigation area. Based on the reported results, the portion of land encompassed by these locations is considered generally unsuitable for irrigation of some or all effluent products.

CONCLUSIONS AND RECOMMENDATIONS

Ensure that effluent irrigation activities are only undertaken on soils considered suitable for that purpose, HLA ENSR recommends that the proposed irrigation area is limited to exclude that portion of land in the vicinity of sample locations HA05 and HA06. Based on the reported soil results, the area of land encompassing the remaining sample locations (HA01 to HA04) is considered suitable for the purposes of effluent irrigation.

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1.0 Introduction

HLA-Envirosciences Pty Limited (HLA ENSR), a subsidiary of ENSR Corporation, an AECOM company, was engaged by Riverina Oils and Bio Energy Pty Ltd (ROBE) to prepare an Environmental Assessment (EA) for the proposed construction and operation of an integrated oilseed processing and bio-diesel plant (IOPBP) in the City of Wagga Wagga, located in the south western region of New South Wales (NSW).

As part of the EA, an assessment of soil conditions was undertaken to evaluate the suitability of the proposed effluent irrigation area associated with the IOBP for the disposal of effluent produced by the bio-diesel plant. The IOPBP location is detailed on **Figure 1**. The proposed irrigation area is detailed on **Figure 2**.

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2.0 Scope of Work

The scope of work for the soil assessment involved the following:

- A review of published data on the soil landscapes of the study area;
- Completion of a soil survey at six selected locations within the study area;
- Collection of soil samples (topsoil and subsoil) for analysis by an accredited laboratory (Sydney Environmental and Soil Laboratory);
- Comparison of results against the adopted criteria to evaluate the suitability of soils within the study area for effluent irrigation; and
- Preparation of this report discussing the methodologies used, the results of the investigation and providing conclusions regarding the suitability of soil conditions for irrigation purposes.

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3.0 Soil Landscapes of the Proposed Bio diesel Plant Development Site

The following sections provide a detailed description of the soil landscape groups encountered across the proposed development site based on the Department of Land and Water Conservation[1] (1997) Soil *Landscapes of the Wagga Wagga 1:100,000 Sheet*. The Soil Landscape units identified within the study area are illustrated on **Figure 3.**

3.1 East Bomen Soil Landscape (EB)

3.1.1 Location and Background

The East Bomen Soil Landscape (eb) covers the entire study area. Regionally it has a distribution from areas north of the Murrumbidgee Floodplain to the regions near Yarragundry-Collingullie and a small area south of Uranquinty.

The underlying geology comprises Silurian aged granites, mainly Wantabadgery Granodiorite and Collingullie Granite, with occasional Burrandana Granite. The topography comprises undulating rises and minor low hills with slope gradients mostly 3-10%. The landform generally consists of crests and ridges, long waning slopes and shallow drainage lines. The vegetation of this soil unit is largely cleared, with the exception of some residual areas of tall woodland in Crown reserves and along a few roads. Common tree species include white box, grey box and yellow box and white cypress pine. Understory plants include tussock grass, kangaroo grass, plains grass, spear grass and wallaby grass.

Predominant land uses include cropping for wheat with minor barley and cereal rye, and grazing on both stubble and improved pastures.

3.1.2 Dominant Soil Materials

The *Soil Landscapes of the Wagga Wagga 1:100,000 Sheet* (DLWC, 1997) describe the soils of the East Bomen soil landscape group as comprising shallow to moderately deep (40-150cm) Eutrophic Red Dermosols on crests and ridges; deep (80-200cm) Eutrophic Red Dermosols on slopes; and moderately deep (80-150cm) Eutrophic Brown Dermosols in drainage lines. The East Bomen soil landscape typically incorporates the following dominant soil materials and their qualities:

eb1 – Dull Loam (topsoil-A_1 horizon). Dark to dull, sandy loam to clay loam, massive; field pH 5.0-5.5.

Eb2- Reddish light clay (B_1 horizon). Reddish brown, light clay, massive; field pH 6.0-6.5.

eb3-Reddish brown light clay (subsoil-B_{21} horizon). Bright reddish brown to reddish brown, light clay to medium clay, massive to strong pedal; field pH 6.0-7.5.

eb4-Yellowish light medium clay (subsoil-B22 horizon). Dull yellow orange to yellowish brown, light medium clay, moderate to strong pedal; field pH 6.0-7.0.

eb5-Bright sandy light clay (subsoil-BC horizon). Orange to bright yellowish, brown coarse sandy light clay, moderately pedal; field pH 6.0-8.0.

[1] The Department of Land and Water Conservation now forms part of the Department of Environment and Climate Change (DECC).

3.1.3 Landscape Limitations

Landscape limitations are soil properties, which may restrict urban or rural development and potentially the proposed development plans for an integrated oilseed processing and bio-diesel plant. Limitations of topsoils and subsoils in this Soil Landscape include the following:

eb1 Moderately acid

Low wet bearing strength (localised),

Salinity (localised)

Low fertility

Sodicity (localised)

Hardsetting (localised)

eb2 Salinity (localised)

Sodicity (localised)

Low fertility

Low wet bearing strength (localised)

eb3 Low fertility

Sodicity

eb4 Low fertility

Low wet bearing strength

eb5 Low fertility

Low wet bearing strength

3.1.4 Fertility

Fertility of all soil materials is low. The soils of this unit are strong to slightly acid. Nutrient status is generally very low in topsoils and subsoils.

3.1.5 Land Degradation and Erosion

Up to 15cm of soil can be lost to sheet erosion in intensively cultivated regions where soil structure decline also occurs, resulting in hard setting surface. Minor gully erosion occurs along a few drainage lines. Isolated salinisation has occurred locally in one or two drainage flats (north eastern margin of the mapping area).

3.1.6 Soils Ground Truthing

Six soil sites were inspected to enable ground truthing of the mapped Soil Unit and to identify the local characteristics of the soils at the site. Field sheets describing encountered soil conditions are also provided in **Appendix A** and representative soil profiles provided in Plates 2-7.

4.0 Methodology

4.1 Field Work

Fieldwork was carried out following the preliminary review of soil landscapes. The study area was traversed by an HLA ENSR Environmental Scientist on foot, to confirm boundaries of the proposed irrigation areas and to select locations for soil profiling, which were representative of the proposed irrigation area.

Fieldwork included:

- Soil auger survey to evaluate soil texture, thickness and other properties to confirm geology and soil type; and
- Soil samples (topsoil and subsoil) sent to a NATA accredited laboratory (Sydney Environmental and Soil Laboratory) for analysis to evaluate the following parameters:
  - Exchangeable sodium percentage;
  - Salinity measured as electrical conductivity;
  - Saturated hydraulic conductivity;
  - Available water capacity;
  - Soil pH;
  - Effective cation exchange capacity;
  - Emmerson aggregate test; and
  - Phosphorous P sorption.

4.1.1 Soil Survey

Field soil profiling, analysis and sample collection were conducted within the proposed irrigation area as detailed on **Figure 4**.

A total of six sites were surveyed to obtain Site specific soil data and to verify Soil Landscape Units. Sites were chosen within Landscape Units described by DLWC 1997 with the objective of evaluating the suitability of soils for irrigation purposes. Soils were augured and described for:

- Texture, based on the behaviour of the moist bolus (McDonald et al 1984);
- Colour;
- Structure, the size, shape and coherence of soil aggregates (peds);
- Field pH (CSIRO Inoculo Field pH Kit);
- Layer determination including horizon depth and the nature of the boundary; and
- Inclusions including gravels, cutans, carbonate, organic material and evidence of bioturbation.

Notes were taken on slope, dominant vegetation type, current surface condition, land use, geology and evidence of erosion.

Select representative topsoil and subsoil samples were collected for laboratory analysis by Sydney Environmental and Soil Laboratory (SESL). Analysis was undertaken for a range of analytes and physical parameters as detailed in Section 4.1.

5.0 Site Assessment criteria

The current assessment criteria endorsed by NSW DECC to evaluate soil analytical results for effluent irrigation purposes are based on the Department of Environment and Conservation, 2004. *Environmental Guidelines: Use of Effluent by Irrigation*.

The soil analytical results were compared to guidelines that describe a range of typical soil characteristics. The guidelines are used to evaluate the suitability of soils for effluent irrigation systems in NSW.

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6.0 Soil Analytical Results

The results of the laboratory analysis of soils are compared against the adopted Site Assessment Criteria in Table 1. Laboratory analytical reports are provided in **Appendix B**.

Exchangeable Sodium Percentage (0-40cm)

Exchangeable sodium percentage (ESP) at depths of 0-40 cm reported nil or slight to moderate limitations at all locations analysed with the exception of sample HA05_0.0-0.15 (22.6) and HA06_0.2-0.4 (20.2) which reported severe limitations for effluent irrigation.

Exchangeable sodium percentage (40-100cm)

Exchangeable sodium percentage (ESP) at depths of between 40-100 cm reported nil or slight to moderate limitations at all locations analysed with the exception of sample HA06_0.7-0.9 (20.3) which reported severe limitations for effluent irrigation.

Salinity measured as electrical conductivity (EC_e) (dS/m at 0-70cm)

Salinity at depths from 0 to 70cm reported an electrical conductivity of less than 2 dS/m for all samples analysed indicating nil or slight limitations for effluent irrigation.

Salinity measured as electrical conductivity (EC_e) (dS/m at 70-100cm)

Salinity at depths from 70 to 100 cm reported an electrical conductivity of less than 4 dS/m for all samples analysed presenting nil or slight limitations for effluent irrigation.

Depth to seasonal high water table (metres)

Based on reported water bearing zone information detailed in registered groundwater bore data from the Department of Natural Resources (DNR) website (http://test.nratlas.nsw.gov.au) indicative depth to groundwater reported within the study area varies considerably from a minimum of 4 m bgs to over 100 m bgs. This presents nil or slight limitations for effluent irrigation.

Depth to bedrock or hardpan (metres)

Bedrock was not encountered to the maximum depth of the field investigation, which was 1 metre below ground surface (m bgs). Based on the field investigation, the presence of shallow bedrock (i.e. < 1m bgs) in the vicinity of the study area is not considered likely and as such presents nil or slight limitations for effluent irrigation at the locations analysed.

Saturated hydraulic conductivity

Based on soil texture, the reported saturated hydraulic conductivity for all samples was reported to be low. HLA ENSR considers that the reported results present nil or slight limitations for effluent irrigation.

Available water capacity (AWC, mm/m)

Reported AWC results ranged from 196 mm/m to 288.4 mm/m for all samples analysed indicating nil or slight limitations for effluent irrigation.

Soil pH_{CaCl2} (surface layer)

Soil pH within surficial soils ranged from 5.6 to 7.7 indicating nil or slight to moderate limitations for effluent irrigation.

Effective cation exchange capacity (ECEC, cmol (+)/kg, average 0-40cm)

Reported average ECEC results ranged from 8.9 to 16.8 cmol (+)/kg for all samples analysed at depths between 0-40cm indicating nil or slight limitations for effluent irrigation.

Emerson aggregate test (0-100cm)

Reported Emerson aggregate test results ranged from 2.2 to 6.1 for all samples analysed indicating nil or slight to moderate limitations for effluent irrigation.

Phosphorus (p) sorption (0-100cm)

Reported p sorption results ranged from 91.53% to 100%, which are considered high, indicating nil or slight to moderate limitations for effluent irrigation. HLA ENSR notes that Soils with medium to high phosphorus sorption capacity can adsorb excess phosphorus not taken up by plants. The effectiveness of this depends not only on the sorption capacity but also the depth and permeability.

7.0 Conclusions and Recommendations

The Site has been assessed generally following the guidelines endorsed by NSW DECC. Based on the reported results, two sample locations were identified on the Site which present severe limitations for effluent irrigation. All other reported results indicated the soils at the locations analysed presented nil to slight or moderate limitations for effluent irrigation.

The severe limitations were based on elevated exchangeable sodium percentages at both surface and depth at locations HA05 and HA06, which indicate that soils within this area may be subject to structural degradation and waterlogging. Based on the reported results, the portion of land encompassed by these locations is considered generally unsuitable for irrigation of some or all effluent products. It is noted, however that both locations are located to the north east and generally down gradient of the proposed irrigation area.

To ensure that effluent irrigation activities are only undertaken on soils considered suitable for that purpose, HLA ENSR recommends that the proposed irrigation area is limited to exclude that portion of land in the vicinity of sample locations HA05 and HA06. Based on the reported soil results, the area of land encompassing the remaining sample locations (HA01 to HA04) are considered suitable for the purposes of effluent irrigation.

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Tables

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Table T1
Soil sample Analytical Results

	Limitations				Sample ID	HA01_0.0-0.2	HA01_0.6-0.7	HA02_0.0-0.2	HA02_0.5-0.7	HA03_0.2-0.4	HA03_0.8-1.0	HA04_0.2-0.4	HA04_0.45-0.6
Property	**Nil or Slight**	**Moderate**	**Severe[1]**	**Restrictive Feature**	**Date**	**25/10/2007**	**25/10/2007**	**25/10/2007**	**25/10/2007**	**25/10/2007**	**25/10/2007**	**26/10/2007**	**26/10/2007**
Exchangeable sodium percentage (0-40cm)	0-5	5-10[2]	>10	structural degradation and waterlogging.		3.4	-	8.7	-	3.5	-	8.4	-
Exchangable sodium percentage (40-100cm)	<10	>10	-	structural degradation and waterlogging.		-	5	-	11.9	-	5.6	-	10
Salinity measured as electrical conductivity (EC_e) (ds/m at 0-70cm)	<2	2 - 4	>4[3]	excess salt may restrict plant growth.		0.09	-	0.24	-	0.09	-	0.24	-
Salinity measured as electrical conductivity (EC_e) (ds/m at 70-100cm)	<4	4 - 8	>8[3]	excess salt may restrict plant growth, potential seasonal groundwater rise.		-	0.12	-	0.25	-	0.12	-	0.35
Depth to seasonal high wate table (metres)	>3[4]	0.5-3.0	<0.5	poor aeration, restricts plant growth, risk to groundwater[5]		>4[#]	>4[#]	>4[#]	>4[#]	>4[#]	>4[#]	>4[#]	>4[#]
Depth to bedrock or hardpan (metres)	>1	0.5-1	<0.5	restricts plant groeth, excess runoff, waterlogging		>1*	>1*	>1*	>1*	>1*	>1*	>1*	>1*
Saturated hydraulic conductivity (Ks, mm/h, 0-100cm)	20 - 80	5 - 20[6] or >80[6]	<5	excess runoff, waterlogging, poor infiltration.		Low	Low	Low	Low	Low	Low	Low	Low
Available water capacity (AWC, mm/m)	>100	<100[6]	-	little plant-available water in reserve, risk to groundwater.		288.4	211.4	273	207.2	196	212.8	228.2	236.6
Soil pH_{CaCl2} (surface layer)	>6 - 7.5	3.5[7] - 6.0 >7.5	<3.5	reduces optimum plant growth		5.6	6.1	6.2	7.6	6.3	6.1	6.2	6.2
Effective cation exchange capacity (ECEC, cmol(+)/kg, average 0-40cm)	>15	3 - 15[8]	<3	unable to hold plant nutrients.		8.9	10.9	11.8	11.8	9.6	12.4	11.6	13.5
Emerson aggregate test (0-100cm)	4,5,6,7,8	2,3	1	poor structure.		3.1	5.2	3.1	2.2	6.1	6.1	5.3	6.1
Phosphorus (p) sorption (0-100cm)	high[9]	moderate[9]	Low	unable to immobilise any excess phosphorus.		96.61% (high)	100% (high)	91.53% (high)	94.92% (high)	100% (high)	100% (high)	100% (high)	100% (high)

Notes:
1. Sites with these properties are unlikely to be suitable for irrigation of some or all effluent products.
2. Application of gypsum or lime may be required to maintain long-term site suitability.
3. Some high EC soils containing calcium salts are not necessarily considered 'severe'.
4. Where unable to excavate to 3m, local knowledge and absence of indications of water table to the depth of sampling (1m) should be used.
5. Criteria are set primarily for assessing site suitability for plant growth. Presence of a shallow soil water table may indicate soil conditions that favour movement of nutrients and contaminants into groundwater. In such cases, careful consideration should be given to quality and potential impacts on groundwater.

6. Careful irrigation scheduling and good irrigation practices will be required to maintain site sustainability.

7. Soil pH may need to be increased to improve plant growth. Where effluent is alkaline or lime is available, oppurtunities exist to raise pH. If acid sulfate soil is present, site-specific specialist advice should be obtained.
8. Soil may become more sodic with effluent irrigation. In some cases, however, this soil property may be ameliorated with addition of a calcium source.

9. Soils with medium to high phosphorus sorption capacity can adsorb excess phosphorus not taken up by plan The effectiveness of this depends not only on the sorption capacity but also the depth and permeability .
* Depth to bedrock based on DLWC (1997)*Soil Landscapes of the Wagga Wagga 1:100,00 Sheet Map and field observations.*
[#] Minimum depth to groundwater based on DNR registered groundwater bore data.
Bolding denotes reported results exhibit severe limitations for effluent irrigation.

Table T1
Soil sample Analytical Results

	Limitations				Sample ID	HA05_0.0-0.15	HA05_0.6-0.8	HA06_0.2-0.4	HA06_0.7-0.9
Property	**Nil or Slight**	**Moderate**	**Severe[1]**	**Restrictive Feature**	**Date**	**26/10/2007**	**26/10/2007**	**26/10/2007**	**26/10/2007**
Exchangeable sodium percentage (0-40cm)	0-5	5-10[2]	>10	structural degradation and waterlogging.		**22.6**	-	**20.2**	-
Exchangable sodium percentage (40-100cm)	<10	>10	-	structural degradation and waterlogging.		-	6.6	-	20.3
Salinity measured as electrical conductivity (EC_e) (ds/m at 0-70cm)	<2	2 - 4	>4[3]	excess salt may restrict plant growth.		0.6	-	0.45	-
Salinity measured as electrical conductivity (EC_e) (ds/m at 70-100cm)	<4	4 - 8	>8[3]	excess salt may restrict plant growth, potential seasonal groundwater rise.		-	0.23	-	0.39
Depth to seasonal high wate table (metres)	>3[4]	0.5-3.0	<0.5	poor aeration, restricts plant growth, risk to groundwater[5]		>4[#]	>4[#]	>4[#]	>4[#]
Depth to bedrock or hardpan (metres)	>1	0.5-1	<0.5	restricts plant groeth, excess runoff, waterlogging		>1*	>1*	>1*	>1*
Saturated hydraulic conductivity (Ks, mm/h, 0-100cm)	20 - 80	5 - 20[6] or >80[6]	<5	excess runoff, waterlogging, poor infiltration.		Low	Low	Low	Low
Available water capacity (AWC, mm/m)	>100	<100[6]	-	little plant-available water in reserve, risk to groundwater.		285.6	261.8	198.8	203
Soil pH_{CaCl2} (surface layer)	>6 - 7.5	3.5[7] - 6.0 >7.5	<3.5	reduces optimum plant growth		7.3	7.1	7.7	7.5
Effective cation exchange capacity (ECEC, cmol(+)/kg, average 0-40cm)	>15	3 - 15[8]	<3	unable to hold plant nutrients.		16.8	20	12.1	14.2
Emerson aggregate test (0-100cm)	4,5,6,7,8	2,3	1	poor structure.		3.1	5.3	5.3	5.1
Phosphorus (p) sorption (0-100cm)	high[9]	moderate[9]	Low	unable to immobilise any excess phosphorus.		93.22% (high)	100% (high)	96.61% (high)	100% (high)

Notes:
1. Sites with these properties are unlikely to be suitable for irrigation of some or all effluent products.
2. Application of gypsum or lime may be required to maintain long-term site suitability.
3. Some high EC soils containing calcium salts are not necessarily considered 'severe'.
4. Where unable to excavate to 3m, local knowledge and absence of indications of water table to the depth of sampling (1m) should be used.
5. Criteria are set primarily for assessing site suitability for plant growth. Presence of a shallow soil water table may indicate soil conditions that favour movement of nutrients and contaminants into groundwater. In such cases, careful consideration should be given to quality and potential impacts on groundwater.

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8. Soil may become more sodic with effluent irrigation. In some cases, however, this soil property may be ameliorated with addition of a calcium source.

9. Soils with medium to high phosphorus sorption capacity can adsorb excess phosphorus not taken up by plan The effectiveness of this depends not only on the sorption capacity but also the depth and permeability .
* Depth to bedrock based on DLWC (1997)*Soil Landscapes of the Wagga Wagga 1:100,00 Sheet Map and field observations.*
[#] Minimum depth to groundwater based on DNR registered groundwater bore data.
Bolding denotes reported results exhibit severe limitations for effluent irrigation.

Figures

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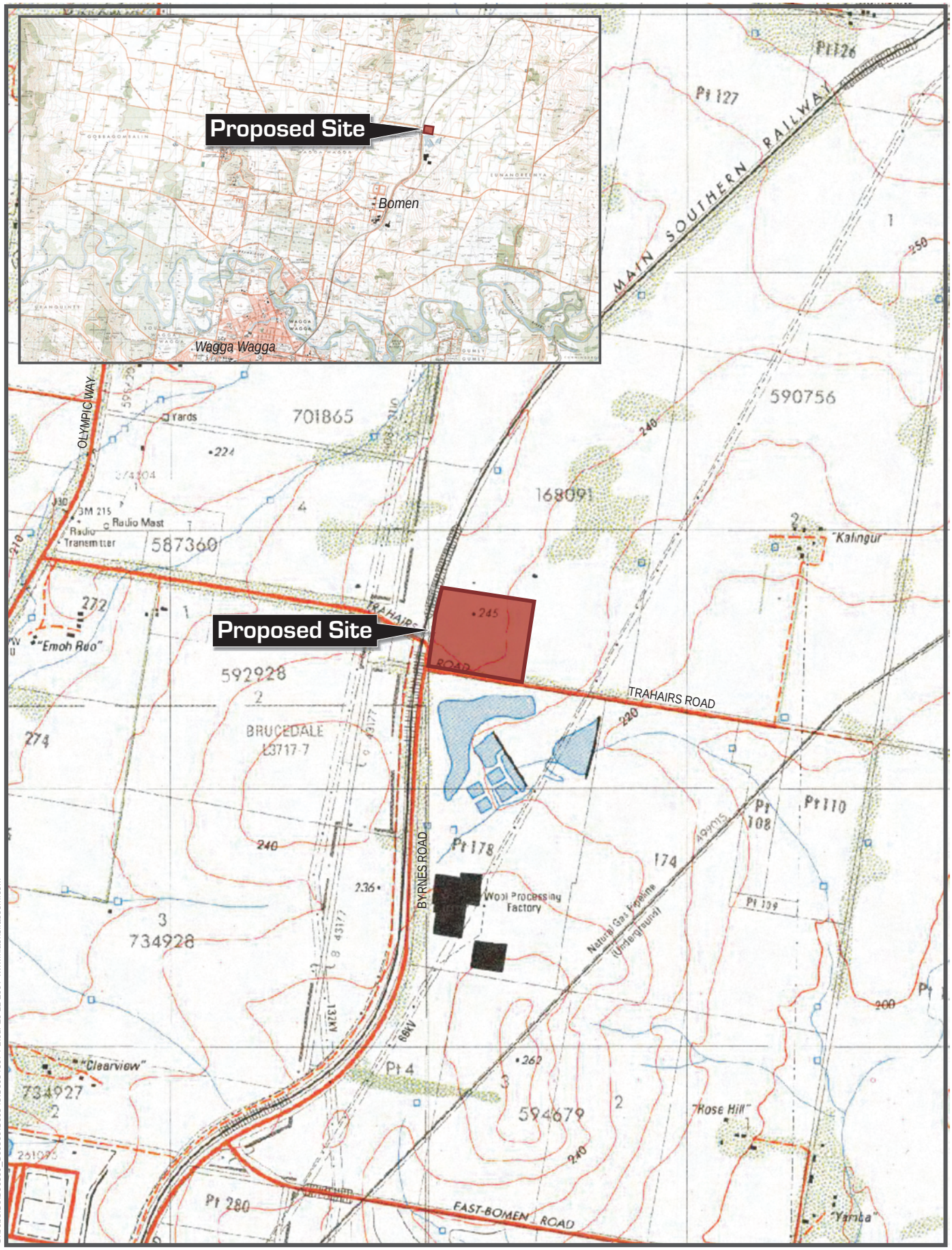

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ENSR | AECOM

0 500m

Figure 1 | **Regional Context**

Riverina Oils and Bio Energy Pty Ltd

Soil Suitability Assessment - Use of Effluent by Irrigation

Integrated Oilseed Processing and Biodiesel Plant

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ENSR | AECOM

0 100m

Approximate project footprint
Property boundary
Proposed storage pond
Proposed irrigation area

Figure 2 | **Project Footprint and Proposed Irrigation Area**

Riverina Oils and Bio Energy Pty Ltd

Soil Suitability Assessment - Use of Effluent by Irrigation

Integrated Oilseed Processing and Biodiesel Plant

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Approximate project footprint

ENSR | AECOM

0 200m

Figure 3 | **Soil Sampling Locations for Proposed Irrigation Areas**

Riverina Oils and Bio Energy Pty Ltd

Soil Suitability Assessment - Use of Effluent by Irrigation

Integrated Oilseed Processing and Biodiesel Plant

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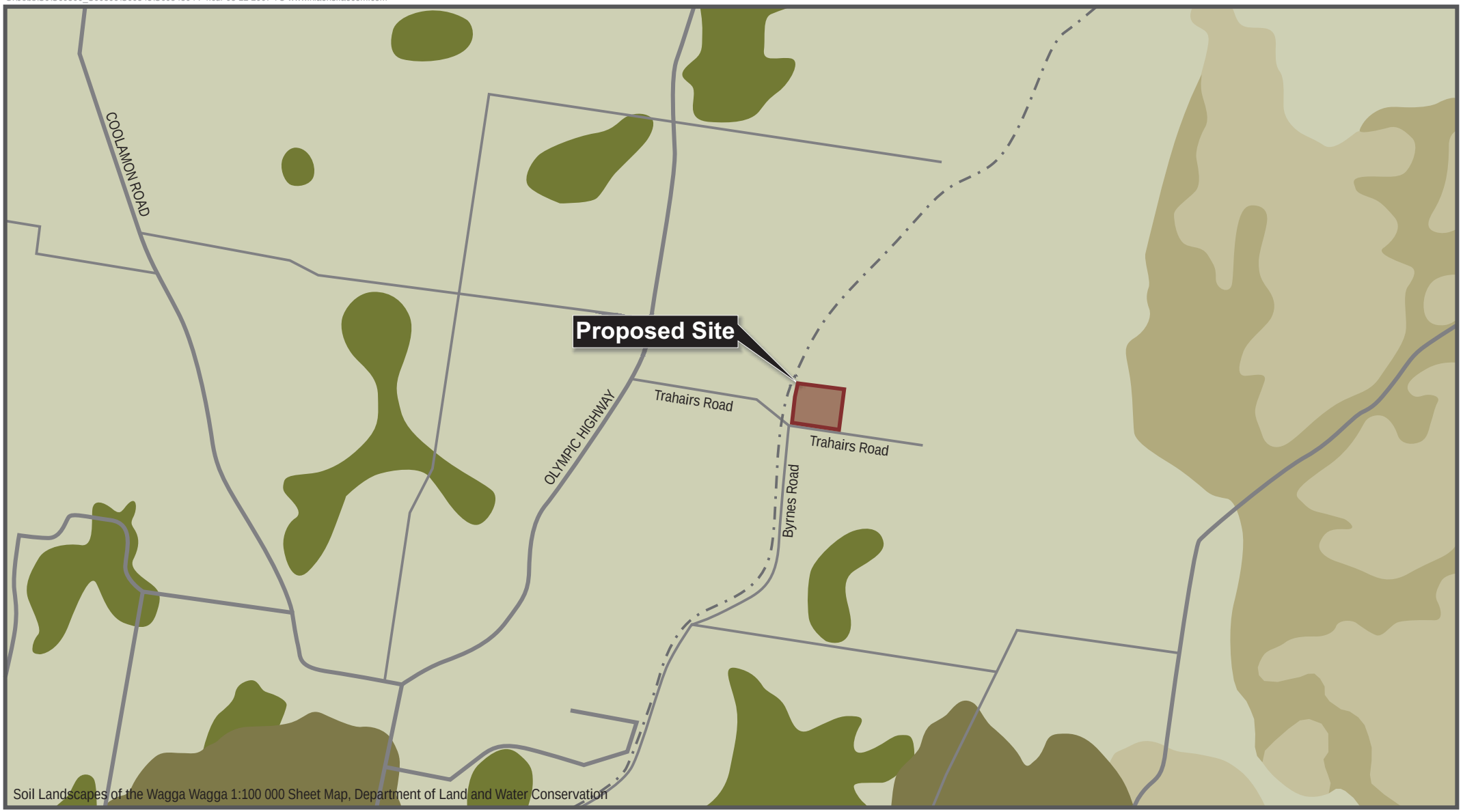

ENSR | AECOM

Main southern railway
Aeolian landscape
Colluvial landscape
Vestigial landscape
Alluvial landscape
Transferral landscape

Figure 4 **Soil Landscape of the Study Area**

Riverina Oils and Bio Energy Pty Ltd

Soil Suitability Assessment - Use of Effluent by Irrigation

Integrated Oilseed Processing and Biodiesel Plant

Plates

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Plate P1: Typical landscape view of the proposed irrigation area looking towards the east.

Plate P2: Soil Profile HA01

Plate P3: Soil Profile HA02

Plate P4: Soil Profile HA03

Plate P5: Soil Profile HA04

Plate P6: Soil Profile HA05

Plate P7: Soil Profile HA06

[Double-Click **here** to insert a new **Plates** Caption]

Appendix A

Soil Profile Descriptions

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Biodiesel Plant EA - Wagga Wagga Soil Survey (S6054304)

Site: HA01 **Date:** 25/10/07	**Location:** Bomen South east corner of Paddock	**Geology:** Aeolian Landscape
Slope: Very gently inclined to east (<5°)	**Landuse:** Wheat paddock	
Vegetation: Wheat Gum trees and occasional Casuarinas along paddock boundary		
Surface Condition: Ploughed, wheat field, 80% cover	**Erosion Features:** None observed	
Field Scientist(s): Anthony Davis		
Other: Sporadic moderate to heavy rain showers throughout day		

Depth	Texture	Dry Colour	Field pH	Gypsum/ Inclusions	Other
0.0-0.2	Loam	Brown	5.5-6.0	Minor rootlets at surface to 0.05m bgs.	Weakly pedal, rough ped fabric at 0.0-0.2 m bgs.
0.2-0.7	Clay Loam	Reddish Brown	7.5-8.0	None identified.	Gradual even boundary, soil fabric broken down.

Comments: Previously ploughed, dry, disturbed soil profile. No bioturbation noted. Soil fabric broken down (presumably due to ploughing).

Hole terminated at 0.7 metres below ground surface.

Samples: HA01_0.0-0.2
HA01_0.6-0.7

Biodiesel Plant EA, Wagga Wagga Soil Survey (S6054304)

Site:HA02 **Date:** 25/10/07	**Location:** Bomen Centre east side of paddock	**Geology:** Aeolian Landscape
Slope: Very gently inclined to east (<5°)	**Landuse:** Wheat paddock	
Vegetation: Wheat (occasional weeds)		
Surface Condition: Compacted/wheat paddock (80% cover)	**Erosion Features:**	
Field Scientist(s): Anthony Davis		
Other: Sporadic moderate to heavy rain showers throughout day.		

Depth	Texture	Dry Colour	Field pH	Gypsum/ Inclusions	Other
0.0-0.3	Dry clay	Brown	6.5	Very minor rounded pebbles.	Weakly pedal rough ped fabric, minor rootlets in top 0.5cm.
0.3-0.7	Dry clay loam	Orange/reddish brown	9.0	None identified.	Gradual even boundary, soil fabric broken down.

Comments: Previously ploughed, disturbed soil profile, dry. No bioturbation noted. Soil fabric broken down (presumably due to ploughing).

Hole terminated at 0.7 metres below ground surface.

Samples: HA02_0.0-0.2
HA02_0.5-0.7

Biodiesel Plant EA, Wagga Wagga Soil Survey (S6054304)

Site: HA03 **Date:** 25/10/07	**Location:** Bomen N/E Corner Paddock	**Geology:** Aeolian Landscape
Slope: Very gently inclined to east (<5°)	**Landuse:** Wheat paddock	
Vegetation: Wheat field with residual gum trees		
Surface Condition: Compacted/wheat paddock (80% cover)	**Erosion Features:** Partially eroded soil stockpiles from water storage dam located 25 m to east (other side of fence)	
Field Scientist(s): Anthony Davis		
Other: Sporadic moderate to heavy rain showers throughout day.		

Depth	Texture	Dry Colour	Field pH	Gypsum/ Inclusions	Other
0.0-0.15	Loam	Brown	6.5-8.5	5cm surface crust, minor bioturbation - ants underneath crust, organic matter, minor rootlets.	Weakly pedal rough ped fabric, <5% pebbles, clear even boundary.
0.15-0.45	Light Clay	Reddish brown	6.5-7	Very minor charcoal fragments.	Highly pedal smooth ped fabric, gradual even boundary.
0.45-0.65	Light Medium Clay	Yellow orange to yellowish brown (mottle)	7.5	Very minor charcoal fragments.	Weakly pedal smooth ped fabric, clear wavy boundary.
0.65-1	Light Clay	Yellow orange	7	None identified.	Weakly pedal smooth ped fabric, distinct, gradual wavy boundary.

Comments: Soil profile is far more intact and moist than previous two sample locations. No obvious reason why (possible less ploughing?). Increased permeability and soil moisture.

Hole terminated at 1.0 metres below ground surface.

Samples: HA03_0.0-0.1
HA03_0.2-0.4
HA03_0.8-1.0

Biodiesel Plant EA, Wagga Wagga Soil Survey (S6054304)

Site: HA04 **Date:** 26/10/07	**Location:** Bomen Southern Central portion of northern paddock	**Geology:** Aeolian Landscape
Slope: Very gently inclined to east (<5°)	**Landuse:** Wheat paddock	
Vegetation: Wheat field with residual gum trees		
Surface Condition: Compacted/wheat paddock (80% cover)	**Erosion Features:** Minimal	
Field Scientist(s): Anthony Davis		
Other: Weather: Over night thunderstorm, moderate to heavy rain showers during day		

Depth	Texture	Dry Colour	Field pH	Gypsum/ Inclusions	Other
0.0-0.15	Loam	Brown	6.5	Minor organics at surface.	Weakly pedal rough ped fabric, gradual wavy boundary.
0.15-0.45	Light medium Clay	Reddish brown No mottles	6.5-7	None identified.	Weakly pedal rough ped fabric, gradual wavy boundary.
0.45-0.65	Light Clay	Dull yellow orange to yellowish brown No mottles	7	None identified.	Weakly pedal smooth ped fabric, gradual wavy boundary.
0.65	Light Clay	Orange/brown, increasing to yellowish brown with depth	7	None identified.	Weakly pedal smooth ped fabric, gradual wavy boundary.

Comments: Slightly moist soil profile. Minor bioturbation at surface – ants.

Hole terminated at 0.8 metres below ground surface.

Samples: HA04_0.0-0.15
HA04_0.2-0.4
HA04_0.45-0.6

Biodiesel Plant EA, Wagga Wagga Soil Survey (S6054304)

Site: HA05 **Date:** 26/10/07	**Location:** Wheat Paddock	**Geology:** Aeolian Landscape
Slope: Very gently inclined to east (<5°)	**Landuse:** Wheat paddock	
Vegetation: Wheat field with residual gum trees		
Surface Condition: Compacted/wheat paddock (80% cover)	**Erosion Features:** Minimal	
Field Scientist(s): Anthony Davis		
Other:		

Depth	Texture	Dry Colour	Field pH	Gypsum/ Inclusions	Other
0-0.15	Loam	Brown	8	Minor organics at surface.	Weakly pedal rough ped fabric, gradual wavy boundary.
0.15-0.45	Light Medium Clay	Reddish brown	7.5	None identified.	Weakly pedal rough ped fabric, gradual wavy boundary.
0.45-0.85	Light Clay	Orange/reddish brown	7	None identified.	Weakly pedal smooth ped fabric, gradual wavy boundary.

Comments: Hole terminated at 0.85 metres below ground surface.

Samples: HA05_0.0-0.15
HA05_0.2-0.4
HA05_0.6-0.8

Biodiesel Plant EA, Wagga Wagga Soil Survey (S6054304)

Site: HA06 **Date:** 26/10/07	**Location:** East Side of N/E Paddock	**Geology:** Aeolian Landscape
Slope: Very gently inclined to east (<5°) almost converging with gentle westerly slope. Topographic low point.	**Landuse:** Irrigated wheat paddock	
Vegetation: Wheat field with residual gum trees		
Surface Condition: Compacted/wheat paddock (80% cover)	**Erosion Features:** Minimal	
Field Scientist(s): Anthony Davis		
Other: Heavy rain during sampling		

Depth	Texture	Dry Colour	Field pH	Gypsum/ Inclusions	Other
0.0-0.15	Loam	Brown	8.5-9.0	Minor organics.	Weakly pedal rough ped fabric, gradual wavy boundary.
0.15-0.55	Light Clay	Reddish brown	8-8.5	None identified.	Weakly pedal rough ped fabric, gradual wavy boundary.
0.55	0.95	Reddish brown 40% brown mottle	7-7.5	None identified.	Weakly pedal smooth ped fabric, gradual wavy boundary.

Comments: Lowest point sampled. Samples very moist when placed in jar due to heavy rain at time of sampling.

Hole terminated at 0.95 metres below ground surface.

Samples: HA06_0.0-0.15
HA06_0.2-0.4
HA06_0.7-0.9

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **1**
Name: **HA01_0.0-0.2**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	6.6	Very Slight Acidity
pH in $CaCl_2$ 1:5	5.6	Medium Acidity
EC mS/cm 1:5	.09	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.3	3.40	Acceptable
Potassium			2.29	25.70	High
Calcium			5.03	56.50	Low
Magnesium			1.29	14.50	Low
Aluminium					
		ECEC	8.90		Low
		Ca/Mg	3.90		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 3.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Loam - Low Soil Permeability Class
Phosphate Sorption Index: 438.1 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 96.61 %
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

Quality Endorsed Company

AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
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Tel: 02 9980 6554
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Em: info@sesl.com.au
Web: www.sesl.com.au

SAMPLE: Batch N°: **4781** Sample N°: **2**
Name: **HA01_0.6-0.7**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	6.7	Very Slight Acidity
pH in $CaCl_2$ 1:5	6.1	Slight Acidity
EC mS/cm 1:5	.12	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.54	5.00	Acceptable
Potassium			.9	8.30	Acceptable
Calcium			5.58	51.20	Low
Magnesium			3.87	35.50	High
Aluminium					
		ECEC	10.90		Low
		Ca/Mg	1.40		Magnesic

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.2 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Clay Loam - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **3**
Name: **HA02_0.0-0.2**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

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TEST	RESULT	COMMENTS
pH in water 1:5	7.0	Neutral
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	.24	Moderate Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.03	8.70	Elevated
Potassium			4.5	38.10	Extreme
Calcium			4.78	40.50	Very Low
Magnesium			1.52	12.90	Low
Aluminium					
		ECEC	11.80		Low
		Ca/Mg	3.10		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 3.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Loam - Low Soil Permeability Class
Phosphate Sorption Index: 317.8 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 91.53%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **4**
Name: **HA02_0.5-0.7**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality System
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TEST	RESULT	COMMENTS
pH in water 1:5	8.8	Strong Alkalinity
pH in $CaCl_2$ 1:5	7.6	Slight Alkalinity
EC mS/cm 1:5	.25	Elevated Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.41	11.90	High
Potassium			5.55	47.00	Extreme
Calcium			3.87	32.80	Very Low
Magnesium			1	8.50	Very Low
Aluminium					
		ECEC	11.80		Low
		Ca/Mg	3.90		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 2.2 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Clay Loam - Low Soil Permeability Class
Phosphate Sorption Index: 379.1 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 94.92%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
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HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **6**
Name: **HA03_0.2-0.4**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

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TEST	RESULT	COMMENTS
pH in water 1:5	7.2	Near Neutral
pH in $CaCl_2$ 1:5	6.3	Slight Acidity
EC mS/cm 1:5	.09	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.34	3.50	Acceptable
Potassium			1.4	14.60	Acceptable
Calcium			5.41	56.40	Low
Magnesium			2.48	25.80	Elevated
Aluminium					
		ECEC	9.60		Low Magnesic
		Ca/Mg	2.20		

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 6.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg^{-1} / $\log_{10}$ $ug\ L^{-1}$
Phosphate Adsorbed from Soil from 150mg P kg^{-1}: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
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HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **8**
Name: **HA03_0.8-1.0**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

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TEST	RESULT	COMMENTS
pH in water 1:5	6.8	Very slight Acidity
pH in $CaCl_2$ 1:5	6.1	Slight Acidity
EC mS/cm 1:5	.12	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.7	5.60	Elevated
Potassium			.79	6.40	Low
Calcium			5.92	47.70	Low
Magnesium			5.03	40.60	Extreme
Aluminium					
		ECEC	12.40		Moderate
		Ca/Mg	1.20		Magnesic

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 6.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
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Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

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SAMPLE: Batch N°: **4781** Sample N°: **10**
Name: **HA04_0.2-0.4**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	6.8	Very Slight Acidity
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	.24	Moderate Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.98	8.40	High
Potassium			2.48	21.40	High
Calcium			5.84	50.30	Low
Magnesium			2.33	20.10	Acceptable
Aluminium					
		ECEC	11.60		Low
		Ca/Mg	2.50		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.3 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Medium Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Enviroscience Pty Ltd**
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HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **11**
Name: **HA04_0.45-0.6**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality System
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TEST	RESULT	COMMENTS
pH in water 1:5	6.5	Slight Acidity
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	.35	Elevated Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.35	10.00	High
Potassium			1.19	8.80	Acceptable
Calcium			6.71	49.70	Very Low
Magnesium			4.26	31.60	High
Aluminium					
		ECEC	13.50		Moderate
		Ca/Mg	1.60		Magnesic

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 6.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
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HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

Quality System
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AS/NZS ISO 9001: 2000 QEC 21650

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SAMPLE: Batch N°: **4781** Sample N°: **12**
Name: **HA05_0.0-0.15**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	8.2	Moderate Alkalinity
pH in $CaCl_2$ 1:5	7.3	Slight Alkalinity
EC mS/cm 1:5	.6	Saline

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			3.79	22.60	Extreme
Potassium			6.1	36.30	Extreme
Calcium			6.06	36.10	Very Low
Magnesium			.86	5.10	Very Low
Aluminium					
		ECEC	16.80		Moderate
		Ca/Mg	7.00		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 3.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Loam - Low Soil Permeability Class
Phosphate Sorption Index: 343.3 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 93.22%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
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HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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SAMPLE: Batch N°: **4781** Sample N°: **14**
Name: **HA05_0.6-0.8**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	7.5	Slight Alkalinity
pH in $CaCl_2$ 1:5	7.1	Near Neutral
EC mS/cm 1:5	.23	Moderate Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.31	6.60	Elevated
Potassium			1.71	8.60	Acceptable
Calcium			14.36	71.80	Acceptable
Magnesium			2.6	13.00	Low
Aluminium					
		ECEC	20.00		Moderate
		Ca/Mg	5.50		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.3 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

SAMPLE: Batch N°: **4781** Sample N°: **16**
Name: **HA06_0.2-0.4**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	8.6	Strong Alkalinity
pH in $CaCl_2$ 1:5	7.7	Slight Alkalinity
EC mS/cm 1:5	.45	Saline

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			2.44	20.20	Extreme
Potassium			4.3	35.50	Extreme
Calcium			4.55	37.60	Very Low
Magnesium			.83	6.90	Very Low
Aluminium					
		ECEC	12.10		Moderate
		Ca/Mg	5.50		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.3 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: 438.1 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 96.61%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

SAMPLE: Batch N°: **4781** Sample N°: **17**
Name: **HA06_0.7-0.9**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	7.9	Slight Alkalinity
pH in $CaCl_2$ 1:5	7.5	Slight Alkalinity
EC mS/cm 1:5	.39	Saline

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			2.88	20.30	Extreme
Potassium			1.76	12.40	Acceptable
Calcium			6.77	47.70	Very Low
Magnesium			2.8	19.70	Acceptable
Aluminium					
		ECEC	14.20		Moderate
		Ca/Mg	2.40		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983). **Texture:** Charman & Murphy (1991). **Emerson's Aggregate Test:** Charman & Murphy (1991). **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

HLA

CHAIN OF CUSTODY

HLA - Enviroscience Pty Limited - Sydney
Level 5, 828 Pacific Hwy
PO Box 726 Pymble NSW 2073
Gordon NSW 2072 Australia
Tel: 61 2 8484 8999
Fax: 61 2 8484 8989
adavis@hlaensr.aecom.com

Laboratory Details
Lab Name: SESL
Lab Address:16 Chilvers Road, Thornleigh, 2120
Contact Name: Ryan Jackers
Lab. Ref:
Tel: 9980 6554
Fax: 9484 2427
Preliminary Report by:
Final Report by: 6-Nov-07
Lab Quote No: Q1225

Sampled By: A. Davis
HLA Project No: D1065701
Project Name: S5054304
PO No. 148844

Specifications:

	Yes (tick)
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	
2. Fast TAT Guarantee Required?	
3. Is any sediment layer present in waters to be excluded from extractions?	
4. % extraneous material removed from samples to be reported as per NEPM 5.1.1?	
5. Special storage requirements? (details: _____)	
6. Shell Quality Partnership:	
7. Report Format: ☐ Fax ☐ Hardcopy ☐ Email : adavis@hlaensr.aecom.com	

Lab. ID	Sample ID	25/10/2007	Matrix			Preservation				Container	Analysis Request: Exchangeable Sodium Percentage	Salinity (measured as electrical conductivity (dS/m)	Saturated hydraulic conductivity (Ks, mm/hr)	AWC (mm/m)	Soil pH ($CaCl_2$)	Effective Cation Excchange Capacity (Cmol (+)/kg	Emmerson Aggregate Test	P Sorption (Kg/ha)	hold
		Date	soil	water	other	filt'ed	acid	ice bricks	other	(No. & type)									
	HA01_0.0-0.2	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA01_0.6-0.7	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA02_0.0-0.2	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA02_0.5-0.7	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA03_0.0-0.1	25/10/2007	X					X		1x 375ml jar and lid									X
	HA03_0.2-0.4	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA03_0.6-0.7	25/10/2007	X					X		1x 375ml jar and lid									X
	HA03_0.8-1.0	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA04_0.0-0.15	26/10/2007	X					X		1x 375ml jar and lid									X
	HA04_0.2-0.4	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA04_0.45-0.6	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA05_0.0-0.15	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA05_0.2-0.4	26/10/2007	X					X		1x 375ml jar and lid									X
	HA05_0.6-0.8	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA06_0.0-0.15	26/10/2007	X					X		1x 375ml jar and lid									X
	HA06_0.2-0.4	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA06_0.7-0.9	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	

* Metals Required (Delete elements not required): As Cd Cr Cu Ni Pb Zn Hg

Comments:

Lab Report No.

Esky ID

Relinquished by: Anthony Davis Signed: Date: 29/10/2007

Recieved by: Signed: Date:

Relinquished by: Signed: Date:

Recieved by: Signed: Date:

Appendix B

Laboratory Analytical Reports

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[Double-Click **here** to insert a new **Appendix**]

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **1**
Name: **HA01_0.0-0.2**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

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Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	6.6	Very Slight Acidity
pH in $CaCl_2$ 1:5	5.6	Medium Acidity
EC mS/cm 1:5	.09	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.3	3.40	Acceptable
Potassium			2.29	25.70	High
Calcium			5.03	56.50	Low
Magnesium			1.29	14.50	Low
Aluminium					
		ECEC	8.90		Low
		Ca/Mg	3.90		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 3.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Loam - Low Soil Permeability Class
Phosphate Sorption Index: 438.1 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 96.61 %
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

Quality Endorsed Company

AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
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PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

SAMPLE: Batch N°: **4781** Sample N°: **2**
Name: **HA01_0.6-0.7**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	6.7	Very Slight Acidity
pH in $CaCl_2$ 1:5	6.1	Slight Acidity
EC mS/cm 1:5	.12	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.54	5.00	Acceptable
Potassium			.9	8.30	Acceptable
Calcium			5.58	51.20	Low
Magnesium			3.87	35.50	High
Aluminium					
		ECEC	10.90		Low
		Ca/Mg	1.40		Magnesic

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.2 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Clay Loam - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **3**
Name: **HA02_0.0-0.2**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality System
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Sydney Environmental and Soil Laboratory
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PO Box 357
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Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	7.0	Neutral
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	.24	Moderate Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.03	8.70	Elevated
Potassium			4.5	38.10	Extreme
Calcium			4.78	40.50	Very Low
Magnesium			1.52	12.90	Low
Aluminium					
		ECEC	11.80		Low
		Ca/Mg	3.10		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 3.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Loam - Low Soil Permeability Class
Phosphate Sorption Index: 317.8 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 91.53%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **4**
Name: **HA02_0.5-0.7**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	8.8	Strong Alkalinity
pH in $CaCl_2$ 1:5	7.6	Slight Alkalinity
EC mS/cm 1:5	.25	Elevated Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.41	11.90	High
Potassium			5.55	47.00	Extreme
Calcium			3.87	32.80	Very Low
Magnesium			1	8.50	Very Low
Aluminium					
		ECEC	11.80		Low
		Ca/Mg	3.90		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 2.2 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Clay Loam - Low Soil Permeability Class
Phosphate Sorption Index: 379.1 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 94.92%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **6**
Name: **HA03_0.2-0.4**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	7.2	Near Neutral
pH in $CaCl_2$ 1:5	6.3	Slight Acidity
EC mS/cm 1:5	.09	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.34	3.50	Acceptable
Potassium			1.4	14.60	Acceptable
Calcium			5.41	56.40	Low
Magnesium			2.48	25.80	Elevated
Aluminium					
		ECEC	9.60		Low Magnesic
		Ca/Mg	2.20		

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 6.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg^{-1} / $\log_{10}$ $ug\ L^{-1}$
Phosphate Adsorbed from Soil from 150mg P kg^{-1}: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **8**
Name: **HA03_0.8-1.0**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
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PO Box 357
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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	6.8	Very slight Acidity
pH in $CaCl_2$ 1:5	6.1	Slight Acidity
EC mS/cm 1:5	.12	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.7	5.60	Elevated
Potassium			.79	6.40	Low
Calcium			5.92	47.70	Low
Magnesium			5.03	40.60	Extreme
Aluminium					
		ECEC	12.40		Moderate
		Ca/Mg	1.20		Magnesic

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 6.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

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Em: info@sesl.com.au
Web: www.sesl.com.au

SAMPLE: Batch N°: **4781** Sample N°: **10**
Name: **HA04_0.2-0.4**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	6.8	Very Slight Acidity
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	.24	Moderate Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.98	8.40	High
Potassium			2.48	21.40	High
Calcium			5.84	50.30	Low
Magnesium			2.33	20.10	Acceptable
Aluminium					
		ECEC	11.60		Low
		Ca/Mg	2.50		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.3 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Medium Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Enviroscience Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

SAMPLE: Batch N°: **4781** Sample N°: **11**
Name: **HA04_0.45-0.6**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

Quality System
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TEST	RESULT	COMMENTS
pH in water 1:5	6.5	Slight Acidity
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	.35	Elevated Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.35	10.00	High
Potassium			1.19	8.80	Acceptable
Calcium			6.71	49.70	Very Low
Magnesium			4.26	31.60	High
Aluminium					
		ECEC	13.50		Moderate
		Ca/Mg	1.60		Magnesic

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 6.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

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SAMPLE: Batch N°: **4781** Sample N°: **12**
Name: **HA05_0.0-0.15**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	8.2	Moderate Alkalinity
pH in $CaCl_2$ 1:5	7.3	Slight Alkalinity
EC mS/cm 1:5	.6	Saline

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			3.79	22.60	Extreme
Potassium			6.1	36.30	Extreme
Calcium			6.06	36.10	Very Low
Magnesium			.86	5.10	Very Low
Aluminium					
		ECEC	16.80		Moderate
		Ca/Mg	7.00		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 3.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Loam - Low Soil Permeability Class
Phosphate Sorption Index: 343.3 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 93.22%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

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Web: www.sesl.com.au

SAMPLE: Batch N°: **4781** Sample N°: **14**
Name: **HA05_0.6-0.8**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	7.5	Slight Alkalinity
pH in $CaCl_2$ 1:5	7.1	Near Neutral
EC mS/cm 1:5	.23	Moderate Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.31	6.60	Elevated
Potassium			1.71	8.60	Acceptable
Calcium			14.36	71.80	Acceptable
Magnesium			2.6	13.00	Low
Aluminium					
		ECEC	20.00		Moderate
		Ca/Mg	5.50		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.3 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

Quality System
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SAMPLE: Batch N°: **4781** Sample N°: **16**
Name: **HA06_0.2-0.4**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	8.6	Strong Alkalinity
pH in $CaCl_2$ 1:5	7.7	Slight Alkalinity
EC mS/cm 1:5	.45	Saline

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			2.44	20.20	Extreme
Potassium			4.3	35.50	Extreme
Calcium			4.55	37.60	Very Low
Magnesium			.83	6.90	Very Low
Aluminium					
		ECEC	12.10		Moderate
		Ca/Mg	5.50		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.3 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: 438.1 mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 96.61%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

Effluent Subdivison Profile

CLIENT: **HLA-Envirosciences Pty Ltd**
PO Box 73

HUNTER REGION MC NSW 2310
Attn: Anthony Davis

PROJECT: Name: **S6054304**
Location: **Wagga Wagga**
SESL Quote N°: **Q1225** Client Job N°: Order N°:
Date Received: **30/10/2007**

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SAMPLE: Batch N°: **4781** Sample N°: **17**
Name: **HA06_0.7-0.9**
Test Type: **pH (CaCl2), P sorp, EAT, ECEC, Perm (4419), PWP/FC (calc AWC)**

TEST	RESULT	COMMENTS
pH in water 1:5	7.9	Slight Alkalinity
pH in $CaCl_2$ 1:5	7.5	Slight Alkalinity
EC mS/cm 1:5	.39	Saline

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			2.88	20.30	Extreme
Potassium			1.76	12.40	Acceptable
Calcium			6.77	47.70	Very Low
Magnesium			2.8	19.70	Acceptable
Aluminium					
		ECEC	14.20		Moderate
		Ca/Mg	2.40		Normal

Phosphate Retention Index % PRI mgP/kg PRI kg/ha

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL:

Structure:

Emerson Stability Class : H20 5.1 Low SAR High SAR

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Light Clay - Low Soil Permeability Class
Phosphate Sorption Index: N/A mg/kg $^{-1}$ / log $_{10}$ ug L^{-1}
Phosphate Adsorbed from Soil from 150mg P kg $^{-1}$: 100%
Method Reference: Rayment & Higginson Method 9I1

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983). **Texture:** Charman & Murphy (1991). **Emerson's Aggregate Test:** Charman & Murphy (1991). **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Checked by: Murray Fraser

Consultant: Ryan Jacka

Date of Report 15/11/2007

HLA

CHAIN OF CUSTODY

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Gordon NSW 2072 Australia
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Laboratory Details
Lab Name: SESL
Lab Address:16 Chilvers Road, Thornleigh, 2120
Contact Name: Ryan Jackers
Lab. Ref:
Tel: 9980 6554
Fax: 9484 2427
Preliminary Report by:
Final Report by: 6-Nov-07
Lab Quote No: Q1225

Sampled By: A. Davis
HLA Project No: D1065701
Project Name: S5054304
PO No. 148844

Specifications:

	Yes (tick)
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	
2. Fast TAT Guarantee Required?	
3. Is any sediment layer present in waters to be excluded from extractions?	
4. % extraneous material removed from samples to be reported as per NEPM 5.1.1?	
5. Special storage requirements? (details: _____)	
6. Shell Quality Partnership:	
7. Report Format: ☐ Fax ☐ Hardcopy ☐ Email : adavis@hlaensr.aecom.com	

Lab. ID	Sample ID	25/10/2007	Matrix			Preservation				Container	Analysis Request: Exchangeable Sodium Percentage	Salinity (measured as electrical conductivity (dS/m)	Saturated hydraulic conductivity (Ks, mm/hr)	AWC (mm/m)	Soil pH ($CaCl_2$)	Effective Cation Excchange Capacity (Cmol (+)/kg	Emmerson Aggregate Test	P Sorption (Kg/ha)	hold
		Date	soil	water	other	filt'ed	acid	ice bricks	other	(No. & type)									
	HA01_0.0-0.2	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA01_0.6-0.7	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA02_0.0-0.2	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA02_0.5-0.7	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA03_0.0-0.1	25/10/2007	X					X		1x 375ml jar and lid									X
	HA03_0.2-0.4	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA03_0.6-0.7	25/10/2007	X					X		1x 375ml jar and lid									X
	HA03_0.8-1.0	25/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA04_0.0-0.15	26/10/2007	X					X		1x 375ml jar and lid									X
	HA04_0.2-0.4	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA04_0.45-0.6	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA05_0.0-0.15	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA05_0.2-0.4	26/10/2007	X					X		1x 375ml jar and lid									X
	HA05_0.6-0.8	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA06_0.0-0.15	26/10/2007	X					X		1x 375ml jar and lid									X
	HA06_0.2-0.4	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	
	HA06_0.7-0.9	26/10/2007	X					X		1x 375ml jar and lid	X	X	X	X	X	X	X	X	

* Metals Required (Delete elements not required): As Cd Cr Cu Ni Pb Zn Hg

Comments:

Lab Report No.

Esky ID

Relinquished by: Anthony Davis Signed: Date: 29/10/2007

Recieved by: Signed: Date:

Relinquished by: Signed: Date:

Recieved by: Signed: Date:

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Attachment 2 - Review of Construction and Operational Air Quality Assessment

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(PO Box 5464) Wagga Wagga
NSW 2650

22 February 2022

Ref: 70B-22-0004-GCO-29398-0-draft

Dear Michial,

NGH - 16-276 - EIS Northridge Waste Management Facility Byrnes Road

1 INTRODUCTION

This letter outlines a third party review of the Northbridge Waste Disposal Facility Construction and Operational Air Quality Assessment (Document Ref: IA205100_F0v1), hereafter referred to as the Report, prepared by Jacobs Australia. The review was commissioned by Wagga Wagga City Council as a requirement of the NSW Southern Regional Planning Panel, which has requested a third-party review of the Report and, in particular, with reference to:

> 2. Advice, prepared by a suitably qualified expert, addressing the potential for airborne particles associated with landfill material, in particular fly ash, to contaminate agricultural produce associated with the Riverina Oils facility. The advice should address the risk of contamination and management and mitigation measures that could be employed to manage this risk.

The scope of this review is to:

- Review the local setting information provided in the assessment;
- Review the air quality assessment methodologies and compare with the relevant best practice guidelines and regulatory requirements including but not limited to:
    - NSW Protection of the Environment Operations Act 1997 (POEO Act), Protection of the Environment Operations (Clean Air) Regulation 2010 (POEO Clean Air Regulation), and Protection of the Environment Operations (General) Regulation 2009, Part 5.4 Air pollution.
    - The "Approved Methods for Modelling and Assessment of Air Pollutants in NSW" (Approved Methods), (NSW Environment Protection Authority, 2016);
    - other relevant guidelines;
- Review potential air quality impacts and, in particular, in relation to the potential for contamination of agricultural produce associated with the Riverina Oils Facility;
- Management and mitigation recommendations; and
- Provide a letter outlining all the items reviewed and the associated comments.

2 REVIEW

2.1 ASSESSMENT METHODOLOGY

2.1.1 OVERVIEW

As outlined in the Report, requirements for assessment are provided in the Secretary's Environmental Assessment Requirements (SEARs) (No. 1062 issued July 2016, updated August 2018) issued for the proposal require the assessment of key environmental matters associated with the proposal. The relevant assessment requirements addressed in the Report are:

- Describe all potential sources of emissions
- Provide an assessment of potential air quality impacts in accordance with EPA guidelines; and
- Describe and appraise air quality mitigation and monitoring measures.

Relevant guidance and regulation for the assessment are provided in State documentation which may be summarised as follows:

- State Policies:
    - NSW Protection of the Environment Operations Act 1997 (POEO Act), Protection of the Environment Operations (Clean Air) Regulation 2010 (POEO Clean Air Regulation), and Protection of the Environment Operations (General) Regulation 2009, Part 5.4 Air pollution.
    - The "Approved Methods for Modelling and Assessment of Air Pollutants in NSW" (Approved Methods), (NSW Environment Protection Authority, 2016).

The air quality impact assessment by Jacobs has generally followed the requirements of the cited SEARS, guidance and regulation as summarised below. Any items considered a potential deviation from the document sources are noted and discussed further in the subsequent section.

- The potential sources of dust and particulate matter emissions for construction and operational activities have been identified and described.
- The assessment has been undertaken in general accordance with the guidelines provided in the EPA's Approved Methods document. As required by the Approved Methods:
    - An emissions inventory has been prepared using emission factors and appropriate methodology derived from the relevant NPI EET Manual and USEPA AP42 factors.
    - A site-specific meteorological dataset of hourly records for 12 continuous months has been developed using measured data from the nearest BoM Station. However, it is not clear if all of the meteorological parameters required for the modelling assessment have been derived and, in particular, those specified for dust deposition which does not appear to have been modelled in the assessment.
    - Background data has been adopted from the nearest OEH Monitoring Stations, where possible.
    - Whilst it is acknowledged that an approved dispersion model (AUSPLUME) has applied for the assessment, there is not sufficient information provided in the Report to determine if it is approved for use in this application. In particular, AUSPLUME should not be used for terrain where the height of any receptor exceeds the lowest release height or in locations where a high frequency of stable night-time conditions may occur.
- The cumulative impacts from the emissions are assessed against the appropriate impact assessment criteria, as specified in the Approved Methods.
- A range of air quality control measures, which are consistent with the controls modelled, are outlined in the Report.

2.1.2 RECOMMENDATIONS

Vipac considers that AUSPLUME may not be a suitable dispersion model for the assessment. Further information is therefore requested to demonstrate that conditions specified in the Approved Methods for application of this model are met. Namely, a comparison of the sensitive receptor and source heights and analysis of the frequency of stable night-time conditions.

In addition, further information relevant to the derivation of the meteorological parameters required for dust deposition assessment and/or justification for their exclusion is requested.

2.2 METEOROLOGICAL DATA AND LOCAL SETTING

2.2.1 OVERVIEW

A desktop review of available online information (such as Google Earth imagery) by Vipac has confirmed that the location is correctly defined in the Report and potential residential and industrial receivers inclusive of the neighbouring Riverina Oils Facility appear to be correctly identified.

2.2.2 RECOMMENDATIONS

Vipac's recommendations for further information relevant to the meteorological data are provided in section 2.1.2**Error! Reference source not found.**.

2.3 POTENTIAL AIR QUALITY IMPACTS

2.3.1 OVERVIEW

The Report outlines the assessment of dust impacts (as TSP, PM10 and PM2.5) from the construction and operation of the proposed Facility upon the surrounding environment. Impacts from combustion gases are also considered but not modelled on the basis that exhaust emissions would not be so significant as to adversely affect local air quality. The results of the assessment may be summarised as follows.

Exceedances of the 24-hour averaged PM10 criteria were predicted at the nearest modelled sensitive residential receivers to the west and north during construction, as well as at the industrial receiver R01. However, contributions from the site were predicted to be less than 3 µg/m^3, with background levels contributing 48 µg/m^3. As per the Approved Methods, further assessment was completed which determined that PM10 contributions from the site would not result in any additional exceedances at these two locations. At industrial receiver I01, modelling indicated the potential for three additional exceedances, although all were on days where background concentrations were 46 µg/m^3 or higher.

Cumulative TSP, annually averaged PM10 and 24 hour and annually averaged PM2.5 concentrations were not predicted to exceed relevant impact assessment criteria during construction and no exceedances of criteria were predicted at any modelled sensitive receivers during the most intensive phase of operations.

2.3.2 RECOMMENDATIONS

Vipac considers the rationale for the exclusion of the modelling assessment of gaseous exhaust emissions to be valid. However, no information regarding the potential for dust deposition impacts, and, in particular on the Riverina Oils Facility is provided in the Report. It is acknowledged that impacts from suspended particulate emissions (i.e. TSP, PM10 and PM2.5) are not predicted to exceed criteria at modelled sensitive receptors during operations. However, there is potential for dust deposition and for contamination from contaminants present in the waste materials (e.g. fly ash, sand, road waste products) on the Riverina Oils Facility which should be addressed.

Assessment of dust deposition impacts upon the Riverina Oils Facility is recommended.

2.4 MITIGATION AND MANAGEMENT

2.4.1 OVERVIEW

A range of air quality control measures, which are consistent with the controls modelled, are outlined in the Report. However, these measures may require review subject to the outcomes of the assessment of the dust deposition upon the Riverina Oils Facility.

2.4.2 RECOMMENDATIONS

A review of the proposed air quality control measures is recommended once the outcomes of the assessment of dust deposition upon the Riverina Oils Facility are known.

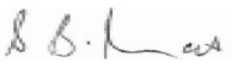
3 CONCLUSIONS AND RECOMMENDATIONS

Vipac has undertaken a third party review of the Northbridge Waste Disposal Facility Construction and Operational Air Quality Assessment (Document Ref: IA205100_F0v1). The following recommendations are provided:

- AUSPLUME may not be a suitable dispersion model for the assessment. Further information is therefore requested to demonstrate that conditions specified in the Approved Methods for application of this model are met. Namely, a comparison of the sensitive receptor and source heights and analysis of the frequency of stable night-time conditions.
- Further information relevant to the derivation of the meteorological parameters required for dust deposition assessment and/or justification for their exclusion is requested.
- Assessment of the impacts and, in particular, dust deposition on the Riverina Oils Facility is recommended.
- A review of the proposed air quality control measures is recommended once the outcomes of the assessment of dust deposition impacts upon the Riverina Oils Facility are known.

Yours faithfully

Vipac Engineers & Scientists Ltd



Dr. Stephen Thomas

Air Quality Principal