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INVESTIGATION AND DESIGN OF CARISBROOK FLOOD AND DRAINAGE MITIGATION TREATMENTS

Detailed Design Report

ENTURA-A31FA
6 June 2016

Prepared by Hydro-Electric Corporation
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1. Introduction

1.1 Background

The township of Carisbrook is located at the confluence of Tullaroop Creek (also referred to as Deep Creek) and McCallum Creek within the Loddon River catchment, in central Victoria, approximately 170 km from Melbourne. Carisbrook experienced severe flooding in January 2011, which was estimated as 1 in 135 AEP flood event. In 2011/12, the North Central Catchment Management Authority (NCCMA) commissioned Water Technology to prepare the Carisbrook Flood and Drainage Management Plan. The Plan identified key flooding issues in the township, determined flood levels for a range of flood events and recommended mitigation works to reduce the risk of future flooding.

Resulting from that study, the flooding of Carisbrook is caused by two mechanisms as follows:

- riverine or main creek flow, the cause of flooding of the major part of the township from overtopping the banks of the McCallums and Tullaroop Creeks with an upstream catchment of about 1,200km^2
- overland flows, from bush areas to the south and west of the township with a local catchment of around 21 km^2

After significant consultation with the community and stakeholders, the community determined their preference was creek vegetation thinning in conjunction with a western levee and drain to protect the town from overland flows.

Based on the Carisbrook Flood and Drainage Management Plan (Water Technology, 2011), there are two mitigations as follows:

- **main creek flows,** for which a vegetation clearing project was defined in order to lower the water levels during flood events in the creek.
- **overland flows** for which a preliminary/detail design study of the two options namely Options A (also known as the Western Levee) and Option B (also known as the Belfast Street Levee) was defined to contain the overland flows and redirect them to the main creek in an optimal manner.

Entura was awarded a contract by Central Goldfields Shire Council (CGSC) to investigate and cost two overland flow flood mitigation options (A and B) in order to consequently develop a detail design for the preferred option in consultation with the council and the community.

1.2 Preliminary Design

Entura undertook the preliminary design of both Options A and B relating to the overland flows (see Section 1.1 for details) and submitted the draft “Preliminary Design Report” to CGSC on 20th of February 2015. The final version of the report incorporating CGSC’s comments was submitted on 27th of February 2015.

As part of the preliminary design phase a topographic survey of the two mitigation options was undertaken.

1.3 Decision making stage

Following the submission of the preliminary report, a decision was made on the preferred option based on the information provided in the Preliminary Design Report (Entura, 2015). The project progress during this stage is summarised below:

- CGSC's board meetings
- Consultation with land owners
- Consultation with VicRoads and VicTrack
- Presentation to Carisbrook Flood Committee

Based on the above, Option A (also known as Western Levee) was selected as the preferred option to proceed with in the detail design stage. Compared to the preliminary design, the following amendments were introduced to the design:

- William Road Levee:
    - Williams Road will be raised on the western side of Landrigan Road instead of constructing a levee next to it.
- Western Levee:
    - A new pipe culvert will be required at around Chainage 450 to ensure environmental flow passes under the levee into the wetland on the eastern side of the levee.
    - The location of the levee/culvert crossing Pyrenees Highway changed:
        - On the southern side of the highway levee was shifted into the western property
        - On the northern side, Pleasant Street was planned to be raised
        - A skewed culvert was deemed suitable in order to minimise the impact on the northern property
    - The drain has been redirected west along the southern side of Wills Street before passing under Wills Street and then through the race course land to direct flows into an existing dam at the request of the client
    - The existing culvert under Pleasant Street and the existing culvert under Wills Street at their intersection are to be removed at the request of the client
    - A new culvert was introduced under Wills Street in the southern-northern direction at approximately 270m from its junction with Pleasant Street.
    - Wills Street was planned to be raised gradually, for 50m, before reaching Pleasant Street to match its new top level.
    - Racecourse Access Road was planned to be raised gradually, for 50m, before reaching Pleasant Street to match its new top level.
    - The levee was extended further north along Pleasant Street to chainage 2700m to take advantage of the higher ground in this location and reduce the length and height of the levee running through the race course land.
    - The channel planned on the western side of the Western Levee between Chainages 1000 and 1550 was extended to the entire length of the levee. This was mainly because of the Concerns raised by the property owners that normal rain will flow through their property for literally any rainfall. Also they were worried about the drainage after the flood started to recede.

1.4 Structure of the report

The report comprises the following sections:

1. Introduction – describing the background of the project, preliminary design, and decision making stage as outlining the structure of the report
2. Stakeholder communication – a summary of the communication and consultation of the stakeholders re the proposed design
3. Cultural/heritage and environmental assessment – a brief section on the different environmental and cultural/heritage aspects
4. Geotechnical investigations – describing the geotechnical investigations and the outcomes
5. Civil design – outlining the design of levees, road raising sections, culverts and floodgates
6. Operations and Maintenance
7. Safety in Design
8. Cost estimation – a summary of the cost estimation for the works
9. References
10. Appendices

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2. Stakeholder communication

2.1 Introduction

Stakeholder communication undertaken in the preliminary design phase is reported in Section 4 of the Preliminary Design Report (Entura, 2015).

Stakeholder communications undertaken in the detailed design phase are reported below.

2.2 Preliminary Design Consultation Activities

The community engagement conducted at the preliminary design stage was as follows:

- Stakeholder identification
- Notification of landowners to facilitate early survey access
- Development and facilitation with CGSC of a notification program to inform the community and key stakeholders of the progression of the flood mitigation treatments actions and preliminary stage activities of the project

The community consultation activities that have been undertaken during the preliminary design stage included:

- Preliminary notification letters to key landowners to gain access for survey works (5 December 2014)
- Discussions with 2 landowners during site visits by Entura survey staff (see Table 2.1 for details)
- Press release in local paper to update activities in regards to flood mitigation works
- Website update
- Mail out update letter to the following stakeholders:
  - Residents update letter mail out to post code 3464 (Carisbrook)
  - Technical working group update letter
  - Chair of community-based steering committee (Carisbrook Disaster Recovery Committee) update letter

Table 2.1 below outlines these activities, their timing and comments in regards to consultation activities during the preliminary design stage to date.

Table 2.1: Stakeholder engagement at preliminary design stage

Engagement activity	Timing	Details and comments
Preliminary notification letters to key landowners to gain access for survey works	Posted on (CGSC) letterhead 5 December 2014	13 letters in total were posted to landowners. Landowners notified were those that that Entura may require access to during the surveying of Williams Street Levee, Belfast Road Levee, and West alignments.
Preliminary Survey Activity Site visits by Entura survey staff	Tuesday 9th-Thursday 11th December 2014	Following the notification letters delivery, Entura staff commenced survey works. CGSC indicated notification letter was adequate for property access. Throughout survey period only two residents approached the surveyor (these were not notified landowners). These individuals expressed their support of the overall works and aims.
Update letter mail out to all residents update in post code 3464 (Carisbrook)	Posted on (CGSC) letterhead from the Mayor. Week starting 23rd February 2015	All residents in Carisbrook region received an update about the flood mitigation works being carried out currently and planned for Carisbrook.
Update letter mail out to Chair of the community-based steering committee (Carisbrook Disaster Recovery Committee Inc)	Posted on (CGSC) letterhead from the Mayor. Week starting 23rd February 2015	The Chair of the community-based steering committee received update letter about the flood mitigation works being carried out currently and planned for Carisbrook. They were requested to notify the current committee members.
Update letter mail out to all Technical working group members (See Appendix E1 for details) -The Technical working group members represent the follow key stakeholder organisations: North Central Catchment Management Authority VicRoads BOM	Posted on (CGSC) letterhead from the Mayor. Week starting 23rd February 2015	All members of the technical working group received an individual update letter about the flood mitigation works being carried out currently and planned for Carisbrook. This assumes that members of the technical working group will provide updates internally within their organisations in regards to the current and

Engagement activity	Timing	Details and comments
SES Goulburn Murray Water DEPI (Department of Environment and Primary Industries) VicTrack Central Goldfields Shire CGSC		planned activity for the flood mitigation works.
Press release in local paper to update activities in regards to flood mitigation works	Week starting 23rd February 2015	CGSC communications to submit to paper
Website update	Week starting 23rd February 2015	CGSC communications to upload

2.3 Meeting with land owners for the detail design

Entura and CGSC conducted landowner meetings on the 3rd, 4th and 5th of March 2015 to discuss the preferred preliminary design (Option A) with the seven property owners whose properties will be most impacted by the proposed alignment of levees. Entura and CGSC wanted to consult the landowners about the proposed alignment of levees and the resulting changes to flooding, outline the specific impacts the levees might have to individual landowners and give them the opportunity to ask questions and raise any concerns.

A memorandum was prepared and submitted to CGSC detailing the discussions / conversations and outcomes of the consultation.

In attendance at the meetings were Michael Willis (Entura - Community Engagement Consultant), Mohsen Moeini (Entura - Project Manager) and Lee Hendrickson (CGSC - Project Coordinator). David Sutcliffe from CGSC filled in for Leigh on Tuesday the 3rd of March. The details of the land owners and individual expectations are not listed here due the confidentiality restrictions.

Each meeting included a general introduction of the people in the meeting and their roles, an outline of the aim of the meeting, viewing of maps and discussion of technical aspects of the project, answering questions, a discussion of how each landowner would be impacted and their feedback on this. Landowners were also asked for suggestion that could improve the benefits of the project for them.

All landowners were told that:

- The project and levee locations are not set in stone yet, which is why we were speaking to the affected landowners to ensure their concerns are addressed in the design.
- The legal framework for the project is still being explored by council.
- Council would like to do the project as soon as possible. However, the project is dependent on grant money from state and federal governments, so the timing is unknown.
- This was just the first meeting. Further meetings to discuss the project with landowners would follow with notification from the council.

Summary of the outcomes related to the design are as follows:

- It was recommended that ongoing, regular and timely communication with these engaged landowners continues as the project progresses and designs changes (to be conducted by Council or Entura on behalf of Council, if required).
- That any commitments or promises for follow up or further information be done in a timely and prompt manner.
- It was recommended that Council (or Entura on behalf of the council, if required) follow up meetings with additional stakeholder identified (for instance the Cemetery).
- It appeared that the road raising should be considered wherever possible to ease the process with the landowners as they all preferred that solution rather than a new levee being constructed next to the existing roads on their lands.
- General consensus was that the railway has no benefits for the township and creates problem after any flooding event. It was understood that this is not what the entire township believes in but this consultation could indicate an overall understanding.

  However, VicTrack was informed of this to see whether they are happy of some trench cutting in key locations until any future planning and the response was that a culvert has to be designed and the existing railway has to be re-instated.
- It was recommended that the Council consider creating opportunities to update the local community through one of the following ways:
  - promoting and manning an information stall (with a banner displaying information, information people can take with them, maps to look at etc) outside the busiest local supermarket or other locations that are frequently visited (for specified set periods of time and advertised)
  - updated information via e.g. brochure, postcard, letter
  - updating the committees (technical and community-based)
  - update the website
  - update article in local paper.

It should be noted that CGSC released public notice on their website and sent a full copy of the preliminary design report (Entura, 2015) to the affected landowners.

2.4 Presentation to the Steering Committee

On 10th of April, a meeting was held with the Carisbrook Flood Mitigation Steering Committee to present the progress of the project and discuss different aspects of the preferred options prior to proceeding with the final design. The meeting location was at Carisbrook Senior Citizens Club and at presence were the following:

- David Sutcliffe (CGSC)
- Keith McLeish
- Camille White (NCCMA)
- Jolene Goulton (NCCMA)
- Lang Dowdell (NCCMA)
- Cr Barry Rinaldi

- Cr Helen Broad
- Cr Paula Nixon
- Trish Coutts
- Shane O'Loughlin (NCCMA)
- Ken Coates (Chair, NCCMA)
- Simone Wilkinson (DELWP)
- Calum Walker (DELWP)
- Leigh Hendrickson (CGSC)
- Mohsen Moeini (Entura)

Mohsen Moeini presented the progress of the project and details of the preferred option were discussed. The attendees were happy with the progress of the project and the preferred option selected for the final design.

The vegetation clearing project being undertaken by the North Central Catchment Management Authority (NCCMA) was also tabled/presented.

The minutes of meeting is provided in Appendix A.

2.5 Consultation with Relevant Authorities

Relevant authorities were consulted throughout the project either directly by Entura team or through CGSC as outlined below.

2.5.1 NCCMA

The NCCMA were contacted to determine the need or otherwise for a permit to construct and operate on a waterway under Section 67 of the *Water Act 1989* for works on the unnamed drainage channel located on two properties (LP219700 and LP205106). Consultation included a phone call and follow up email to Camille White on the 30th of July 2015 in which it was confirmed that a permit would be required and that, as the NCCMA have been extensively involved in the project (eg member of steering committee and undertaking vegetation clearing) they were content not to be a referral agency for the development application.

2.5.2 DELWP

Initial contact was made with DELWP's Regional Planning Officer, Ms Lara Edwards, on 3 August 2015 to confirm the consent requirements for the application. This was followed up with an email and phone call on 7 August 2015. Ms Edwards confirmed the basic information that such a request for consent should contain. She further confirmed by email on 10 August 2016 the email address to which the request for consent should be sent.VicRoads / VicTrack

VicRoads and VicTrack were consulted during the preliminary design and further consultation took place during the course of the detail design to ensure that both authorities approve the design proposed.

David Hildebrand from VicRoads kindly provided some comments on the Drawing EHT-CA-DR-006 relating to the culvert under Pyrenees Highway which were incorporated in the final revision to ensure all VicRoads requirements are addressed.

Two meetings were held with Matthew Bunney from VicTrack as follows:

- On 17th of March, Scott Lobdale (Entura) and Leigh Hendrikson (CGSC) tabled the preliminary design drawings and initial feedback was taken into consideration for the detail design.
- On 10th of July, Mohsen Moeini (Entura) tabled a copy of the Drawing EHT-CA-DR-007 relating to the culvert under the Railway. The initial feedback was that VicTrack is essentially happy with the design as it appears that it ticks all the boxes. However, if approvals were required and official application needed to be lodged so that an independent review can be undertaken.

2.5.3 Utility services

As detailed in Section 5.9, the key affected services that require alteration are as follows:

- At Pyrenees Highway
  - Gas distribution main / Ausnet Services

    On the northern side of the highway, the existing gas pipe will interfere with the channel/culvert and requires altering. Downer/Tenix manage Ausnet's gas infrastructure. Zack Ilic from Downer/Tenix was consulted in July 2015 and advised the following:

    - they do not have an objection of the proposed works
    - the works will be required to be completed by AusNet Services accredited subcontractor prior to start of Pyrenees Highway culverts construction works. The time to organise and see AusNet Services accredited subcontractor on the site can take up to 8 weeks.
    - a quotation for this work has been obtained and has been included in the cost estimate
  - Water distribution pipe / Central Highlands Water

    On the southern side of the highway, the existing water pipe will interfere with the channel/culvert and requires altering. Marnie Ireland from Central Highlands Water was contacted in July 2015 and advised the following:

    - The issue with Carisbrook water supply is it is a 250mm single feed pipeline – there is no alternate supply for Carisbrook. Temporary service for the town needs to be built first or a notice is issued to the whole town of the Shut Down of supply for 5 hours.
    - The 250mm pipe can be lowered (preferred options as lower risk) as per normal engineering design process.
    - or build as a DICL main and built above ground (Risk is 1000 kPa system water pressure therefore needs to be anchored in place).
  - Telecom Cables / Telstra

    After contacting Telstra, it was understood that the process for Telstra starts with logging the project. At that stage they will get a field advisor to scope the job and several of their authorised contractors to quote on the work. This sounds like something that would be done by the construction contractor. The person in Telstra we spoke to did not know of any formal approvals required at the design stage and we have not been able to find reference to anything. Subsequent to this, the Council obtained a quotation for the relocations required and this amount has been included in the cost estimate.

- At the Railway

On the northern side of the railway, the culvert/channel will interfere with the existing Fibre Optic Cable from Telstra. Similar to the Telecom Cables along Pyrenees Highway (see the above), apparently there is no clear process or approvals required at this stage from Telstra until the construction company is appointed for the job. At that stage, Telstra will appoint a field advisor to scope the job and several of their authorised contractors to quote on the works. Then the alteration works will be undertaken prior to the commencement of the channel/culvert works by the construction company for Carisbrook Flood Mitigation Project.

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3. Cultural heritage and environmental assessment

The use of land for flood mitigation structures, such as a levee, is defined as a Utility Installation under the Central Goldfields Planning Scheme. The levee extends across six zones and fiver overlays and requires a permit as a Section 2 use. A permit is also required for building and works as well as for the removal of native vegetation.

A comprehensive application report has been prepared for lodgement. The report demonstrates that the relevant provisions of the planning scheme have been addressed and recommends that the application be approved.

The levees cross a number of private and public properties, roads and the railway. All stakeholders have been consulted in order to optimise the design and minimise impacts upon landowners. As required under the planning scheme, the consent of the land managers of the two public use zones (DELWP & VicTrack) has been requested to accompany the application for permit.

Specialist studies have been undertaken to ascertain the impact of this development:

- Entura undertook a biodiversity assessment in May 2015 to identify and map remnant patches of native vegetation and scattered trees that would be affected by the proposed levee. The assessment found the proposed levee will be predominantly constructed on cleared agricultural land but will affect three remnant patches of native vegetation and three scattered trees. The required clearing of native vegetation is less than 0.5 ha in total. An offset requirement will ensure no net loss.
- A cultural heritage scoping study was undertaken in June 2015 by Landskape Heritage Management which found that no Aboriginal cultural heritage sites had previously been recorded in the development corridors proposed for flood mitigation works. Predictive modelling showed that there was a low to negligible potential for Aboriginal cultural heritage to occur in the development site. The scoping study found that the activity area for the proposed flood mitigation works was not an area of cultural heritage sensitivity according to the *Aboriginal Heritage Regulations 2007* and concluded that a CHMP is not required for the construction of the project. A copy of the updated cultural heritage assessment is provided in Appendix B.

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4. Geotechnical investigations

Geotechnical investigations were undertaken by Tonkin and Taylor on behalf of Entura.

The field works were carried out between 25th and 28th of May 2015 and included:

- 17 boreholes
- 25 test pits

The following in-situ tests were carried out:

- 41 dynamic cone penetrometer tests;
- 6 standard penetration tests; and
- 117 shear vane tests.

The following laboratory tests also were carried out:

- sieve analysis test;
- California bearing ratio;
- moisture content;
- Emerson class number; and
- permeability.

In summary, local material can be used for building the levee partially from the channel excavation next to the Western levee and the rest from the borrow areas already identified. The test results also show that adequate bearing capacity exists for all the culverts.

A standalone report was prepared for the geotechnical investigation and testing as presented in Appendix C.

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5. Civil design

This section of the report outlines the details of the project components and associated design. The concept of the design is based on the preliminary stage incorporating amendments identified during the stakeholder consultation, environmental/cultural heritage assessment, and CGSC's review.

5.1 Outline of the design

The project comprises the following elements:

- Western Levee (2.9km)
- Williams Rd Levee (0.7km)
- Culverts (3 box culverts and 2 pipe culverts)
- A non-return valve (or floodgate)

A portion of both levees intersects with the existing council roads, namely Pleasant St and Williams Rd, which need to be raised to act as a water barrier.

The details of each element are further described in the sections below. The drawings listed in Table 5.1 have been prepared and provided in Appendix E:

Table 5.1: List of the drawings

Title	Drawing number
General Arrangement – Plan	EHT-CA-DR-C-001A
Locality Plan / Geotech Details	EHT-CA-DR-C-001B
Western Levee - Plan and Profile - Sheet 1 of 7	EHT-CA-DR-C-002A
Western Levee - Plan and Profile - Sheet 2 of 7	EHT-CA-DR-C-002B
Western Levee - Plan and Profile - Sheet 3 of 7	EHT-CA-DR-C-002C
Western Levee - Plan and Profile - Sheet 4 of 7	EHT-CA-DR-C-002D
Western Levee - Plan and Profile - Sheet 5 of 7	EHT-CA-DR-C-002E
Western Levee – Wills St Channel, High St & Pleasant St Transition Long Sections - Sheet 6 of 7	EHT-CA-DR-C-002F
Western Levee - Plan and Profile - Sheet 7 of 7	EHT-CA-DR-C-002G
Williams Rd Levee - Plan and Profile	EHT-CA-DR-C-003
Western Levee - Cross Sections	EHT-CA-DR-C-004
Western Levee - Cross Sections – Sheet 1 of 2	EHT-CA-DR-C-004A
Western Levee - Cross Sections – Sheet 2 of 2	EHT-CA-DR-C-004B
Western Road Levee - Cross Sections – Sheet 1 of 13	EHT-CA-DR-C-004C
Western Road Levee - Cross Sections – Sheet 2 of 13	EHT-CA-DR-C-004D
Western Road Levee - Cross Sections – Sheet 3 of 13	EHT-CA-DR-C-004E

Title	Drawing number
Western Road Levee - Cross Sections – Sheet 4 of 13	EHT-CA-DR-C-004F
Western Road Levee - Cross Sections – Sheet 5 of 13	EHT-CA-DR-C-004G
Western Road Levee - Cross Sections – Sheet 6 of 13	EHT-CA-DR-C-004H
Western Road Levee - Cross Sections – Sheet 7 of 13	EHT-CA-DR-C-004I
Western Road Levee - Cross Sections – Sheet 8 of 13	EHT-CA-DR-C-004J
Western Road Levee - Cross Sections – Sheet 9 of 13	EHT-CA-DR-C-004K
Western Road Levee - Cross Sections – Sheet 10 of 13	EHT-CA-DR-C-004L
Western Road Levee - Cross Sections – Sheet 11 of 13	EHT-CA-DR-C-004M
Western Road Levee - Cross Sections – Sheet 12 of 13	EHT-CA-DR-C-004N
Western Road Levee - Cross Sections – Sheet 13 of 13	EHT-CA-DR-C-004O
Wills St, High St & Pleasant St. Transitions Cross Sections – Sheet 1 of 1	EHT-CA-DR-C-004P
Williams Road Levee - Cross Sections	EHT-CA-DR-C-005
Williams Road Levee - Cross Sections – Sheet 1 of 2	EHT-CA-DR-C-005A
Williams Road Levee - Cross Sections – Sheet 2 of 2	EHT-CA-DR-C-005B
Williams Road Levee Levee- Cross Sections – Sheet 1 of 1	EHT-CA-DR-C-005C
Pyrenees Highway Culvert - Plan and Sections – Sheet 1 of 2	EHT-CA-DR-C-006A
Pyrenees Highway Culvert - Plan and Sections – Sheet 2 of 2	EHT-CA-DR-C-006B
Railway Culvert - Plan and Sections	EHT-CA-DR-C-007
Other Culverts - Plans and Sections	EHT-CA-DR-C-008
Other Culvert - Plan – Sheet 1 of 2	EHT-CA-DR-C-009A
Other Culvert - Sections – Sheet 2 of 2	EHT-CA-DR-C-009B
Williams Road Levee and Landrigan Road Intersection Plan	EHT-CA-DR-C-010
Floodgates – Section and Details	EHT-CA-DR-C-011
Driveway Crossing – Typical Details – Type 1	EHT-CA-DR-C-012
Driveway Crossing – Typical Details – Type 2	EHT-CA-DR-C-013

5.2 Basis of design

The design criteria used for designing levees, to-be-raised roads, and pre-cast culverts are based on the following standards and guidelines:

- Section 12 of IDM (*2014), Infrastructure Design Manual,* Local Government Infrastructure Design Association, Victoria.
- AGRD03 and AGRD05 (2013), *Guide to Road Design*, Austroads.
- Australian Standard (2010), *Precast reinforced concrete box culverts – Part 1: Small culverts*, Standards Australia Limited, AS 1597.1-2010.
- Australian Standard (2004), *Bridge Design – Part 2: Design Loads*, Standards Australia Limited, AS 5100.2- 2004.
- USBR (1987), *Design of Small Dams*, U.S. Bureau of Reclamation, Dept. of the Interior, Washington, D.C.

- Fell R., MacGregor P., Stapledon D. and Bell, G. (2005) *Geotechnical Engineering of Dams*, Balkema

Further details are provided in the respective sections below for different elements. For the water levels and discharge figures, the results presented in Section 5.3 and the revised MIKE Flood model was used.

5.3 Hydraulics

The hydraulic modelling undertaken by Water Technology was reviewed in the preliminary design stage and the outcomes were documented in Section 3 of the Preliminary Design Report (Entura, 2015).

However, because of (i) some design adjustments that were introduced during the decision making stage (see Section 0) and (ii) standard size selection of the culverts based on the AS 1597.1-2010, the MIKE Flood model was run again for design purposes to extract the more accurate information for design of the culverts and levees. The hydraulic characteristics related to the new culverts are summarised in Table 5.2 based on the revised model results.

Table 5.2: Summary of hydraulic characteristics of the new culverts (for 1 in 100 AEP design flood)

Culvert Location / Flow Direction	**Dimensions**	**Invert Level (mAHD)**	**Max. upstream water level (mAHD)**	**Max. downstream water level (mAHD)**	**Peak Discharge (m^3/s)**
Western Levee (CH 450) / towards East	Φ225	195.45	196.98	195.87	0.1
Western Levee (CH 1000) / towards East	Φ450	194.15	195.67	194.72	0.4
Pyrenees Highway (CH1550) / towards North	2@(1200W×1200H)	194.00	195.65	195.22	6.5
Railway (CH1950) / towards North	4@(1200W×900H)	192.40	193.80	193.63	6.2
Wills Street	2@(600W×450H)	192.20	193.50	192.85	1.3

The existing culvert under Landrigan Rd at its junction with Williams Rd will have a maximum discharge of $1.1m^3/s$ with the maximum upstream water level at EL 197.52m. It is noted that the dimensions of this culvert were not correct in the original Water Technology model and it was found that this culvert was adequate to pass the 1:100AEP flows.

The water levels relating to 1 in 100 AEP flood event have only been changed slightly compared to the preliminary design model review. Water levels along the levees and road levees are provided in Table 5.5 and Table 5.6.

5.4 Levees

There are two levees that need to be constructed as follows:

- Western Levee
  - It is to be constructed from south to north
  - It is 2.9km long, 1.1km of which is raising the existing Pleasant Street between CH1563 (Pyrenees Highway) and CH2703 .
  - It crosses the following roads and railway:
    - Pyrenees Highway at around CH1550; the relevant authority is VicRoads and it is a B class road in accordance with Austroads classification
    - Railway at around CH2000; the relevant Authority is VicTrack
    - Wills St at around CH2150; the relevant authority is CGSC
    - Racecourse access track at around CH 2600; the relevant authority is CGSC
  - There are 3 new culverts to be built under the above-mentioned roads and the Railway generally in south-north direction in parallel to the levee
  - There are 2 new culverts to be built under the levee in west-east direction at CH450, CH1000.
  - Removing the existing culvert under the Pleasant Street at CH2150 to limit the flows into the bluestone drain.
- Williams Rd Levee
  - It is to be laid down from west to east
  - It is 738m long, 232m of which is raising the existing Williams Rd between CH000 and CH232
  - It crosses Landrigan Rd; the relevant authority is VicRoads and it is a C class road in accordance with Austroads classification

For the design of council road levees, refer to Section 5.5.

5.4.1 Cross section

The cross section developed under the preliminary design was examined based on the additional information obtained from the geotechnical investigation. The foundation and fill design are explained in the subsections below.

5.4.1.1 Foundation

In essence, the foundation under the levee alignment can be summarised in 3 layers of Sandy Silt, Clay, and Mixed as presented in Table 5.3.

Based on the results of the geotechnical investigation summarised in Table 5.3, the following was concluded for design and construction of the levees:

- The upper layer (Sandy Silt) has to be stripped wherever it is encountered under the levee alignment to expose the middle layer (Clay). For quantity estimation and drawing preparation at this stage, it is assumed that on average 0.3m stripping is required under the levee throughout.

- The middle layer (Clay) will be the foundation of the levee almost everywhere and its depth goes down to a minimum of 2m. Given that the height of the levee (from the existing ground level prior to stripping) never exceeds 1.6m this is considered an appropriate foundation with a bearing capacity of 100-150kPa and appropriate water tightness for the 1 in 100 AEP flood duration.
- The lower layer (Mixed) was not investigated at all places but only at the boreholes/test pits deeper than 2m. A mix of Clay, Silty Sand, and Sandy Silt was reported.

Table 5.3: Soil stratification under the levee (excluding to-be-raised road sections)

Layer	**Depth**	**Description**
Upper (Sandy Silt)	0 to 0.30-0.45m	• Low plasticity with fine to coarse sand and stiff to very stiff. • No groundwater was observed. • Out of 23 test pits along the levees, 8 did not encounter this and started with Clay.
Middle (Clay)	0.30-0.45m to 2.00m	• Low to medium plasticity and stiff to hard. • No groundwater was observed. • Some thin layers of sand encountered occasionally in some of the test pits of Clayey Sand, Sandy Clay, Clay with sand or Clay with gravel.
Lower (Mixed)	Deeper than 2.00m	• Test Pits 5 and 12 went down to 3m depth and recorded Clay. • BH01 (at Pyrenees Highway) recorded Clay down to 2.8m, then Silty Sand / Sandy Silt down to 4.7m, then went into Clay down to 6.5m. • No groundwater was observed.

5.4.1.2 Homogenous fill material

The levee was designed with homogenous fill material. The results of the geotech investigation confirm that suitable material exists in the vicinity of the levee and Clay (Middle layer in Table 5.3) can be used for construction of the levee. The additional laboratory tests on Clay showed the following:

- Permeability tests (6 tests on clay samples):
  - almost impermeable (permeability of 1×10^{-10} to 6×10^{-9} m/s)
  - dry density was 1.59t/m^3 in-situ on average which went up to a 1.63t/m^3 after compaction
  - initial moisture content was an average of 21.4% and the optimum moisture content was 22.3%
- Moisture content (4 tests from BH01 and BH05)
  - 2 tests at the depth of 3.0-3.5m recorded 8.6% and 14.5% moisture content
  - 2 tests at the depth of 4.7-6.4m recorded 23.2% and 26.8% moisture content
- Emerson Class Number (10 tests)

  - Tests were undertaken on the samples collected at the depths 0.0-3.0m in BH11, BH16 and 5 test pits (5, 12, 16, 18, and 22).
  - Other than the test associated with TP16 (an ECN of 5), the rest of the results were either 2 or 3. As such, all had slaking and some partial dispersion.
  - Test Pits 5, 12 and 18 are the identified borrow areas.

From permeability perspective, the clay material is suitable and relatively consistent. However, given that the clay material is susceptible to dispersion and erosion, erosion protection on fairly stable slopes of the embankment fill is required. A strong grass cover with topsoil is recommended.

5.4.1.3 Recommended cross section

Based on the above, the cross section that was considered in the preliminary design is endorsed. The details of the typical cross section, as shown on the Drawing EHT-CA-DR-004 and 005, are as follows:

- a minimum of 300mm stripping at the foundation to clear the vegetation and Sandy Silt layer;
- slope protection on the slopes with topsoil layer and grassing;
- batter slopes of 1V:3H for the embankment fill; and
- 300mm deep basecourse with 3.5m width on top and side slopes of 1V:3H. A cross fall of 1% to be provided towards the wet side of the levees.
- the clay material needs to be moisture conditioned prior to be used as fill.

The bearing pressure on the foundation with and without the overburden is summarised in Table 5.4 which is acceptable taking into account allowable bearing capacity of 100-150kPa.

Table 5.4: Assessment of the bearing pressure on the foundation

Height of the levee (m)	Width at the base, m	Maximum bearing pressure kPa	Compared to allowable bearing capacity
0.5	5.9	11	<<100kPa
1.0	8.9	20	<<100kPa
1.5	11.9	30	<<100kPa
2.0	14.9	39	<<100kPa

5.4.2 Longitudinal profile

The longitudinal profile which was set up in the preliminary design stage was updated for the final design taking into consideration the following (based on the details discussed in Section 0):

- Minor changes in the water levels due to the culvert sizing/number modification
- Adjustment of the levee alignment resulting from the decision making stage
- Minor adjustment in chainages based on the above
- Road raising for about 1.2km of both levees

A summary of the final levee levels and grading is provided in Table 5.5 and Table 5.6 for Western Levee and Williams Road Levee, respectively. Water levels are also provided in the tables based on the revised MIKE Flood model with the adjusted culvert sizing and changes raised in the decision making stage.

The maximum levee height from the existing ground levels is 1.5m whilst the maximum road raising section in relation to the existing road level is 0.9m. It should be noted that as a minimum the Sandy Silt layer (or the existing basecourse of the roads) for 300mm needs to be stripped prior to the construction.

Table 5.5: Western Levee crest grading and corresponding flood levels based on 1 in 100 AEP design flood

Levee/Road Raising	Segments	Chainage, m	Crest Level, mAHD	Flood Level, mAHD	Crest Grading
Levee	1	0	198.00	197.47	0.00000 (Horizontal)
	2	50	198.00	197.45	0.00175
	3	450	197.30	196.72	0.00371
	4	800	196.00	195.71	0.00000 (Horizontal)
	5	1550	196.00	195.65	0.05386
		1555.57	195.70 (Southern side of Pyrenees Highway)	195.65	
Pyrenees Highway (assumed 7m wide)					
Raising Pleasant Street	6	1562.57	195.51 (Northern side of Pyrenees Highway)	195.22	0.00000 (Horizontal)
	7	1665	195.51	195.01	0.00600
	8	1900	194.10	193.80	0.00000 (Horizontal)
	9	1950	194.10	193.80	0.00952
		1981.50	193.80	193.79	

Levee/Road Raising	Segments	Chainage, m	Crest Level, mAHD	Flood Level, mAHD	Crest Grading
Railway (assumed 7m wide)					
Raising Pleasant Street	10	1988.50	193.80	193.64	-0.01304
	11	2000	193.95	193.63	0.00100
	12	2150	193.80	193.50	0.01200
	13	2200	193.20	192.86	0.00129
Levee	14	2703.34	192.46 (levee joining Pleasant Street)	192.32	0.00186
		2900	192.00	191.79	

Table 5.6: Williams Road Levee crest grading and corresponding flood levels based on 1 in 100 AEP design flood

Levee/Road Raising	Segments	Chainage, m	Crest Level, mAHD	Flood Level, mAHD	Crest Grading
Raising Williams Road	1	0	197.92	197.61	0.00000 (Horizontal)
		166.92	197.92	197.57	
	2	232.55	197.30 (Western side of Landrigan Road)	197.26	0.01
Landrigan Road (assumed 7m wide)					
Levee	3	239.00	197.30 (Eastern side of Landrigan Road)	197.26	0.003
		340	196.94	196.63	
	4				0.002
	5	420	196.75	196.45	0.00000 (Horizontal)
	6	700	196.75	196.42	Grade to existing
		738	196.35	196.42	

5.4.3 Channel

There is an existing drain/channel running in parallel to the Williams Road Levee to cater for normal rain and drainage and given that the project is not altering anything in that area, no changes were proposed.

However, this is not the case for the Western Levee. The design undertaken by Water Technology (2011) did not include a channel running in parallel to the Western Levee except the sections either side of the Pyrenees highway roughly between Chainages 1300 and 2100 mainly because there is no natural fall to ensure that water flows under the road.

However, resulting from the consultations with landowners and outcomes of the decision making stage (refer to Section 0), a trapezoidal channel was design along the wet side of the Western Levee from start to Wills Street, along the southern side of Wills St for 270m, crossing under Wills Street in a box culvert and then running along the race course southern boundary before turning north into the existing dam. The following constraints were considered in the design of the channel:

- To avoid costly design and use excavation with stable slopes and grass protection
- To limit the excavation depth of the channel preferably no more than 1m
- To ensure the channel is within the road reserve or as otherwise agreed with the council and property owners
- To ensure that a minimum of 0.5m^3/s can flow in the channel without overtopping the western bank

Based on Figure 4-3 of the Water Technology Report (2011) which is shown in Figure 5.1, the MIKE Flood model has 11 inflow locations the hydrographs of which were extracted from a RORB model.

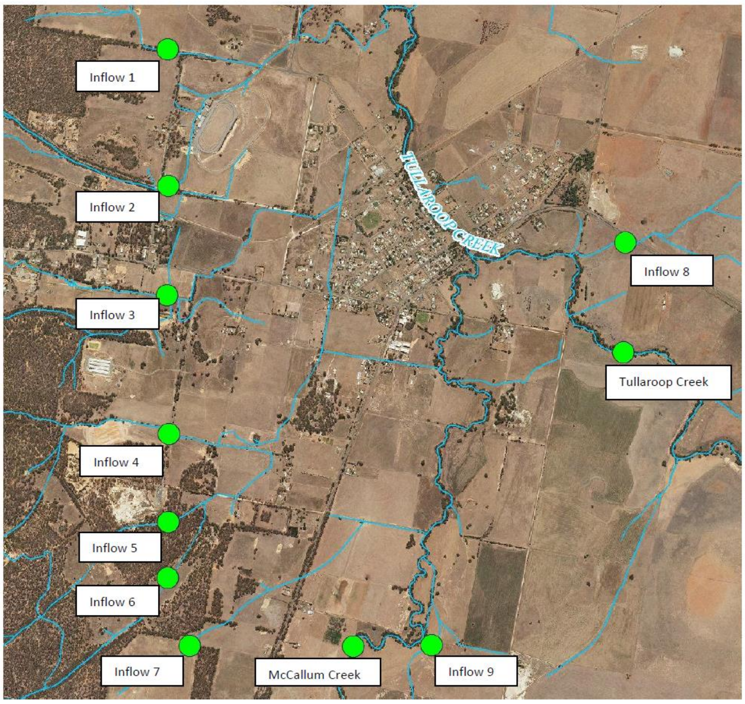

Figure 5.1: Extracted from Water Technology Report (2011); location of RORB extracted hydrographs around Carisbrook

Four of these inflows flow on the western side of the Western Levee, the peak flows of which are summarised in the Table below.

Table 5.7: Summary of the inflow peak values used in MIKE Flood model for different AEPs

Inflow Points	**Peak 5yr**	**Peak 10yr**	**Peak 100yr**	**100/10yr factor**	**100/5yr factor**
3	2.44	3.78	15.29	4.0	6.3
4	1.16	3.34	15.38	4.6	13.2
5	0.24	0.76	3.53	4.6	14.7
6	0.25	0.82	3.55	4.3	14.1

Inflow 4, 5, and 6 collectively will pass under the Pyrenees Highway Culvert. Given that the model has a total of 6.5m^3/s discharge under the culvert for the 1 in 100 AEP event, 0.5m^3/s can be translated to a 1 in 5 AEP flood event although no modelling has been undertaken in MIKE Flood and it might correspond to even a bigger event given that a bigger routing could be anticipated. As such it is assumed that 0.5m^3/s is a reasonable assumption for the channel on the southern side of the Pyrenees Highway.

The Inflow No.3 does not joining the flows in the channel for a normal rain (let's say 1 in 5 AEP) and the new culvert under Wills St will take this flow directly into the drain on the other side of the road. .

The details of the channel cross section are as follows:

- 2m width at the base

- side slopes of 1V:2.5H
- grassing on the slopes

Summary of the levels and longitudinal slopes of the channel is provided in Table 5.8. The hydraulic calculations associated with different slopes are provided in Figure 5.2 to Figure 5.8. A manning's coefficient of 0.022 has been considered for the calculations. It should be noted that all the channel segments are categorised hydraulically as Mild (M) and the water profiles at the intersections between them would be M1 and M2 curves.

Table 5.8: Summary of the channel characteristics in parallel to Western Levee

Segment	**Levee Chainage, m**	**Channel Chainage, m**	**Invert Level, mAHD**	**Top of the topo on the LHS, mAHD**	**Maximum depth, m**	**Longitudinal slope**
1	0	0	197.95	197.95	0.80	0.1
2	8.850	8.85	197.11	197.75	0.64	0.004
3	400	400	195.55	196.18	0.63	0.0025
4	950	950	194.18	194.80	0.62	0.0005
5	1300	1292.57	194.01	194.56	0.55	0.00003
	1550	1550	194.00	194.94	0.94	
Pyrenees Highway culvert with 0.001 slope (including approach and transitions at each end)						
6	1562.6	1581	193.97	194.9	0.93	0.001
7	1650	1665.21	193.89	194.65	0.76	0.005
8	1950	1959.42	192.41	193.4	0.98	0.001
	1981.5	1972.54	192.40	193.6	1.20	
Railway culvert with 0.001 slope (including approach and transitions at each end)						
8	1988.5	1982.54	192.39	193.4	1.01	0.001
9	2100	2102.35	192.27	193.07	0.80	0.0015
	2148.22	2150.57	192.20	192.9	0.70	
Wills Street channel and culvert with 0.001 slope						
10	0.0		192.2	192.7	0.52	0.001
			191.60	192.2		

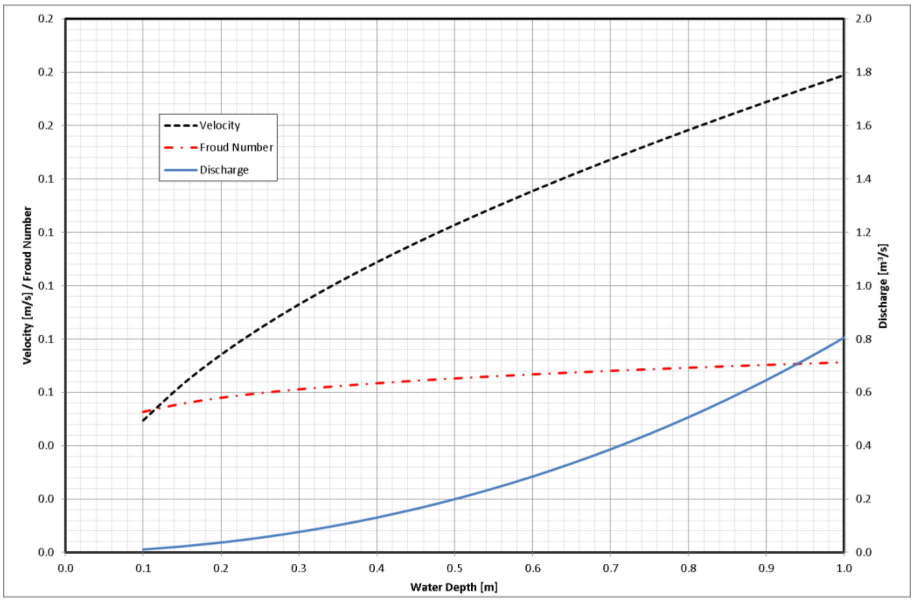

Figure 5.2: Hydraulic characteristics of the trapezoidal channel with a longitudinal slope of 0.00003

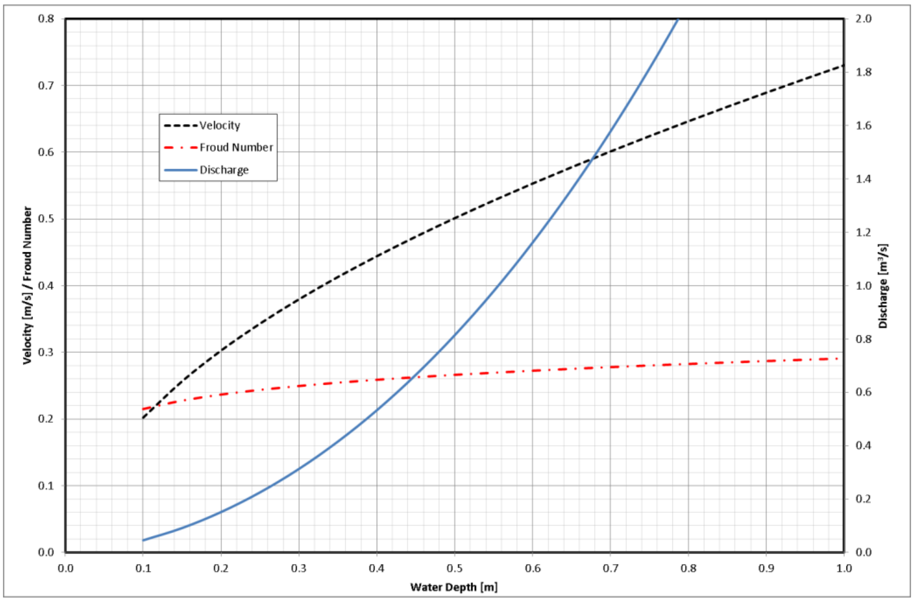

Figure 5.3: Hydraulic characteristics of the trapezoidal channel with a longitudinal slope of 0.0005

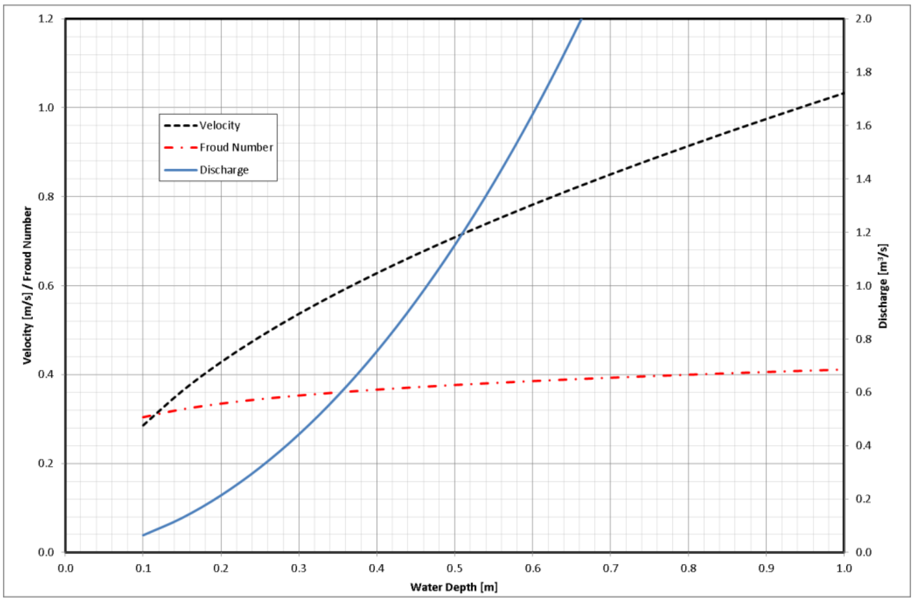

Figure 5.4: Hydraulic characteristics of the trapezoidal channel with a longitudinal slope of 0.001

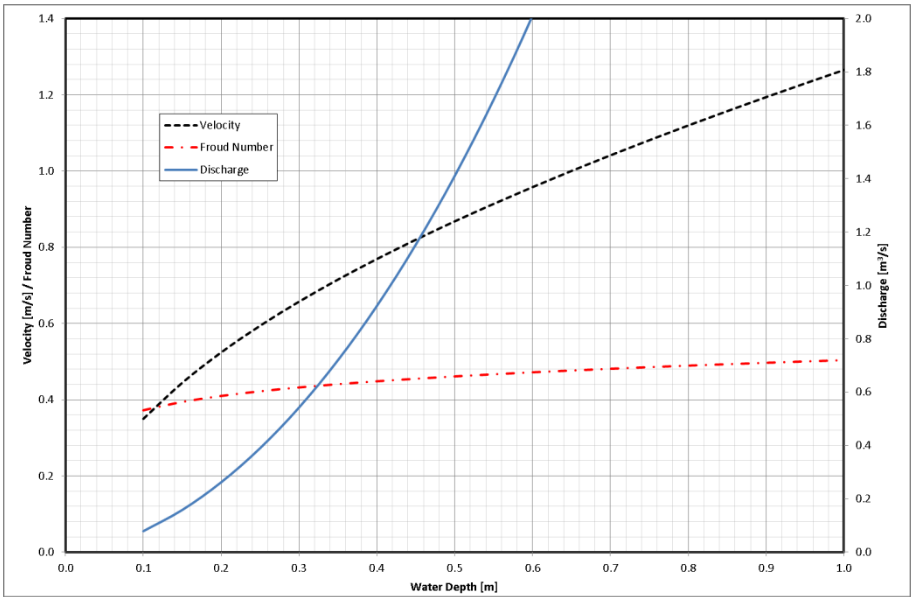

Figure 5.5: Hydraulic characteristics of the trapezoidal channel with a longitudinal slope of 0.0015

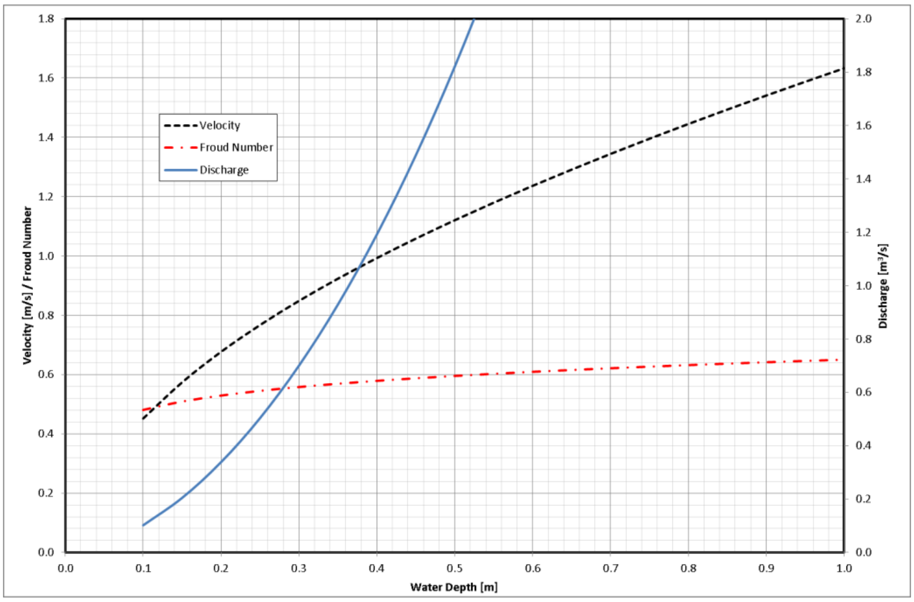

Figure 5.6: Hydraulic characteristics of the trapezoidal channel with a longitudinal slope of 0.0025

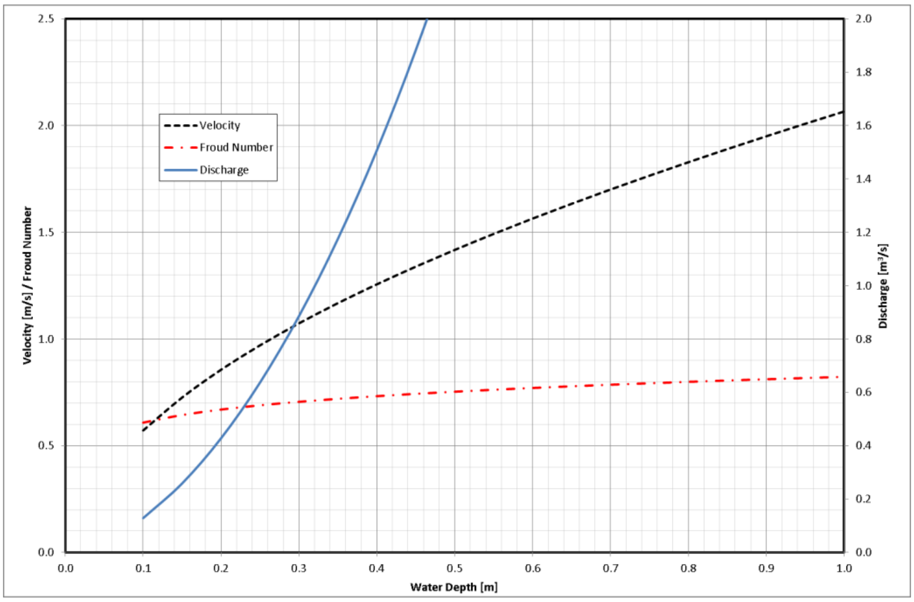

Figure 5.7: Hydraulic characteristics of the trapezoidal channel with a longitudinal slope of 0.004

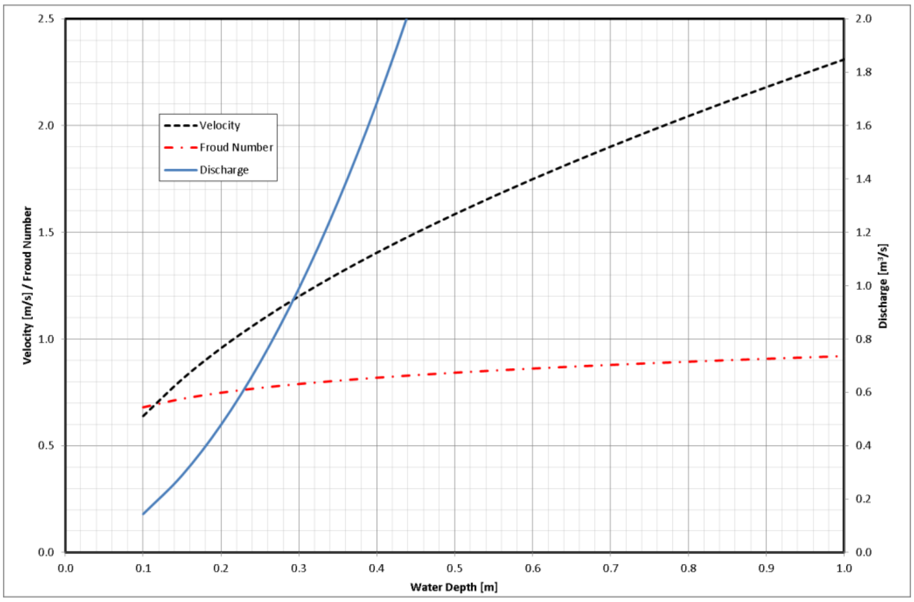

Figure 5.8: Hydraulic characteristics of the trapezoidal channel with a longitudinal slope of 0.005

5.5 Road raising sections

As mentioned above, a portion of both levees involves raising the existing council roads to act as a water barrier as follows:

- Western Levee: between chainages 1562.57 and 2563.18, for 1km Pleasant Street needs to be raised
- Williams Road Levee: between chainages 0.00 and 232.55, Williams Road needs to be raised

Other than the above the local council roads joining Pleasant Street need to be raised locally with a gradual slope at their intersection with Pleasant Street as follows:

- High Street for 20m at around Chainage 1970 near the Railway
- Wills Street for 50m at around Chainage 2150
- Racecourse Access Road for 50m at around Chainage 2550
- Pleasant Street at around Chainage 2700.

5.5.1 Cross section and pavement reinstatement

The cross section of the raised roads will be different than the levee cross sections in terms of the following aspects:

- The total width at top of the roads will be 7.00m (including shoulders) based on the Drawing SD 615 of IDM (2014) and email received from CGSC (dated 23 June 2015 from Leigh Hendrickson)
- The roads are categorised as “Rural Access – Group A Councils”
- A cross fall of 3% each side from the centreline of road
- Sprayed Seal should be used

- Minimum pavement depth should be 300mm based on Table 9 of IDM (2014)
- Sub-grade/sub-base, and basecourse should be compacted to 98% and 100%, respectively
- The batter slopes are to be flattened to 1V:4H for traffic safety

Pavement reinstatement needs to be undertaken carefully in accordance with the requirements of IDM (2014), Austroads Guidelines and VicRoads Supplementary Guidelines to Austroads. The existing base course material seems suitable for re-use and can be stockpiled.

5.5.2 Longitudinal profile

The details of the crest level, longitudinal slope and water levels can be found in Table 5.5 and Table 5.6.

5.6 Access to the properties

The access to the properties can be split into two categories (i) reinstating the access to the properties due to raising the existing council roads and (ii) providing access to the properties affected by the construction of the new levees.

5.6.1 Reinstating property access due to road raising

Given that the maximum heightening of the existing roads (Pleasant Street and Williams Road) does not exceed 0.9m compared to the existing road levels, it is deemed that the existing access arrangements can be reinstated. It is also understood that raising of the Williams Road does not involve disturbing any existing property access and the cemetery located on the southern side of Williams road has access through Landrigan Road. Property access will be via a ramp with a gradient of no more than 1V:10H with a 375mm diameter culvert to provide drainage along the road reserve. This arrangement is designated a ‘Type 1’ access on the drawings.

5.6.2 Providing property access due to the new levees and drain

It is understood that access to the affected properties are required at the following points based on the current agreement with the landowners:

- Western Levee
  - At around Chainage 1020
  - The levee will split a property in two and an access needs to be provided to the western side of this property. A ramp access is proposed to be provided from the eastern side to the western side with a slope not steeper than 10% and box culverts in the drain. . This type of arrangement is designated a ‘Type 2’ access on the drawings. At around Chainage 1760m

    To provide access off Pleasant St, with arrangements similar to above.
  - At around Chainage 2120m

    As above.
- Williams Road Levee
  - At around Chainage 550

Currently, there is a temporary timber bridge located over the existing bluestone drain to provide access between the northern and southern properties. Given that the new levee will be drivable (only for the landowners on either side and only limited to a truck of maximum 20t), a ramp is planned to be provided from the top of the levee to provide access at the location of the existing temporary bridge via a 'Type 2' crossing.

5.7 Culverts

As summarised in Section 5.3 and Table 5.2, there are 3 box culverts and 2 pipe culverts to be constructed as part of the project. Precast box/pipe culverts are recommended for minimal traffic disruption and ease of installation.

The hydraulic characteristics of the culverts for the design flood of 1 in 100 AEP as extracted from the updated MIKE Flood model are provided in Table 5.2.

All box culverts are designed based on AS 1597.1:2010 and pipe culverts based on AS/NZS 4058:2007. Humes Australia, one of the well-recognised culvert manufacturers in Australia, was consulted closely during the detail design to ensure the accuracy of the design based on the Australian Standards requirements and also to obtain accurate quantity/cost estimation for the works.

The road/railway loadings considered for the design of the culverts are as presented inTable 5.9.

Table 5.9: Summary of hydraulic characteristics of the new culverts (for 1 in 100 AEP design flood)

Culvert Location / Flow Direction	**Dimensions**	**Depth of fill on top (including pavement, m**	**Loading on top of the road/railway/levee**	**Bearing Pressure, kPa[1]**
Western Levee (CH 450) / towards East	Φ225	1.3	20kPa	60
Western Levee (CH 1000) / towards East	Φ450	1.8	20kPa	60
Pyrenees Highway (CH1550) / towards North	2@(1200W×1200H)	0.5	SM1600	92
Railway (CH1950) / towards North	4@(1200W×900H)	0.3	R300LA	106
Wills Street towards North	2@(600W×450H)	1.1	W80/A160	59

[1] The results are without dynamic factors. It is understood that with the dynamic factors higher bearing capacity will be available for the foundation.

As shown on the drawings and specified in the Specification, all the culvert works including, bedding, side zone backfilling, overlay zones, etc. shall comply with AS 1597.1:2010 and AS/NZS 4058:2007.

5.8 Floodgates

It is envisaged that two floodgates will be installed on the 2-cell culvert Carisbrook Talbot Road (or Landrigan Road) . Floodgates are proposed to prevent water surcharging up the drains in large riverine flood events. Typical floodgates operate using a top hinge and in a flood event water rises on the downstream face will push the floodgate against the culvert structure to form a seal. Under normal operating conditions a floodgate will limit flow, requiring a minimum water level upstream to overcome the weight of the gate before it can open. For this reason smaller rain events may result in pooling of water on the upstream side.

The headwalls on this culvert have been cast in-situ and do not have a flat face for the flood gates to seal against the side of the gate and base of the head wall. To overcome this, it is necessary to replace the existing head wall with a pre-cast headwall that will allow the gates to seal effectively. It is recommended to use commercially available box culvert floodgates with the following specifications:

- Moulded fibreglass reinforced polyester floodgate material
- High tensile stainless steel hinge and hinge pin
- Replaceable neoprene seal around the culvert face
- Minimum 100mm gap from ground level to the base of the flap although this is unlikely to be achievable in this location due to the limited fall in the drains currently available.

5.9 Affected services during construction

At the beginning of the project and prior to the preliminary design, a feature survey of the areas affected by the project was undertaken and Entura surveyor, Toby Dove, identified some of the affected services especially near the Pyrenees Highway. A DBYD was undertaken in the preliminary design stage (for both Options A and B at the time) and it was understood that for Option A, water and gas pipes are running along Pyrenees highway are the key services that will be affected.

Given that 4 months was passed from the preliminary design DBYD and a few changes were introduced to the design (see Section 0), a new DBYD was undertaken especially for Western Levee. The services affected are summarised in Table 5.10. The respective maps associated with these services received from different entities are provided in Appendix D.

Table 5.10: Summary of the affected services

Location	Affected Services / Entity	Measured Depth[1]
Southern side of Pyrenees Highway	Water Distribution Pipe (250MPVC) / Central Highlands Water	Top of the pipe at around EL 194.4
Northern side of Pyrenees Highway	Gas Distribution Main / Ausnet Services	Top of the pipe at around EL 194.3
Northern side of Pyrenees Highway	Telecom Cables / Telstra	2 Cables at around EL 194.2 and EL 194.3
Northern side of the Railway	Fibre Optic Cable / Telstra	Cable at around EL 192.4
Western side of Pleasant St ch. 1590m	Private power supply	Not measured

[1] These measurements are undertaken by CGSC in July 2015. The construction company is responsible for liaising with the relevant service provider to ensure safe arrangements for lowering the services below the proposed works.

The affected services listed in Table 5.10 are buried within a depth of around 1m from the natural surface level and certainly will be affected by the culverts and drains crossing the Railway and Highway:

- At Pyrenees Highway:
  - The invert level of the culvert at Pyrenees Highway (EL 194.00) is required to ensure that the new channel next to the Western Levee can discharge a minimum of 0.5m^3/s (approximately a 1:5 AEP flood) from the southern side of the Pyrenees Highway to the northern side in order to avoid inundation of the land on the southern side.
  - To locate the culvert and drain invert above all the services, the invert elevation of the culvert would need to be raised by around 0.8-1.0m above the current design level to ensure that the foundation of the culvert is 0.2-0.4m above the pipes. Alternatives of increasing the number of cells and lowering the internal height of the culvert to 0.6m were considered. Culvert heights of less than 600mm are not recommended as this is the only passage of flow from the south and so must not be clogged during the flood. The alternative of raising the invert level is not a viable solution as there is not sufficient space above the crown of the culvert for the minimum pavement thicknesses required by VicRoads or sufficient hydraulic capacity to pass the 0.5m^3/s 1:5AEP flood flows.
  - The water and gas pipes as well as the Telecom cables should be lowered to ensure there is an adequate depth between the top of these services and the foundation of the culvert and invert of the drain.
- At the Railway:
  - The Fibre Optic Cable located on the northern side of the railway will need to be lowered as the foundation of the culvert is located at EL192.1. To raise the culvert’s invert level the internal height can be reduced to 0.6m which will elevate the foundation level to EL192.4 just about the same surveyed level by CGSC.
  - The current invert level at the railway was selected in order to ensure the following:
    - A minimum of 0.3m of fill can be placed above the culvert crown as required by the Australian Standards

    - The internal height of the culvert is adequate enough to avoid clogging during a flood. Although there is an argument that the height can be less than 0.9m, it is highly recommended to be at least 0.9m to minimise the risk of clogging.

Also in addition to the above-mentioned affected services, the following should be taken into consideration during the construction:

- There are several power poles along the western side of Pleasant Street. The design was undertaken in order to keep the poles between the batter of the Pleasant Street levee and the channel. However, the construction around the power poles shall be undertaken in consultation with CitiPower/Powercor to ensure their safety.
- There is a 100AC water pipe running on the eastern side of Pleasant Street between Pyrenees Highway and the Railway. Although Pleasant Street is to be raised, minimal stripping of the top base course layer is required. The removal of this layer and then compaction of new material on top of it should be undertaken cautiously in consultation with Central Highlands Water.
- At the junction of Wills Street and Pleasant Street, there is a sewerage pipe at around EL 191.5 as surveyed by CGSC which appears to be low enough compared to the invert level of the existing culvert under the Pleasant Street. The new culverts are both set up with the same invert level and therefore it is unlikely that the sewerage pipe needs to be altered or lowered. However, the excavations in this area should be undertaken with caution.
- The same sewerage pipe (as per the above bullet point) is running on the eastern side of Pleasant Street between the Railway and Wills Street. Similar to the 100AC water pipe above, the removal of the basecourse layer and then compaction of new material on top of it should be undertaken cautiously in consultation with Central Highlands Water.

6. Operations and maintenance

The flood levees, channels and culverts will need to be maintained in good condition in order to function effectively over the long term. Key maintenance items are:

- Inspections to ensure that all maintenance items listed below are addressed in a timely manner, with a minimum frequency of quarterly and whenever there are floods.
- Controlling the vegetation on the embankments. Trees and shrubs growing on the embankments may lead to desiccation cracking of the embankments or create leakage paths through the embankments. Excessively long grass may pose a fire hazard. Embankments should be mowed to control the length of the grass and trees and shrubs should be removed before they get to 0.3m in height (cut and poison).
- Controlling the vegetation in the channels to ensure that the design hydraulic capacities are maintained. Channels should be mowed to control the length of the grass and trees and shrubs should be removed before they get to 0.3m in height (cut and poison).
- Clearing debris and sediment from culverts to ensure that the design hydraulic capacities are maintained.
- The flood gates will need to be checked to ensure that they are moving freely, are clear of obstructions and seals are in good condition. Repair or replace as necessary.
- Road surfaces, markings and signage will need to be maintained in good working order to minimise the risk of traffic accidents. Repair or replace as necessary.
- Monitor the levees during floods to ensure correct operation and undertake emergency actions if necessary.
- Close road levees during major floods if possible to limit chance of car driving into flood waters.
- Limit vehicle speeds on levees to less than 20km/h as have not been designed as roads.
- Confirm location of services before undertaking ground breaking maintenance.

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7. Safety in Design

7.1.1 Introduction

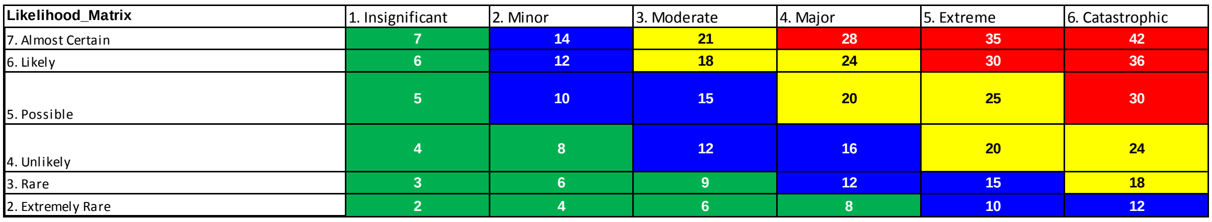
Safety in design has been considered throughout the design process. This has included consideration of:

- Design and construction risks
- Operational and maintenance risks

A project risk assessment has been compiled to include the above safety in design risks.

7.1.2 Methodology

The safety in design risk assessment has been prepared using the risk assessment matrix provided in Figure 7.1.



Likelihood_Matrix	1. Insignificant	2. Minor	3. Moderate	4. Major	5. Extreme	6. Catastrophic
7. Almost Certain	7	14	21	28	35	42
6. Likely	6	12	18	24	30	36
5. Possible	5	10	15	20	25	30
4. Unlikely	4	8	12	16	20	24
3. Rare	3	6	9	12	15	18
2. Extremely Rare	2	4	6	8	10	12

Figure 7.1: Safety in Design Risk Matrix

The likelihood of occurrence was rated in accordance with Table 7.1. The consequence was rated in accordance with Table 7.2.

Table 7.1: Likelihood ratings

Rating	Indicative Probability	Descriptor
7. Almost Certain	91% – 100%	Event is expected
6. Likely	61% – 90%	Event is likely to occur
5. Possible	21% – 60%	Event may occur, but not likely
4. Unlikely	6% – 20%	Event not expected
3. Rare	1% – 5%	Event extremely unlikely
2. Extremely Rare	< 1%	May only occur in extreme and exceptional circumstances

Table 7.2: Consequence ratings

Rating	Descriptor
1. Insignificant	First-aid treatment. Incident resolved by routine management activities.
2. Minor	Medical treatment injury with no long term impact on health or wellbeing.
3. Moderate	Serious injury with anticipated full recovery.
4. Major	Severe injury, temporary disability.
5. Extreme	Severe injury, permanent disability to one or more persons.
6. Catastrophic	One or more fatalities.

7.1.3 Summary of Results

The key hazards and risks to be managed include:

- buried services
- overhead services
- traffic management during construction
- road safety in operation.

8. Cost estimation

Cost estimation was undertaken based on the final drawings and updated the preliminary estimates.

Similar to the cost estimation undertaken as part of the preliminary design, key exclusions from the cost estimation are as follows:

- Investigation and design costs to date.The cost associated with land acquisition and compensation to the property owners.
- Insurances
- The construction works interfacing with the railway and main roads would not encounter any unexpected issues other than normal traffic management and some fencing/protection wall inclusion

A contingency amount of 10% has been included. The following assumptions were made:

- Materials can be borrowed local to the levees
- Sub-total costs were rounded up to the nearest $1000
- Existing fences are to be reinstated.
- To reinstate the railway line is comparable to reinstating the VicRoads highway.
- Project management costs are estimated to be 10% of direct costs.

Rates are based on Rawlinsons, quotations from suppliers and past experience. The summary of the cost estimation for the final option is provided in **Error! Not a valid bookmark self-reference.**. A detailed breakdown of the costs can be found in Appendix G.

Table 8.1: Summary of cost estimate for the project (excluding GST)

Items	**Cost**
Mobilisation / Demobilisation	80,000
Western Levee (South Of Pyrenees Highway)	957,000
western Levee (North Of Pyrenees Highway)	1,666,000
Williams Road Levee	287,000
Landrigan Road Flood Gates	24,000
Permits and Approvals	60,000
Sub Total	**3,074,000**
Project Management (10%)	308,000
Sub Total	**3,382,000**
Contingency (10%)	339,000
Total Estimated Cost (Excl. GST)	**$3,721,000**

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Appendices

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A Minutes of Meeting with Carisbrook Flood Mitigation Steering Committee (10 April 2015)

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Meeting Name:	Carisbrook Flood Study Steering Committee Meeting (6)
Reference:	
Date:	Friday 10 April 2015
Time:	2.30pm – 5:00pm
Location:	Carisbrook Senior Citizens Club
Chair	Ken Coates; North Central CMA Natural Resource Management Committee (NRMC)
Attendees:	David Sutcliffe (Council) Keith McLeish Camille White (NCCMA) Jolene Goulton (NCCMA) Lang Dowdell (NCCMA) Cr Barry Rinaldi Cr Helen Broad Cr Paula Nixon Trish Coutts Shane O'Loughlin (NCCMA) Ken Coates (Chair, NCCMA) Simone Wilkinson (DELWP) Calum Walker (DELWP) Leigh Hendrickson (Council) Mohsen Moeini (Entura)
Apologies:	Robert Rowe, Keith McLeish, Cr Paula Nixon, Andrea Kelleher (DELWP)

Meeting Minutes

Item	Item	Action Items
Welcome	Ken Coates (KC): Welcomed all attendees Camille White (CW) requested everyone introduce themselves	
Apologies	KC: Asked for confirmation of apologies; Moved; Trish Coutts (TC) Second; Callum Walker (CWa) Carried	
Purpose of Meeting	CW: Gave overview of meeting structure David Sutcliffe (DS): Gave background to flood modelling and mitigation strategies completed by Water Technology. Overview of assessment of two different levee options by Entura.	
Investigation/Design Option to manage overland flows	PowerPoint presentation by Mohsen Moeini (Entura) assessing the effectiveness of two design options: a. Western Wall b. Belfast Levy	

	Western Wall assessed as the best mitigation option for Carisbrook. David Sutcliffe advised that Option A (Western Levee) is projected to cost $2.7million, only applied for $2.1million. 30% of projected cost is contingency funding, also hoping that competition during tendering process will bring cost down. MM advised that projected cost excludes landowner compensation. It was asked where the material would be sourced to construct the levee and would it be adjacent to the levee or sourced locally. David Sutcliffe advised that some local soil material is not suitable for levee construction. MM advised that geotechnical testing will assess local materials for suitability. CWa asked whether the soil under the levee would be tested also. MM advised that yes the soil under the levee would be tested. The levee is proposed to be a homogeneous levee therefore the underlying base of the levee is important. David Sutcliffe advised that they are investigating raising the road instead of constructing a new levee. Raising the road as part of levy construction will need to consider access for landowners. Highway is a similar height, don't envision problems	
Vegetation Management Works	Presentation by CW (NCCMA) on planned vegetation management including: • purpose of works • principles of vegetation management • approvals • proposed staging of works Discussion around proposed scope of works. CW advised that were not exempt from requiring permits and offsets for the removal of native trees are likely to require offsets. There was a level of concern about this requirement and there was a general discussion around how and where to obtain offsets. CWa advised that will be key to find a balance between the cost of offsets and minimising flood risk. A general discussion was held around the removal of wood from the waterway. TC advised that the community were keen to see the removal of dead wood in the creek. LD and CW explained the benefits of the large wood and advised that the wood would not be removed along the entire length of the waterway in its entirety. Wood upstream of the Pyrenees Highway that was generally below waterline and did not block flow would be retained, likewise for downstream of the CFA watering point. Barry Rinaldi (BR) asked whether the works proposed to remove some of the sand that had built up in the creek. CW advised that removal of sand from the waterway was not proposed as part of these works. It was agreed that a future management arrangements for the maintenance of the creek should be determined as part	

	of this process. Shane O'Loughlin suggested that an ecological burn might provide a cost-effective solution. CWa advised that as the area is river redgum dominant ecological burning is not desirable as it would likely kill the river redgums. BR asked how long the works would take on-ground. Lang Dowdell advised that there was approximately 3 weeks on-ground work required, depending on the final agreement about what is required through the town section (i.e. bridge to bridge). BR asked whether the felled trees would be made available to the community. LD advised that the native wood would be taken to the masonic lodge as per past works and the remainder (i.e. willows would be burnt in stockpiles). Simone Wilkinson recommended that it may be warranted to hire an independent person to assess the proposed works and advise whether the works would achieve the desired roughness. Simone advised that she would be able to help to provide names of appropriate experts. There was a general discussion about the permit process in particular concerns about the time that it will take to get permits. CWa advised that it is possible to reduce time taken up by the referral process through interagency discussion before permit submission. It was agreed that community consensus is paramount to quick permit process. Trish Couts provided some historic information, Bucknell Street houses flooded by water from creek during September 2010 flood, never flooded by creek in the past. This provides basis that vegetation management in the waterway is important. Helen Broad offered to take it to the community once they (Helen, Trish and Barry) had agreed on a level of vegetation removal and Helen/Trish advised that they did not agree with the CMA proposal at this time. Barry Rinaldi asked if we had a communication plan. He requested that we come up with an agreed plan and direction that could be taken to the media/community. CW advised that as part of the contract with Council that it would develop a comms plan for the committee to sign off. At this stage the proposed communication with the community was a brochure to sent out in the post and provide opportunities for land owners to drop in for one-one sessions. Not community meeting was proposed at this time. It was agreed that Helen Broad, Trish & Barry would do a walk through with Camille, Jolene and Lang. on Tuesday 14 April @ 9.30am. CW: The most important section to agree on is the section between the two bridges	Action: CW to coordinate committee representatives walk through on creek between bridges to agree on vegetation management actions and present back to the committee

	DS: Lets organise an onsite walk through Leigh Hendrickson (LH): Community desire to manage this section via a landcare group. CWa: For any earthworks on banks a cultural heritage plan is required and Dja Dja Wurrung is likely to impose conditions on permit CW: Post meeting plan: • Walk creek between bridges (CW, JG, LD, BR, TC, HB) Tuesday 14th April 9:30am • Community brochure (overview of works) • Drop in sessions • No community meeting	
Meeting closed	KC closed meeting	

CGSC – Central Goldfields Shire Council
NCCMA – North Central CMA
DELWP – Department of Environment, Land, Water and Planning

Meeting Name:	Carisbrook Flood Study Steering Committee Meeting (6)
Date:	Tuesday 14 April 2015
Time:	9.30am – 11:30am
Location:	Tullaroop Creek (between bridges in town)
Attendees:	Camille White (NCCMA) Jolene Goulton (NCCMA) Lang Dowdell (NCCMA) Cr Barry Rinaldi Cr Helen Broad Trish Coutts

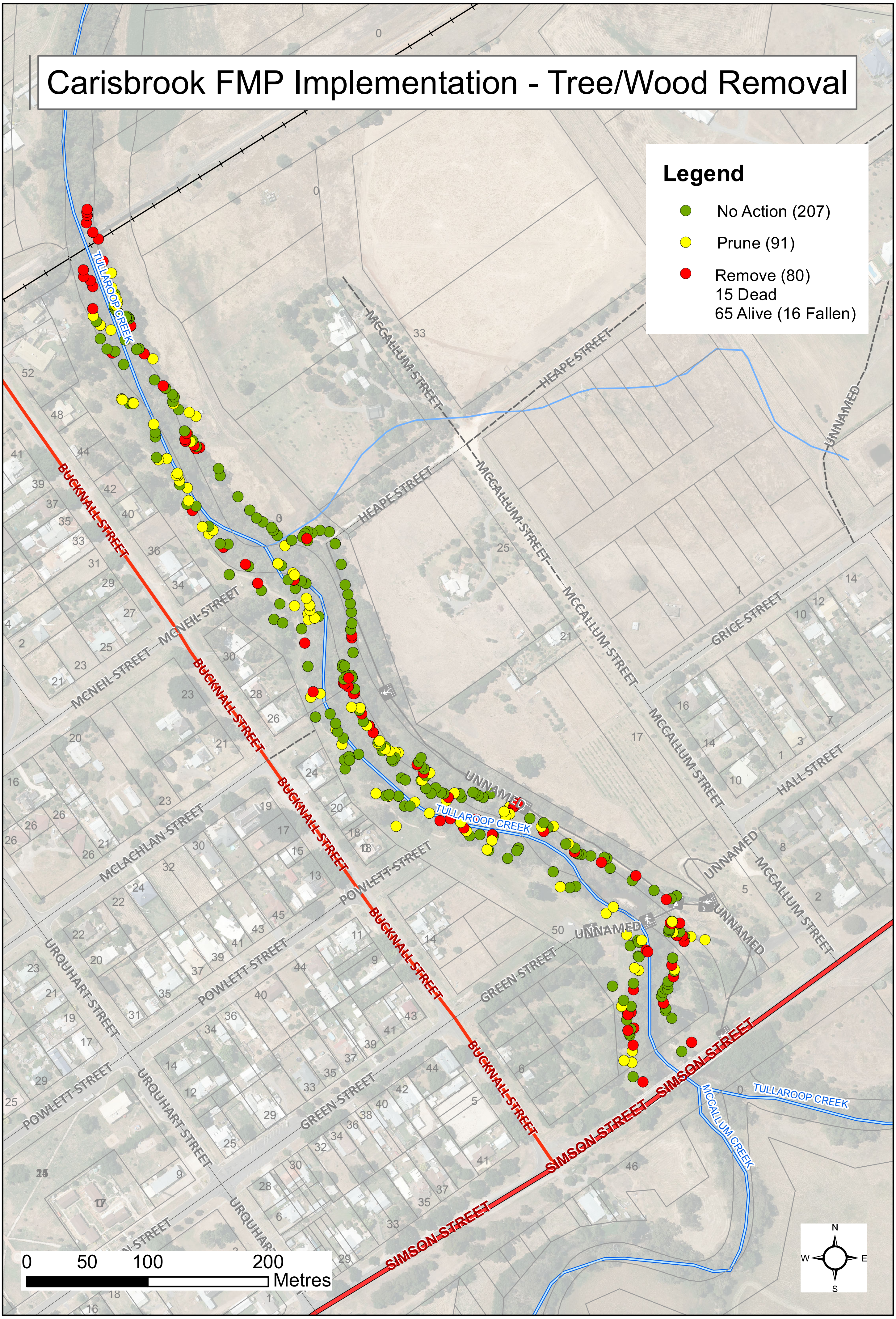
A walk along the Deep Creek between the Pyrenees Highway and the Railway line was held on the 14 April 2015. North Central CMA provided photos and a list of proposed actions for all existing trees along this section of the waterway. The committee members assessed each of these proposed actions and advised whether they agreed to the proposed action. Generally the committee members agreed to the proposed works, where there was disagreement an alternative action was agreed to.

The following proposed staging of works agreed to by attendees (for consideration by Carisbrook Flood Study Steering Committee):

1. Poison willows along both Tullaroop and McCallum creeks (do not remove).
2. Prune identified trees, remove red gum regrowth and dead wood in creek along Tullaroop creek between bridges in town.
3. Remove identified mature of trees and coordinate offsets process.
4. Investigate community-led options to assist maintaining banks and vegetation along town section of Tullaroop creek, including Green Army, CFA, and Dja Dja Wurrung.

Stages 2 and 3 would be undertaken concurrently if approvals can be obtained at the same time. However it was agreed if the resolution of offsets could not be achieved quickly, then Stage 2 would proceed and not be held up by Stage 3.

Carisbrook FMP Implementation - Tree/Wood Removal



B Aboriginal Cultural Heritage Due Diligence Assessment

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Central Goldfields Shire Council

Carisbrook Flood and Drainage Mitigation Treatments

Aboriginal Cultural Heritage Due Diligence Assessment

Report to Entura

24 June 2015

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Central Goldfields Shire Council

Carisbrook Flood and Drainage Mitigation Treatments

Aboriginal Cultural Heritage Due Diligence Assessment

Report to Entura

Landskape
Natural and Cultural Heritage Management
a division of M.L. Cupper Pty Ltd
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Author: **Dr Matt Cupper**

Date: **24 June 2015**

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Executive Summary

Central Goldfields Shire Council proposes to undertake works to mitigate flooding at Carisbrook in central Victoria. Works include construction of earthen levees and installation of drainage infrastructure.

As part of the planning approvals process preceding the proposed infrastructure upgrade Landskape's principal research scientist Dr Matt Cupper was engaged by Entura on behalf of Central Goldfields Shire Council to conduct a due diligence investigation to identify any possible Aboriginal cultural heritage issues that might need to be addressed prior to construction of the proposed infrastructure. Dr Cupper is a qualified archaeologist and geoscientist, with 16 years experience as a cultural heritage practitioner and high-level expertise in geomorphology and soil science.

No Aboriginal cultural heritage sites have previously been recorded in the upgraded infrastructure corridors proposed for flood mitigation works. Predictive modelling shows that there is a low to negligible potential for Aboriginal cultural heritage to occur in the proposed work corridors.

This scoping study concludes the activity area for the proposed flood mitigation works is not an area of cultural heritage sensitivity according to the *Aboriginal Heritage Regulations* 2007.

Accordingly, the proposed flood mitigation works do not require a mandatory Cultural Heritage Management Plan (CHMP) under Section 46 of the *Aboriginal Heritage Act* 2006.

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List of Abbreviations

CHMP – Cultural Heritage Management Plan

OAAV – Office of Aboriginal Affairs Victoria

RAP – Registered Aboriginal Party

VAHR - Victorian Aboriginal Heritage Register

VCAT – Victorian Civil and Administrative Tribunal

1 Introduction

Central Goldfields Shire Council proposes to undertake works to mitigate flooding at Carisbrook in central Victoria. Works include construction of earthen levees and installation of drainage infrastructure.

As part of the planning approvals process preceding the proposed infrastructure upgrade Landskape's principal research scientist Dr Matt Cupper was engaged by Entura on behalf of Central Goldfields Shire Council to conduct a due diligence investigation to identify any possible Aboriginal cultural heritage issues that might need to be addressed prior to construction of the proposed infrastructure. Dr Cupper is a qualified archaeologist and geoscientist, with 16 years experience as a cultural heritage practitioner and high-level expertise in geomorphology and soil science (see Section 1.2).

1.1 Aims of the Investigation

The aim of this cultural heritage due diligence investigation was to prepare a general statement identifying known Aboriginal cultural heritage places and objects and any areas of archaeological potential within the proposed flood mitigation work areas. Statutory requirements pertaining to Aboriginal cultural heritage were also examined to determine their applicability to the proposed development.

Preparation of this due diligence study involved review of the *Aboriginal Heritage Act* 2006 and the *Aboriginal Heritage Regulations* 2007 (last amended 2009). Any Aboriginal cultural heritage places or objects recorded previously in the proposed work corridors were identified by searching the Victorian Aboriginal Heritage Register (VAHR) site database maintained by the Office of Aboriginal Affairs Victoria (OAAV).

A general predictive model examining possible cultural heritage site locations within the proposed upgraded infrastructure corridors was formulated from this and other relevant archaeological and environmental data. Preparation of this model also involved the use of topographic and geological maps and aerial photographs to identify landscape features likely to contain archaeological sites.

A field inspection of the proposed upgraded infrastructure corridors was undertaken to complement the predictive model of the desktop assessment, examine the ground surface and determine the actual risk to cultural heritage.

1.2 Personnel Involved in the Assessment

Landskape's principal research scientist Dr Matt Cupper undertook the investigation and produced this report. Dr Cupper has a wide background in the sciences and humanities, with degrees (including a PhD) in archaeology and classical history, geology and botany, with particular expertise in understanding the formation of archaeological sites and Quaternary environments. He has published extensively on these topics in high-profile, peer-reviewed scientific journals and was lead author for the Quaternary chapter of the *Geology of Victoria* (Cupper *et al*. 2003), the current, premier reference to Victoria's geology.

Dr Cupper is currently a Research Fellow in the School of Earth Sciences at The University of Melbourne (www.findanexpert.unimelb.edu.au/display/person20521), where he manages the luminescence dating facility in addition to teaching geological methods and sedimentary geology to undergraduate students and supervising postgraduate research. Dr Cupper is also a Visiting Researcher in the Research School of Earth Sciences at The Australian National University (https://researchers.anu.edu.au/researchers/cupper-ml)

As a consulting archaeologist and geoscientist, Dr Cupper has been engaged in hundreds of management and research-oriented studies throughout southeastern Australia for industry and government. These have included investigation of the cultural heritage of New South Wales and Victoria for petroleum, coal and mineral extraction, and archaeological surveys of road, rail, electricity, water supply and telecommunications infrastructure.

Dr Cupper is also an Office of Aboriginal Affairs Victoria-approved Cultural Heritage Advisor (http://www.dpc.vic.gov.au/images/Aboriginal_Affairs/Cultural_Heritage_Advisors/Cultural_Heritage_Advisor_List_-_June_2015.pdf).

2 Contextual Information

2.1 Legislative Context

All Victorian registered and unregistered Aboriginal cultural heritage sites are protected by the *Aboriginal Heritage Act* 2006 (commenced 28 May 2007). This Act prohibits the wilful destruction or disturbance of any Aboriginal cultural heritage site, place or object, whether on private or public land.

The Office of Aboriginal Affairs Victoria is the Victorian State Government agency that administers this Act.

2.1.1 *Aboriginal Heritage Act* 2006

The *Aboriginal Heritage Act* 2006 and its *Aboriginal Heritage Regulations* 2007 (last amended 2009) are of particular relevance to the proposed development. A core component of this Act is the preparation of Aboriginal Cultural Heritage Management Plans (CHMPs), which are required under certain circumstances for high impact activities. Aboriginal Cultural Heritage Management Plans must meet prescribed standards and be approved by the Office of Aboriginal Affairs Victoria before they can be used to support permit applications to local government or other agencies.

The Act also established the Aboriginal Heritage Council, which invites Aboriginal community groups with cultural heritage interests in particular parts of the State to become Registered Aboriginal Parties (RAPs). The RAP(s) for a given area must endorse an Aboriginal Cultural Heritage Management Plan before the Office of Aboriginal Affairs Victoria will approve it. The Dja Dja Wurrung Clans Aboriginal Corporation has RAP-status over the activity area for the Carisbrook Flood Mitigation Works.

The regulations can be used to determine if an Aboriginal Cultural Heritage Management Plan is required for an activity. Section 5 of this scoping study makes such a determination for the proposed flood mitigation works. The regulations also detail the standards expected of an Aboriginal Cultural Heritage Management Plan.

2.2 Environmental Context

The proposed works would be located on alluvial plains at Carisbrook in the Midlands of Victoria. The geological framework of these dissected uplands of central Victoria comprises hills and plateaux of Ordovician (500-465 million year old) marine sandstones of the Castlemaine Group and late Neogene and Quaternary (past few million year old) volcanic lava flows (VandenBerg 1997). The geology of the study area is alluvial sediments deposited in the valleys of Deep, McCallum and Tullaroop Creeks over the Quaternary (the past 2 million years; Joyce and Webb 2003).

Prior to settlement by Europeans, the alluvial plains are likely to have supported a vegetation cover of eucalypt woodlands with a grassy understorey (DEPI 2015).

Overall, the environment of the proposed work corridors have been extensively modified by past land use. Since the establishment of Carisbrook pastoral run in 1839 (Spreadborough and Anderson 1983), Europeans have cleared and levelled the proposed work areas. Extensive earthworks have previously occurred along their entire lengths to construct infrastructure including roads, fences, culverts, drains and levees.

2.3 Aboriginal Cultural Heritage Context

2.3.1 Aboriginal Ethno-History

At the time of first contact with Europeans, Aboriginal people of the Dja Dja Wurrung language group occupied the part of the Victorian Midlands encompassing the study area (Barwick 1984, Clark 1990). The Dja Dja Wurrung were part of the Kulin group of languages, who included peoples of the related Bun wurrung (or Bunurong)–, Daung wurrung (or Taungurong)–, Djab wurrung–, Ngurai-illam wurrung–, Wath wurrung (or Wathaurong) and Woi wurrung (or Woiworung)–speakers (Barwick 1984, Clark 1990). These language groups shared similar language and kinship systems, notably the division members into patrilineal moieties (two-part social classification) termed ‘Waa’ (raven) and ‘Bungil’ (eagle) (Clark 1990).

Clark (1990) estimates that there were at least 25 clans in the Victorian Midlands encompassing the study area, with between 40-120 adult men, women, adolescents and children in each, suggesting a total population of around 1000-3000 people.

Aboriginal people caught fish including eels, freshwater crayfish, yabbies and tortoises in the streams and wetlands in the region (Dawson 1881). Fish traps were also constructed, with Chief Protector of Aborigines George Augustus Robinson noting a system of channels and weirs near the Grampians (Bird 1984). Nets were used to catch waterbirds, whose eggs were also collected. Some of the other animals that Aboriginal people of the Midlands hunted include kangaroos, wallabies, emus, possums, echidnas, lizards, snakes and frogs (Dawson 1881, Howitt 1904). Plant foods included native millet, panic grass, pigface fruits, wild cherries, kangaroo apple, tubers, yams, roots and other grass grains (Dawson 1881, Gott 1983, Zola and Gott 1992).

Aspects of the initial interaction between Europeans and the Aboriginal people of the

Midlands led to violent conflict. Aborigines were shot, poisoned and displaced from their land by pastoral settlers and, in retaliation, sheep were speared and settlers threatened (Bride 1898, Clark 1990). In response, the Aboriginal Protectorate system was introduced, with Assistant Protector Edward Park establishing the Mount Franklin Protectorate Station near Daylesford (Clark 1990). The Aboriginal Protectorate recorded a rapid decline in Dja Dja Wurrung numbers, caused by dispossession of land and the consequent destruction of habitat and social networks. Diseases including malnutrition also took their toll.

Many Dja Dja Wurrung continued to live by “fringe dwelling” on the outskirts of mining settlements and survived largely through begging, as their traditional food resources were greatly depleted. Honorary Correspondent depots were set up around Victoria to dispense food and other supplies to Aboriginal people. The Aboriginal Protectorate system was replaced in 1860 by the Central Board for the Protection of Aborigines (Barwick 1984). It established Coranderrk Station at Healesville and the Framlingham Mission at Purnim for the surviving Dja Dja Wurrung people.

Today, the interests of Aboriginal cultural heritage are in the custodianship of the Dja Dja Wurrung Clans Aboriginal Corporation.

2.3.2 Previous Aboriginal Archaeological Studies

Previous archaeological studies of sites in the Victorian Midlands have demonstrated Aboriginal occupation dating back to the last glacial period some 26,000 years ago. The oldest archaeological site in the region is a swamp near Lancefield, approximately 80 km southeast of the study area (Gillespie *et al*. 1978). The deposits of this swamp contain the fossilized bones of extinct giant marsupials or ‘megafauna' in association with Aboriginal stone artefacts. These finds indicate that Aboriginal people and megafauna interacted for at least 7,000 years. However, no evidence was recovered to suggest that Aboriginal people had hunted the megafauna or had butchered them for food.

Early Aboriginal occupation of the Western Uplands is also evident from the Drual rockshelter in the Grampians, approximately 100 km west of the study area. Stone artefacts and ochre at the lower levels of the Drual sequence have been radiocarbon dated to 22,140 ± 160 years before present (Beta-88523; Bird *et al*. 1998). The only formal tool types in these early assemblages are thumbnail scrapers, which are present throughout the sequence. Later mid-Holocene (around 5000 years ago) assemblages include backed microliths and greenstone flakes. This is the oldest, continuous cultural sequence in Victoria.

One of the most impressive Aboriginal sites in Victoria is the Carisbrook Ceremonial Stone Arrangement first described by Massola (1963). It is a large, boomerang-shaped stone arrangement 60 m long and 5 m wide associated with two stone circles and a small rock cairn. The site overlooks Tullaroop Creek some 4 km southeast of Carisbrook. Massola (1956) also recorded three Aboriginal rock wells on the outskirts of Maryborough, west of the study area.

Most surface archaeological sites in the region probably date to within the past 5000 years. One of the most significant is the Mount William Axe Quarry also located near Lancefield (McBryde 1984). This is a site where Aboriginal people have extracted diorite or ‘greenstone’ for the manufacture and trade of stone axe heads. Ground edge axe heads from this quarry have been found throughout Victoria and as far afield as Broken Hill in NSW. The geographical spread of these axe heads is used by archaeologists to infer past Aboriginal exchange networks. Other significant Aboriginal stone quarries in the region are located at Mount Camel (Mitchell 1949) some 80 km east of Carisbrook. These sites comprise worked greenstone strewn over the hillsides of Mount Camel. Among the artefact types represented are axe blanks and large struck flakes. These were also used by McBryde (1984) to reconstruct trade networks in the region.

2.3.3 Previously Identified Aboriginal Cultural Heritage in the Study Area

According to the Office of Aboriginal Affairs Victoria’s Victorian Aboriginal Heritage Register (VAHR), accessed on 19 June 2015, no Aboriginal cultural heritage places have been located previously in the proposed work corridors The nearest Aboriginal archaeological site is an isolated find of a broken groundstone axe-head (VAHR site number 7623-0024), located by a farmer in his paddock, some 1.5 km west of the proposed work corridors. There are also a number of Aboriginal cultural heritage places along Tullaroop Creek, approximately 2.5-4 km east of the proposed work corridors. These include a number of stone artefact scatters, a tree scarred by Aboriginal people, and a stone arrangement.

3 Cultural Heritage Predictive Model

Previous archaeological studies indicate that the most frequently recorded Aboriginal cultural heritage places in the Victorian Midlands are stone artefact scatters and scarred trees (OAAV Victorian Aboriginal Heritage Register for Creswick 7623 1:100,000 map sheet area). Earthen features such as mounds have also been identified in the archaeological record. Other site types include stone sources, rock art and rock shelter sites, stone arrangements and burials. Based on these observations of archaeological site types and their distribution and landscape setting, the following predictive model of Aboriginal cultural heritage site locations for the Carisbrook flood mitigation works can be proposed. A summary of the predictive model is presented in Table 1.

Past Aboriginal occupation of the Victorian Midlands would have focussed on the region's creeks and their associated wetlands because these water sources would have offered a richer resource zone than more poorly watered parts of the landscape. Consequently, most archaeological sites can be expected adjacent to water sources. However, the proposed infrastructure areas for the Carisbrook flood mitigation works would largely traverse the flood plains perpendicularly, rather than paralleling them, reducing the potential for encountering cultural heritage.

The potential for encountering Aboriginal cultural heritage in the planned infrastructure corridors for the Carisbrook flood mitigation works is also substantially reduced by the high degree of previous disturbance of the study area. The past removal the original vegetation lessens the probability that scarred trees would be encountered. Similarly, substantial modification of the original land surface by earthworks associated with previous gold mining, the construction of roads, culverts, drains, dams and levees, installation of fences, power lines and telecommunication cables, and agricultural clearing and ploughed cultivation would have destroyed earthen features such as mounds and hearths and stone features such as arrangements and ceremonial rings, had they previously existed in the proposed infrastructure areas.

Table 1. Desktop predictive model of encountering Aboriginal cultural heritage sites in the activity area.

Scarred trees	Stone artefacts	Earthen features	Stone features	Burials	Hearths	Shell middens
Low	Low	Negligible	Negligible	Negligible	Negligible	Negligible

4 Field Inspection

Project archaeologist Dr Matt Cupper inspected the proposed upgraded infrastructure corridors on 19 June 2015. No Aboriginal archaeological sites were observed. Moreover, the area has little archaeological potential and detailed archaeological investigation is not warranted. If Aboriginal people had occupied the subject land, any possible traces of this occupation are likely to have been destroyed by past development.

The corridors have been extensively modified by past European land use practices. The original vegetation has been completely removed and the corridors cut and levelled. The topsoil and subsoil has been substantially disturbed during past excavations for the construction of roads, culverts, drains and levees (Figures 1-4). This has included cutting up to several metres into the original land surface. Earthworks have also heavily modified the remainder of the topsoil and subsoil during past excavations to install utilities, destroying all of the original land surface. This extensive previous ground disturbance means that none of the original land surface for the entire development area remains intact.

Section 5 (below) makes a case that the infrastructure corridors have been subject to *significant ground disturbance* and any possible archaeological sites are likely to have been destroyed. The investigation was *preliminary* only and in no way constitutes a formal archaeological study. For Aboriginal sites, this would require participation of the relevant Aboriginal stakeholders under the *Aboriginal Heritage Act* 2006.

Figure 1. Pleasant Street, Carisbrook, proposed for levee construction.

Figure 2. Pleasant Street, Carisbrook, proposed for levee construction.

Figure 3. Existing drain, proposed for levee construction.

Figure 4. Existing drain, proposed for levee construction.

5 Assessment of Proposed Development According to *Aboriginal Heritage Regulations* 2007

All Aboriginal cultural heritage is protected by the State *Aboriginal Heritage Act* 2006. Responsibility rests with the proponent of a development to demonstrate that due care and diligence have been taken to identify and avoid impacts on archaeological sites through construction works.

A key component of the Act is Aboriginal Cultural Heritage Management Plans, which are required under certain circumstances for high impact activities.

Using the *Aboriginal Heritage Regulations* 2007 that accompany the *Aboriginal Heritage Act* 2006 it is possible to determine whether the development proposal for the Carisbrook flood mitigation works would trigger the requirement for an Aboriginal Cultural Heritage Management Plan.

The *Aboriginal Heritage Regulations* 2007 (r. 6) stipulate that an Aboriginal Cultural Heritage Management Plan is required for a proposed activity, if:

> (a) all or part of the activity area for the activity is an area of *cultural heritage sensitivity*[1]; and,
>
> (b) all or part of the activity is a *high impact activity*.

Part (b) of regulation 6 is met because a utility installation impacting an area exceeding 25 square metres is a high impact activity (see r.43[1][b][xxiii][D]).

According to regulation 23(1), any land within 200 m of a waterway (not subject to significant ground disturbance) is an area of cultural heritage sensitivity. Part of the corridor proposed for construction of a levee is located within 200 m of McCallum Creek[2].

However, under regulation 23(2), 'if part of a waterway or part of the land within 200 metres of a waterway has been subject to significant ground disturbance, that part is not an area of cultural heritage sensitivity'.

Significant ground disturbance is defined in the *Aboriginal Heritage Regulations* 2007 as disturbance of:

> (a) the topsoil or surface rock layer of the ground; or

---

[1] An area of 'cultural heritage sensitivity' means an area with the potential to contain Aboriginal cultural heritage items, places and/or values.

[2] The proposed infrastructure also traverses two unnamed artificial drains, but these are not waterways as defined by r. 4 of the *Aboriginal Heritage Regulations* 2007 because they are not named according to the *Geographic Place Names Act* 1998.

> (b) a waterway -
>
> by machinery in the course of grading, excavating, digging, dredging or deep ripping, but does not include ploughing other than deep ripping.

OAAV have produced a practice note for determining significant ground disturbance (see Appendix A). This practice note is based on the Victorian Civil and Administrative Tribunal's (VCAT) recent determination about significant ground disturbance in the Mainstay Australia Pty Ltd v Mornington Peninsula SC & Others [2009] VCAT 145 (24 February 2009) case. The following determination for the proposed Carisbrook flood mitigation works is guided by the VCAT (145) case and complies with OAAV's practice note.

According to OAAV and VCAT, the words *disturbance, topsoil, surface rock layer, machinery, grading, excavating, digging, dredging, ploughing* (other than deep ripping) are not defined in the regulations and therefore have their ordinary meanings. Topsoil is of particular relevance to the proposed flood mitigation works because there is no surface rock layer in the corridors. VCAT use the Macquarie Dictionary to define topsoil as 'simply the surface or upper part of the soil' and state that 'disturbance to the topsoil could therefore arise through a relatively limited interference at limited depth'.

For significant ground disturbance to have occurred on the topsoil, machinery must have been used. If machinery has been used to grade, excavate, dig or dredge the topsoil of an area, it will constitute significant ground disturbance of that area.

The onus rests with the planning permit applicant to prove that there has been significant ground disturbance if an exemption from the *Aboriginal Heritage Regulations* 2007 is to apply. The standard of proof required should be enough to satisfy a planning decision maker that there has been significant ground disturbance, on the balance of probabilities having regard to the purposes of the *Aboriginal Heritage Act* 2006, which in essence is to protect Aboriginal cultural heritage. Mere assertion of disturbance by an applicant or landowner has little weight.

Notwithstanding the burden of proof on the applicant, OAAV submitted to VCAT that there should be no hard and fast rules on what information should be required to satisfy a planning decision maker that significant ground disturbance has occurred and cautioned against guidelines that might create unreasonable obligations on applicants or responsible authorities. VCAT agreed. The level of inquiry, and the information required, will depend on the circumstances of each case.

As a result of these deliberations, VCAT proposed four levels of inquiry and that assessment of significant ground disturbance should be dealt with at lowest applicable level. These levels are summarised by OAAV as follows:

Level 1 – Common knowledge

The fact that land has been subject to significant ground disturbance may be common knowledge. Very little or no additional information should be required from the responsible authority. For example, common knowledge about the redevelopment of a petrol filling station with extensive underground storage tanks.

Level 2 – Publicly available records

If the existence of significant ground disturbance is not common knowledge, a responsible authority may be able to provide assistance from its own records about prior development and use of land, or advise the applicant about other publicly available records, including aerial photographs. These documents may allow a reasonable inference to be made that the land has been subject to significant ground disturbance. In such event, no further inquiries or information would be needed by the responsible authority. The particular records and facts relied upon should be noted by the responsible authority as a matter of record.

Level 3 – Further information from applicant

If common knowledge or publicly available records do not provide sufficient evidence of significant ground disturbance, the applicant may need to present further evidence either voluntarily or following a formal request from the responsible authority. Further evidence could consist of land use history documents, old maps or photographs of the land, or statements by former landowners or occupiers. Statements should be provided by statutory declaration or similar means.

Level 4 - Expert advice or opinion

If these levels of inquiry do not provide sufficient evidence of significant ground disturbance (or as an alternative to Level 3), the applicant may submit or be asked to submit a professional report with expert advice or opinion from a person with appropriate skills and experience. Depending on the circumstances, this may involve a site inspection and/or a review of primary documents. If there is sufficient uncertainty, some preliminary sub-surface excavation may be warranted.

VCAT and OAAV anticipate that a level 1 or 2 inquiry should be sufficient to determine significant ground disturbance and that a level 3 or 4 inquiry should not be required as a matter of course. In terms of expertise, OAAV regard geomorphologists as suitable to undertake high-level inquiries. The cultural heritage practitioner in this case is also a geoscientist, with a PhD in geomorphology.

Common knowledge (Level 1) is not applicable in this case. Publicly available records (Level 2) in the form of an aerial photograph and expert advice (Level 4) based on the field investigation described in Section 4 (above) are instead used to establish that the section of the proposed infrastructure corridor within 200 m of McCallum Creek has been subject to significant ground disturbance. The aerial photograph in Figure 5 clearly shows the location of earthworks associated with past drain construction. These surface features clearly visible on a publicly available aerial photograph show that some corridor has been previous directly impacted by significant ground disturbance.

The results of geomorphologist Dr Cupper’s level 4 inquiry show that the corridor has been impacted by the use of light and heavy earthmoving machinery (Figures 6 and 7). This includes extensive excavations for a drain.

Importantly, there was no trace of the original soil profile, including topsoil, on any part of the section of the proposed infrastructure corridor within 200 m of McCallum Creek (see Section 4). Any archaeological sites that might have occurred in this area are no longer present as a consequence.

Figure 5. Aerial photograph of the section of the proposed infrastructure corridor within 200 m of McCallum Creek demonstrating the significant ground disturbance.

Figure 6. Section of the proposed infrastructure corridor within 200 m of McCallum Creek demonstrating the significant ground disturbance caused by drain construction.

Figure 7. Section of the proposed infrastructure corridor within 200 m of McCallum Creek demonstrating the significant ground disturbance caused by drain construction.

6 Conclusions and Recommendations

No Aboriginal cultural heritage sites have previously been recorded in the upgraded infrastructure corridors proposed for flood mitigation works. Predictive modelling shows that there is a low to negligible potential for Aboriginal cultural heritage to occur in the proposed work corridors.

This scoping study concludes the activity area for the proposed flood mitigation works is not an area of cultural heritage sensitivity according to the *Aboriginal Heritage Regulations* 2007.

Accordingly, the proposed flood mitigation works do not require a mandatory Cultural Heritage Management Plan (CHMP) under Section 46 of the *Aboriginal Heritage Act* 2006.

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Appendix A.

OAAV Practice Note: Significant Ground Disturbance.

Aboriginal Heritage Act 2006
Practice Note:
Significant Ground Disturbance

This Practice Note provides guidance about the meaning of **significant ground disturbance** as it relates to requirements to prepare Cultural Heritage Management Plans under the *Aboriginal Heritage Act 2006**.

The Practice Note covers:

- when a Cultural Heritage Management Plan is required
- why significant ground disturbance should be assessed
- what significant ground disturbance means
- who needs to provide proof
- how to determine significant ground disturbance
- who can determine this
- what is the role of the responsible authority
- how Aboriginal cultural heritage is protected in areas of significant ground disturbance.

Background

The *Aboriginal Heritage Act 2006* (Act) and *Aboriginal Heritage Regulations 2007* (Regulations) provide protection in Victoria for all Aboriginal places, objects and human remains regardless of their inclusion on the Victorian Aboriginal Heritage Register or whether they are located on public or private land.

When is a Cultural Heritage Management Plan required?

A Cultural Heritage Management Plan is required for an activity (i.e. the use or development of land) if the activity:

- is a high impact activity
- falls in whole or in part within an area of cultural heritage sensitivity.

The terms 'high impact activity' and 'cultural heritage sensitivity' are defined in the Regulations.

A Plan must also be prepared when an activity requires an Environmental Effects Statement, or when the Minister for Aboriginal Affairs requires.

High impact activities are categories of activity that are generally regarded as more likely to harm Aboriginal cultural heritage. Most high impact activities provided for in the Regulations are subject to a requirement that the activity results in significant ground disturbance.

Areas of cultural heritage sensitivity are landforms and land categories that are generally regarded as more likely to contain Aboriginal cultural heritage. A registered Aboriginal cultural heritage place is also an area of cultural heritage sensitivity.

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If part of an area of cultural heritage sensitivity (other than a cave) has been subject to significant ground disturbance that part is not an area of cultural heritage sensitivity.

If a Cultural Heritage Management Plan is required for an activity it must be approved before the sponsor can obtain any necessary statutory authorisation for the activity and/or before the activity can start. For more information about Cultural Heritage Management Plans see Aboriginal Affairs Victoria's (AAV) website (www.aboriginalaffairs.vic.gov.au).

Why should significant ground disturbance be assessed?

It is important to assess significant ground disturbance when considering whether a cultural heritage management plan is required because:

- A Cultural Heritage Management Plan does not need to be prepared for a high impact activity if <u>all</u> the area of cultural heritage sensitivity within the activity area has been subject to significant ground disturbance.
- Some types of activity will not be a high impact activity, meaning a Cultural Heritage Management Plan would not need to be prepared, if the activity does not cause significant ground disturbance.

The Regulations specify the landforms and land categories that are areas of cultural heritage sensitivity. Areas of cultural heritage sensitivity are displayed in a series of maps available on AAV's website. The areas delineated on these maps however do not take account of the past history of land use and development that may have caused significant ground disturbance in localised areas.

How is significant ground disturbance defined?

'Significant ground disturbance' is defined in r.4 of the Regulations as meaning disturbance of –

(a) the topsoil or surface rock layer of the ground; or

(b) a waterway –
by machinery in the course of grading, excavating, digging, dredging or deep ripping, but does not include ploughing other than deep ripping.

The words 'disturbance', 'topsoil', 'surface rock layer', 'machinery', 'grading', 'excavating', 'digging', 'dredging', 'ploughing' (other than deep ripping) are not defined in the regulations and therefore have their ordinary meanings.

Ploughing (other than deep ripping) to any depth is <u>not</u> significant ground disturbance. Deep ripping is defined in the regulations to mean 'ploughing of soil using a ripper or subsoil cultivation tool to a depth of 60 centimetres or more'. None of the words used in this definition are defined, and therefore have their ordinary meanings. The Victorian Civil and Administrative Tribunal (VCAT) has determined that a ripper or subsoil cultivation tool must be distinguished from conventional ploughs or topsoil cultivation tools such as disc ploughs or rotary hoes which are not sufficient to show significant ground disturbance.

Deep ripping will result in significant ground disturbance regardless of the degree of disturbance caused to the topsoil or surface rock layer of the ground.

Who needs to provide proof that land has been subject to significant ground disturbance?

The burden of proving that an area has been subject to significant ground disturbance rests with the applicant for a statutory authorisation for the activity (or the sponsor of the activity). The responsible authority may assist by providing the applicant access to any relevant records it has about past land use and development.

How can a sponsor determine whether significant ground disturbance has occurred?

The responsible authority should require evidence of support for claims that there has been significant ground disturbance of an area. The levels of inquiry outlined below provide some guidance about what information should be required to satisfy a responsible authority (depending on the circumstances of each case) that significant ground disturbance has occurred. The levels of inquiry are listed in order of the level of detail that may be required. An assessment of whether significant ground disturbance has occurred should be dealt with at the lowest possible level in order to avoid unnecessary delay or cost to applicants.

Little weight should be given to mere assertions by applicants or land owners that an activity area has been subject to significant ground disturbance.

Level 1 – Common knowledge

The fact that land has been subject to significant ground disturbance may be common knowledge. Very little or no additional information should be required from the responsible authority.

For example, common knowledge about the redevelopment of a petrol station with extensive underground storage tanks.

Level 2 – Publicly available records

If the existence of significant ground disturbance is not common knowledge, a responsible authority may be able to provide assistance from its own records about prior development and use of land, or advise the applicant about other publicly available records, including aerial photographs. These documents may allow a reasonable inference to be made that the land has been subject to significant ground disturbance. In such event, no further inquiries or information would be needed by the responsible authority. The particular records and facts relied upon should be noted by the responsible authority as a matter of record.

For example, a former quarry site subsequently filled, but where the public records show the area of past excavation.

Level 3 – Further information

If 'common knowledge' or 'publicly available records' do not provide sufficient information about the occurrence of significant ground disturbance, the applicant may need to present further evidence either voluntarily or following a formal request from the responsible authority. Further evidence could consist of land use history documents, old maps or photographs of the land or statements by former landowners or occupiers. Statements should be provided by statutory declaration or similar means.

For example, the construction of a former dam on a farm.

Level 4 – Expert advice or opinion

If these levels of inquiry do not provide sufficient evidence of significant ground disturbance (or as an alternative to level 3), the applicant may submit or be asked to submit a professional report with expert advice or opinion from a person with appropriate skills and experience. Depending on the circumstances, this may involve a site inspection and/or a review of primary documents. If there is sufficient uncertainty some preliminary sub-surface excavation may be warranted.

An expert report should comply with VCAT's practice note on expert evidence.

The responsible authority must be reasonably satisfied that the standard of proof presented by the applicant shows that all of the land in question has been subject to significant ground disturbance.

A level 1 or 2 inquiry will commonly provide sufficient information as to whether or not the activity area has been subject to significant ground disturbance, and a level 3 or 4 inquiry should not be required as a matter of course.

There will be cases when the responsible authority is simply not persuaded or where there remains genuine doubt about significance ground disturbance regardless of the level of inquiry. In these circumstances the default position is that a Cultural Heritage Management Plan is required. This is in line with the purpose of the Act and Regulations to provide for the protection of Aboriginal cultural heritage in Victoria.

Who can provide expert advice about significant ground disturbance?

A person needs to have expertise to decide, based upon an inspection of the land or interpreting primary documents, whether the land has been subject to significant ground disturbance.

A cultural heritage advisor may not necessarily have this expertise. Under section 189 of the Act, an advisor must have a qualification directly relevant to the management of Aboriginal cultural heritage such as ‘anthropology, archaeology or history’ or have extensive experience or knowledge in relation to the management of heritage. An advisor appropriately qualified in archaeology may be able to assist where excavation is required to determine significant ground disturbance.

Other experts such as a land surveyor, geomorphologist or civil engineer could also have the necessary expertise (depending on the circumstances). For example, a civil engineer should have the qualifications and experience to determine the extent of previous engineering works along a watercourse or road, and therefore the extent of significant ground disturbance.

What is the role of the responsible authority?

The responsible authority determines whether a Cultural Heritage Management Plan is required for an activity. It may require the applicant to provide information to satisfy it that an area has been subject to significant ground disturbance.

Evaluating information relating to the occurrence of significant ground disturbance may be critical in deciding whether a Cultural Heritage Management Plan is required and therefore whether a statutory authorisation can be granted. This question should be resolved at an early stage in planning a proposed development. Applicants for statutory authorisations and the responsible authority should therefore seek to agree at an early stage about whether a Cultural Heritage Management Plan is required. In the event of a dispute this can be brought without delay to VCAT for resolution. The responsible authority should take care to document the steps taken in each case.

What if Aboriginal cultural heritage is discovered in an area determined to have been subject to significant ground disturbance?

It is possible that there are Aboriginal cultural heritage places, objects or human remains within areas determined to no longer be areas of cultural heritage sensitivity due to significant ground disturbance. It is also possible that Aboriginal cultural heritage could be harmed by activities which do not amount to high impact activities.

These Aboriginal places are still protected under the Act. In particular, it is an offence under sections 27 and 28 of the Act to harm Aboriginal cultural heritage unless acting in accordance with a Cultural Heritage Permit or approved Cultural Heritage Management Plan (regardless of whether a Plan was required).

** This Practice Note is based on VCAT’s determination about significant ground disturbance. For further details see VCAT, Reference No. P1020/2008 – Mainstay Australia vs Mornington Peninsula SC.*

C Geotechnical Investigation by Tonkin and Taylor

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REPORT

Carisbrook Flood Mitigation Scheme

Geotechnical Investigation

Prepared for

Entura

Prepared by

Tonkin + Taylor Pty Ltd

Date

August 2015

Job Number

4548.000.R1

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Table of contents

1 Introduction

As part of the design works being carried out for the Carisbrook flood mitigation works, Tonkin & Taylor Pty Ltd (T&T) has been engaged by Entura to conduct geotechnical site investigations along the alignments of the proposed levees in Carisbrook and at potential borrow pits in the area.

We understand that a system of levees, known as Option A, is being considered to protect the township of Carisbrook from flooding. The option consists of:

- a 2.8 km long levee approximately 1.5 m high to the west of the township;
- an 800 m long levee approximately 1.5 m high to the south of the township; and
- three (3) drainage culverts.

It is also understood that the intention is to construct the levees from locally available soils and that potential borrow areas are also to be investigated.

The objectives of the investigations were to provide the soil profiles along the alignments of the levees, foundation conditions for the proposed culverts and soil properties of borrow materials to be used in the construction of the levees.

T&T were engaged in accordance with our proposal letter 4548.000.P2 dated 19th May 2015.

2 Proposed Flood Mitigation Scheme

2.1 Project Description

The proposed flood mitigation scheme (Option A) consists of two levees and three drainage culverts. The two levees will have a maximum height of approximately 1.5 m, a crest width of 3.5 m and upstream and downstream batters formed at 1(V) to 3(H). A portion of the western levee between Ch. 1600 and Ch. 2800 is to be constructed along an existing road known as Pleasant Street as a result of which the road will be reconstructed on top of the levee and the crest of the levee will be widened to 7 m to accommodate a two-lane road.

Of the three culverts, one which is to be located at Ch. 1000 m will be a single 30 m long, 500 mm diameter pipe culvert beneath the levee. The other two culverts will be box culverts located upstream of the levee at Ch.1550 and Ch. 1900 m and will be installed beneath the Pyrenees Highway and the Castlemaine – Maryborough rail line, respectively. The culvert at Ch.1550 m will consist of three (3) rows of 1.2 m by 0.75 m by 12 m long box sections while the culvert at Ch. 1900 m will consist of seven (7) rows of 1.2 m by 0.45 m by 20 m long box sections.

2.2 Scope of Works

Based on our understanding of the project the following scope of works was developed for the site investigation:

- Two (2) boreholes drilled to depth of 6 m below existing ground level (bgl) at the proposed locations of the box culverts; where refusal to the solid auger occurred prior to the target depth the drilling method was changed to HQ coring to enable the borehole to be advanced to the target techniques and the rock cored to a depth of 6 m;
- Fifteen (15) boreholes drilled to a maximum depth of 2 m bgl or to refusal whichever was the lesser along the proposed levee alignments which were within existing road reserves;
- Twenty-two (22) test pits to a maximum depth of 2 m bgl depth or to refusal whichever was the lesser along the proposed levee alignments which were within private property;
- Three (3) test pits to a maximum depth of 3 m bgl or to refusal whichever was less within proposed borrow pits;
- Dynamic Cone Penetrometer testing to a maximum depth of 1.5 m bgl or to refusal whichever was less to determine density/consistency of the soils;
- Shear vane testing in cohesive soils; and
- Retrieval of representative disturbed samples of soils from the borrow areas to assess their suitability for use in the construction of the proposed levees.

Following the completion of the site investigation, Entura informed T&T that the diameter of the pipe culvert at Ch. 1000 m had been changed to 450 mm and that an additional 225 mm diameter pipe culvert was to be installed beneath the levee at Ch. 400 m to discharge runoff during low flow periods into an adjacent wetland.

3 Existing Information Relating to Geotechnical Issues

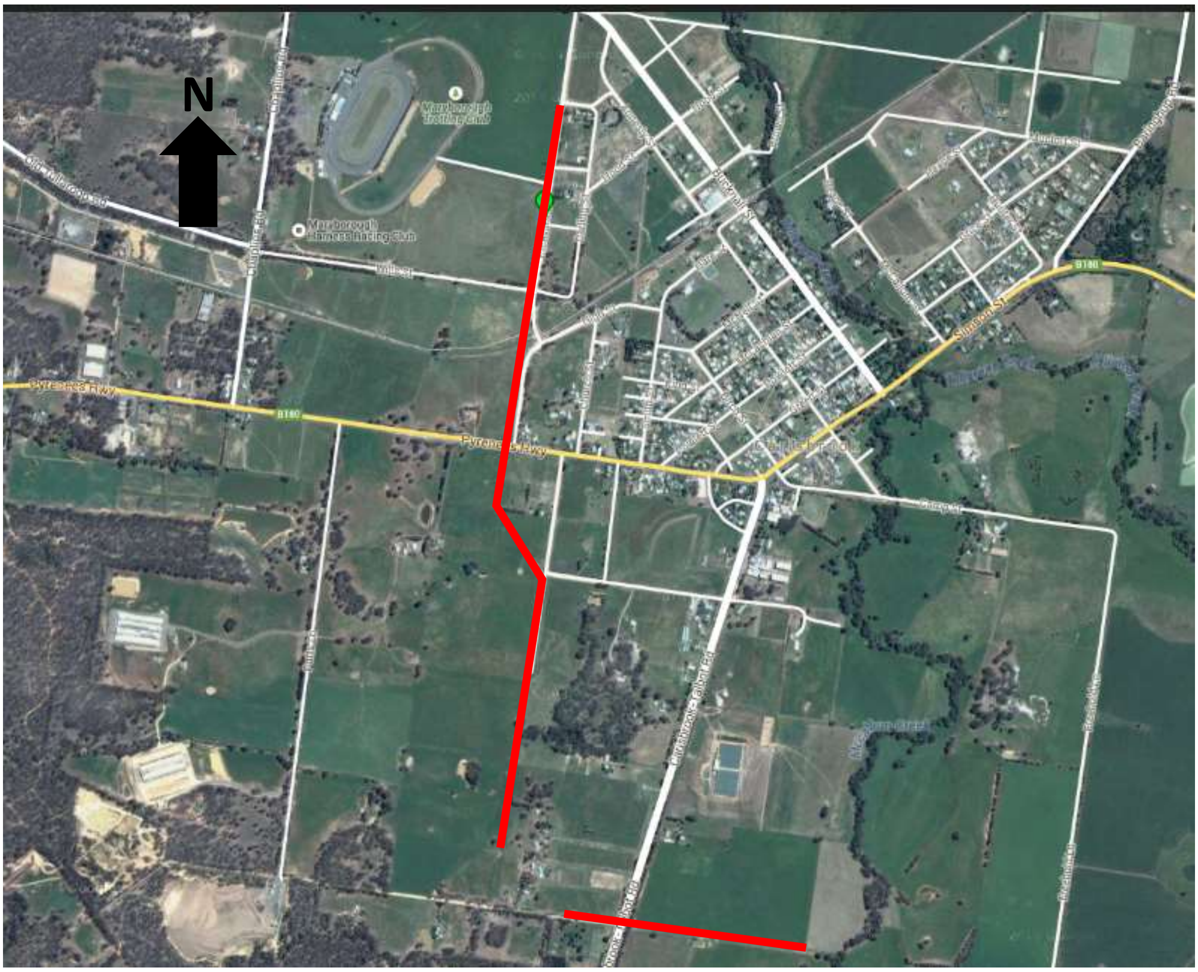
3.1 Regional Geology

The Department of Economic, Development, Jobs, Transport and Resources online geology mapping indicates that the areas in which the levees are to be located are underlain by the Quaternary Age Newer Volcanics and the Ordovician Age Castlemaine Group. However, the findings of our investigation indicated that the alignments are only underlain by soils and rock consistent with the Ordovician Age Castlemaine Group.

3.2 Aerial Photographs

An aerial photograph of the township of Carisbrook has been sourced from the "Nearmap Online Aerial Photograph Site", see figure 1. The proposed levee alignments are shown in red.

Figure 1 Aerial Photograph of Carisbrook (not to scale)



4 Field Work

4.1 General

The field work which was carried out between the 25th and 28th May 2015, comprised:

- Seventeen (17) boreholes;
- Twenty-five (25) test pits;
- Forty-one (41) Dynamic Cone Penetrometer tests;
- Six (6) Standard Penetration Tests; and
- One hundred and seventeen (117) shear vane tests.

Details of the individual field tests are discussed in the sections below.

All fieldwork was carried out under the direction and full time presence of a T&T geotechnical engineer who was responsible for:

- Positioning the test locations.
- Directing the extent of sampling and testing.
- Performing the dynamic cone penetrometer and logging the conditions encountered.

The approximate locations of the boreholes and test pits are shown on the site plan contained in Appendix A. The locations were recorded using hand held GPS unit and the accuracy of the survey data is +/- 5 m.

The engineering field logs are presented in Appendix B. Material classification and logging techniques were carried out in accordance with the attached explanatory notes and wherever possible, material classifications have been correlated to the results of laboratory testing. However, it should be noted that field classification of materials is based on a visual assessment by the site engineer and some variation from the descriptions derived from the results of the laboratory testing can occur.

4.2 Boreholes

A total of seventeen (17) boreholes numbered BH01 to BH17 were drilled to target depths between 2 m and 6.45 m bgl to give information on the soil profile along the northern end of the western levee and the western end of the southern levee and at the proposed culvert locations. The deeper boreholes, drilled to 6.4 to 6.45 m were located at the culvert crossings at the Pyrenees Highway and adjacent to the railway line. Boreholes were drilled using Hanjib D&B drill rig supplied and operated by Chadwick Geotechnics Pty Ltd (Chadwick). Drilling was carried out using solid auger techniques.

Disturbed soil samples were collected and shear vane tests were performed where cohesive soils were encountered in the boreholes. Groundwater levels were monitored in the boreholes during drilling wherever possible.

4.3 Test Pits

A total of twenty-one (21) test pits, numbered TP01 to TP04, TP06 to TP11, TP13 to TP17, and TP20 to TP25, were excavated to target depths of between 2 m bgl to give information on the soil profiles along the levee alignments south of the Pyrenees Highway and east of the Talbot-Carisbrook Road. A further four (4) test pits, numbered TP05, TP12, TP18 and TP19, were excavated to a target depths of 2m and 3 m bgl within the proposed borrow areas to the west of the western levee and to the north of the Carisbrook horse racing track. Test pits were excavated using backhoe supplied and operated by Shay Excavations. Test pitting was carried out using a 450mm bucket.

Disturbed soil samples were collected and shear vane tests were performed on cohesive soils. Groundwater levels were monitored in the test pits during excavation.

4.4 Dynamic Cone Penetrometer Tests

A total of forty one (41) Dynamic Cone Penetrometer (DCP) tests were undertaken and the results are contained on the engineering logs. Four (4) tests at BH06, TP07, TP09 and TP14, refused on a hard stratum at depths between 0.7 m and 1.1 m. No testing was conducted at borehole BH01 due to the presence and depth of gravel associated with the Pyrenees Highway pavement.

Penetration resistance between 2 blows/100 mm and 26 blows/100 mm were recorded in the sandy silt layer indicating a soil of variably firm to hard consistency.

Penetration resistance between 1 blows/100 mm and 20 blows/100 mm were recorded in the clayey sand layer indicating a variably very loose to dense soil.

Penetration resistance between 2 blows/100 mm and 23 blows/100 mm were recorded in the clay layer indicating a soil of firm to hard consistency.

Penetration resistance between 8 blows/100 mm and 20 blows/100 mm were recorded in the silty sand layer indicating a variably medium dense to dense soil.

4.5 Standard Penetration Tests

A total of six (6) standard penetration tests (SPT) were undertaken and the results are contained on the engineering logs.

SPT ‘N” values between 5 and 13 were recorded in the clay layer indicating variably firm to very stiff consistency of the clay.

SPT ‘N” values between 9 and 15 were recorded in the sand layer indicating variably medium dense sands.

4.6 Shear Vane Tests

A total of one hundred and seventeen (117) shear vane tests were undertaken and the readings ranged from 98 to >213 kPa indicating variably stiff to hard consistency of the clay.

5 Field and Laboratory testing

At each test location insitu dynamic cone penetrometer testing was under taken to a depth of 1.5 m below ground level (bgl) or refusal whichever was the lesser and shear vane tests undertaken in cohesive soils.

Laboratory testing was undertaken by a NATA approved at Chadwick's laboratory. A summary of the test results are presented in Table 5-1. The laboratory test reports are included in Appendix C.

Table 5-1 Field and Laboratory Test Results

Test Site	Material	Layer Depth (m)	DCP (Blow/100mm)	Shear Vane (kPa)	SPT (N Value)	CBR (%)	Swell (%)	Permeability (m/sec)	Emerson Class Number	LL (%)	PL (%)	PI (%)	LS (%)	(%) Passing		
														0.075mm	0.425mm	2.36mm
BH01	Sprayed Seal	0.0-0.01														
	Sandy Gravel	0.01-1.2														
	CLAY	1.2-2.7		150 - 213						22	14	8	4	66	90	95
	Silty SAND	2.7-4.3			9											
	CLAY	4.3-4.5														
	Silty SAND	4.5-4.7			11											
	CLAY	4.7-6.0								54	28	26	7	98	99	100
	Clayey SAND	6.0-6.3			15											
	CLAY	6.3-6.45														
BH02	Sprayed Seal	0-0.025														
	Sandy Gravel	0.025-0.23														
	Clayey SAND	0.23-1.5	1-20													
	CLAY	1.5-2.0		111												
BH03	Sandy Gravel	0-0.12														
	Sandy SILT	0.12-2.00	7-14	128												

DCP: Dynamic Cone Penetrometer; CNT: Could Not Penetrate; SPT: Standard Penetration Test; CBR: California Bearing Ratio; LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; LS: Linear Shrinkage

Table 5-1 Field and Laboratory Test Results (continued)

Test Site	Material	Layer Depth (m)	DCP (Blow/100mm)	Shear Vane (kPa)	SPT (N Value)	CBR (%)	Swell (%)	Permeability (m/sec)	Emerson Class Number	LL (%)	PL (%)	PI (%)	LS (%)	(%) Passing		
														0.075mm	0.425mm	2.36mm
BH04	Sandy Gravel	0.0-0.15														
	Sandy SILT	0.12-1.0	7-15													
	Sandy GRAVEL	1.0-3.0	3-8	CNP												
BH05	CLAY	0-2.0	2-6	147-209						30	16	14	6	84	96	98
	Sandy CLAY	2.0-5.0		140-147	5-9					26	17	9	5	83	99	100
	Silty SAND	5.0-5.6														
	CLAY	5.6-6.4			13											
BH06	Sandy Gravel	0-0.05														
	Silty SAND	0.05-0.8	11-R													
	CLAY	0.8-2.0		CNP												
BH07	Sandy Gravel	0-0.05														
	Sandy SILT	0.05-1.2	8-11													
	CLAY	1.2-2.0	4-7	>213												
BH08	Sandy Gravel	0-0.05														
	Silty SAND	0.05-0.8	9-20													
	SILT	0.8-1.2	13-17	CNP												
	CLAY	1.2-2.0	11-14	>213												

DCP: Dynamic Cone Penetrometer; CNP: Could Not Penetrate; SPT: Standard Penetration Test; CBR: California Bearing Ratio; LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; LS: Linear Shrinkage

Table 5-1 Field and Laboratory Test Results (continued)

Test Site	Material	Layer Depth (m)	DCP (Blow/100mm)	Shear Vane (kPa)	SPT (N Value)	CBR (%)	Swell (%)	Permeability (m/sec)	Emerson Class Number	LL (%)	PL (%)	PI (%)	LS (%)	(%) Passing		
														0.075mm	0.425mm	2.36mm
BH09	Sandy Gravel	0.0-0.07														
	Silty SAND	0.07-0.4	8													
	CLAY	0.4-2.0	3-12	128->213												
BH10	Sandy Gravel	0-0.08														
	CLAY	0.08-1.6	3-10	196-202												
	Sandy SILT	1.6-2.0														
				114												
BH11	Sandy Gravel	0-0.07														
	CLAY	0.07-2.0	4-12	196-203					2	43	19	24	9	95	98	100
BH12	Sandy Gravel	0-0.05														
	CLAY	0.05-2.0	5-9	190-213												
BH13	Sandy Gravel	0-0.05														
	CLAY	0.05-2.0	4-9	183-213												
BH14	Sandy Gravel	0-0.05														
	CLAY	0.05-2.0	5-13	164-213												

DCP: Dynamic Cone Penetrometer; CNP: Could Not Penetrate; SPT: Standard Penetration Test; CBR: California Bearing Ratio; LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; LS: Linear Shrinkage

Table 5-1 Field and Laboratory Test Results (continued)

Test Site	Material	Layer Depth (m)	DCP (Blow/100mm)	Shear Vane (kPa)	SPT (N Value)	CBR (%)	Swell (%)	Permeability (m/sec)	Emerson Class Number	LL (%)	PL (%)	PI (%)	LS (%)	(%) Passing		
														0.075mm	0.425mm	2.36mm
BH15	Sandy Gravel CLAY	0.0-0.25 0.25-2.0	4-13	170->213												
BH16	Sandy Gravel CLAY Clayey SAND	0-0.35 0.35-2.9 2.9-3.0	6-12	CNP-172					3	23	13	10	5	82	95	99
BH17	Sandy Gravel CLAY Silty SAND	0-0.4 0.4-2.2 2.2-2.5	4-11	CNP												

DCP: Dynamic Cone Penetrometer; CNP: Could Not Penetrate; SPT: Standard Penetration Test; CBR: California Bearing Ratio; LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; LS: Linear Shrinkage

Table 5-1 Field and Laboratory Test Results (continued)

Test Site	Material	Layer Depth (m)	DCP (Blow/100mm)	Shear Vane (kPa)	SPT (N Value)	CBR (%)	Swell (%)	Permeability (m/sec)	Emerson Class Number	LL (%)	PL (%)	PI (%)	LS (%)	(%) Passing		
														0.075mm	0.425mm	2.36mm
TP01	Sandy SILT	0.0-0.4	4-13													
	Sandy CLAY	0.4-2.0	7-R	>213												
TP02	Sandy Gravel	0-0.11														
	CLAY	0.11-0.55	3-15													
	Clayey SAND /Sandy CLAY	0.55-2.0	8-17	CNP-213												
TP03	Sandy Gravel	0-0.2														
	CLAY	0.2-2.0	2-9	>213												
TP04	Sandy SILT	0-0.4	3-5													
	CLAY	0.4-2.0	4-7	160-186												
TP05	Sandy SILT	0-0.3	2-6													
	CLAY	0.3-3.0	3-8	180-213				$1E^{-10}$	2	51	21	30	9.5	98	99	100
								$4E^{-10}$	3	27	16	11	4.5	83	97	100
TP06	Sandy SILT	0-0.45	2-12													
	CLAY	0.45-1.6	4-17	CNP-213												
	Gravelly SAND	1.6-2.0														

DCP: Dynamic Cone Penetrometer; CNP: Could Not Penetrate; SPT: Standard Penetration Test; CBR: California Bearing Ratio; LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; LS: Linear Shrinkage

Table 5-1 Field and Laboratory Test Results (continued)

Test Site	Material	Layer Depth (m)	DCP (Blow/100mm)	Shear Vane (kPa)	SPT (N Value)	CBR (%)	Swell (%)	Permeability (m/sec)	Emerson Class Number	LL (%)	PL (%)	PI (%)	LS (%)	(%) Passing		
														0.075mm	0.425mm	2.36mm
TP07	Sandy SILT	0.0-0.45	2-20													
	CLAY	0.45-1.2	22-R	CNP												
	Clayey SAND	1.2-1.8														
	Gravelly SAND	1.8-2.0														
TP08	CLAY	0-2.0	2-16	167-213												
TP09	CLAY	0-2.0	4-R	>213												
TP10	Sandy SILT	0-0.45	3-9													
	CLAY	0.45-2.0	7-20	>213												
TP11	CLAY	0-2.0	2-19	>213												
TP12	Sandy SILT	0-0.6	4-6													
	CLAY	0.6-3.0	3-10	160-213				$4E^{-10}$	2	45	20	25	9.0	96	98	100
								$1E^{-9}$	2	41	21	20	7.0	96	98	100
TP13	CLAY	0-2.0	3-12	>213												

DCP: Dynamic Cone Penetrometer; CNP: Could Not Penetrate; SPT: Standard Penetration Test; CBR: California Bearing Ratio; LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; LS: Linear Shrinkage

Table 5-1 Field and Laboratory Test Results (continued)

Test Site	Material	Layer Depth (m)	DCP (Blow/100mm)	Shear Vane (kPa)	SPT (N Value)	CBR (%)	Swell (%)	Permeability (m/sec)	Emerson Class Number	LL (%)	PL (%)	PI (%)	LS (%)	(%) Passing		
														0.075mm	0.425mm	2.36mm
TP14	Sandy SILT CLAY	0.0-0.45 0.45-2.0	5-13 18-R	 CNP												
TP15	Sandy SILT CLAY Clayey SAND /Sandy CLAY	0-0.35 0.35-1.5 1.5-2.0	3-5 8-15	 >213												
TP16	Sandy SILT CLAY	0-0.4 0.4-2.0	4-10 6-17	 CNP					 5	 36	 15	 21	 9.0	 84	 97	 100
TP17	Sandy SILT CLAY	0-0.3 0.3-2.0	2-5 2-7	 127-190												
TP18	CLAY Gravelly CLAY	0-1.5 1.5-3.0	5-20	CNP		4.5	1.5	$3E^{-10}$ $6E^{-9}$	2 3	44 28	18 22	26 6	8.5 3.5	84 46	95 57	98 67
TP19	CLAY	0-2.0	2-8			2.5	2.0			42	19	23	12.0	97	99	100
TP20	Sandy SILT CLAY	0-0.25 0.25-2.0	4-8 6-13	 >213												

DCP: Dynamic Cone Penetrometer; CNP: Could Not Penetrate; SPT: Standard Penetration Test; CBR: California Bearing Ratio; LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; LS: Linear Shrinkage

Table 5-1 Field and Laboratory Test Results (continued)

Test Site	Material	Layer Depth (m)	DCP (Blow/100mm)	Shear Vane (kPa)	SPT (N Value)	CBR (%)	Swell (%)	Permeability (m/sec)	Emerson Class Number	LL (%)	PL (%)	PI (%)	LS (%)	(%) Passing		
														0.075mm	0.425mm	2.36mm
TP21	CLAY Clayey SAND	0.0-1.6 1.6-2.0	7-15	196-202												
TP22	CLAY Clayey SAND	0.0-1.7 1.7-2.0	3-7	154-213					2	42	19	23	7.5	94	98	100
TP23	CLAY	0-2.0	5-9	>213												
TP24	CLAY	0-2.0	6-13	>213												
TP25	CLAY	0-2.0	2-8	196-213												

DCP: Dynamic Cone Penetrometer; CNP: Could Not Penetrate; SPT: Standard Penetration Test; CBR: California Bearing Ratio; LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; LS: Linear Shrinkage

6 Discussion and Recommendations

6.1 Surface Conditions

The sites of the proposed levees are to the south and west of the township of Carisbrook and comprise a 2.8 km long western levee, the northern section of which runs along Pleasant Street and an 800 m long southern levee which in part runs along Williams Road. Both Pleasant Street and Williams Road are unsealed pavements consisting of sandy river gravels. Some water ponding was observed along the drainage channels on Pleasant Street.

The topography to the north of the Pyrenees Highway in the vicinity of Pleasant Street and the race course is essentially level. To the south of the Pyrenees Highway the land falls gently from north to south to TP1 then there is a steep incline up to Williams Road. The grazing paddocks consisted of low lying grass with mature gum trees and various farm dams. A drainage channel runs parallel to the 800m levee alignment from the intersection of Carisbrook-Talbot Road and Williams Road.

6.2 Subsurface Stratigraphy

The following summary of the subsurface stratigraphy is inferred from the available site investigation data, and as such only represents the site conditions at the locations of the field testing. It is possible that conditions at locations between the field tests may be quite different and therefore this summary should only be understood to apply to the test locations.

The subsurface materials encountered in the boreholes and test pits at the site could be categorised into four main geological units and summarised as follows:

6.2.1 Unit 1 – FILL

FILL material was found at the ground surface in all the boreholes except BH05 and extended to depths ranging from 0.05 to 1.2 m bgl. The greatest depth of fill (1.2 m) was found adjacent to the Pyrenees Highway (BH01) but was generally less than 0.1 m along Pleasant Street and ranged from 0.25 m to 0.4 m along Williams Road. The Fill is predominantly described as sandy gravel which was fine to coarse grained and medium dense. A Sandy Gravel FILL was also encountered in test pits TP02 and TP03 and was 0.12 to 0.2 m deep. This Fill appears to have been placed to provide an alternative driveway to the farm house during the wetter months of the year.

6.2.2 Unit 2 – Sandy SILT/Silty SAND

Except where Fill was encountered this Unit was found at the surface along the majority of the western levee alignment where it extended to depths ranging from 0.3m to 0.45 m bgl. The Unit was also encountered beneath the FILL along Pleasant Street (BH03, BH04, BH07 to BH09) where it extended to depths ranging from 0.8 m to 2.0 m bgl.

This unit is typically described as a Sandy SILT of low plasticity with fine to coarse grained sand and of stiff to very stiff consistency except at BH09 where it is described as a loose to medium dense Silty SAND, it was found to be dry to moist.

6.2.3 Unit 3 - CLAY

This unit was found in all boreholes and test pits; it was encountered at ground surface along the majority of the southern levee alignment and within the proposed borrow area to the north of the race track and extended to depths ranging from 2 m to 6.45 m bgl. The unit is described as sandy CLAY or CLAY of low to medium plasticity and of stiff to hard consistency. At the proposed borrow area to north of the race track (TP18) the CLAY graded to a gravelly CLAY below a depth of 1.5 m bgl.

6.2.4 Unit 4 - SAND

Thin layers of sand were encountered in the deeper boreholes which were drilled for the culvert crossings below the clay and then went back into clay. In the base of BH16, BH17, TP6, TP7, TP21 and TP22 sands were also encountered and were described as gravelly or silty or clayey sands which were medium dense to dense and moist.

7 Borrow Pits and Levee Construction

7.1 Groundwater

Groundwater was not observed during the investigation and it is considered unlikely that groundwater will be encountered in the proposed excavations.

However, it is recommended that an allowance is made for localised sump pumping to deal with any surface water run-off that may collect within excavations.

7.2 Excavation Conditions

Considering the results of the site investigation, excavations along the levee alignments and at the proposed borrow areas will encounter predominantly CLAY soils except for the borrow area to the north of the race track where weathered Siltstone is expected to be found at depths exceeding 1.5 m bgl. Hence, excavation to depths not exceeding 3 m bgl should be achievable using conventional earthmoving equipment such backhoes, excavators, bulldozers or scapers.

7.3 Construction Materials

The sandy SILT is not suitable for structural fill and should be stripped from the borrow areas and from the footprint of the proposed levees. It can be stockpiled for later reuse as topsoil.

The CLAY encountered within the borrow areas is considered to be suitable for use as structural fill in the proposed levees but will require modification to reduce its susceptibility to erosion. From the laboratory testing of compacted specimens, the Clay has a permeability between 3 x 10^{-10}m/sec and 1 x 10^{-9}m/sec which are considered acceptable for water retention structures. However the Emerson Class Number tests gave results of 2 and 3 which are indicative of a soil which is moderately to highly dispersive and hence susceptible to erosion. Therefore, if the material is to be used for construction of the levees, it is recommended that it be blended with lime or gypsum to reduce its erosion potential. If lime is used it should be added at a rate of 4% by mass of pure quicklime but if gypsum is used it should be added at 7% by mass; the active ingredient in both cases is the Calcium ion which is available in a higher proportion in quicklime (CaO) than in Gypsum ($CaSO_4$). Further testing is recommended to confirm the optimal rate of addition of lime or gypsum to change the characteristics of the clay.

The blended fill can be used within the central third of the embankment but over the full height and should be used for the full width of the embankment for a distance of 3 m from each side of the pipe culverts.

In addition, it is recommended that the batters be covered with a minimum 200 mm depth of topsoil and sown with grass immediately after construction. Some temporary erosion protection such as jute matting should be provided until the grass cover becomes established. Where high flow velocities are expected (such as at overflows and channels), more robust erosion protect in the form of rock revetment may be required.

The Gravelly CLAY encountered beneath the CLAY in one of the borrow areas (TP18) recorded a permeability of 6 x 10^{-9} m/s and is not considered suitable for use in the construction of the levees.

Laboratory CBR tests on samples of clay taken from TP18 and TP19 recorded values between 2.5% and 4.5%. On that basis a CBR value of 3% can be adopted for the design of the reconstructed section of Pleasant Street.

7.4 Compaction

All filling works should be carried out under Level 1 Supervision requirements as set out in Australian Standard AS3798-2007 Guidelines on earthworks for commercial and residential developments. The CLAY soil (Unit 3) should be placed in compacted layers not exceeding 0.2m in thickness.

The blended CLAY fill should be compacted to a minimum density ratio of 98% of Standard Maximum Dry Density at a moisture content in the range between standard optimum moisture content and 3% wet of standard optimum moisture content. The natural clay has a maximum dry density in the range of 1.55 to 1.64 t/m^3 and an optimum moisture content in the range of 20% to 26.8%. At the time of the investigation the clay was generally dry of its optimum moisture content and if it is in this condition at the time of construction it will need to be moisture conditioned to increase its moisture content prior to being used as fill. The fill should be moisture conditioned.

The Clay fill should be free of clods and rock particles exceeding 75mm in size. Rock particles exceeding 75mm in size should be removed from the fill and “clods” exceeding 75mm in size should be broken down by mechanical processing.

8 Culvert Construction

8.1 General

The Option A scheme will require the construction of four culverts; two box culverts and a 225 mm diameter and a 450 mm diameter pipe culverts.

The nature and continuity of subsoil conditions away from and at depth below the investigation locations has been inferred, and it must be appreciated that actual conditions could vary from those adopted in the ground model.

8.2 Site Classification

This site is classified in accordance with AS2870-2011 as CLASS M-D with reference to footing design and construction. This classification was determined by taking into consideration the geology of the area, the soil profiles encountered, and the climatic zone of the area. However, it should be noted that as the proposed structures are not residential buildings as described in the Standard, the site classification is provided for guidance purposes only.

At this site, it is anticipated that the characteristic surface movement, y_s, of the soils will be less than 40mm.

8.3 Box Culvert Construction

8.3.1 Load Class

The culverts installed under the Pyrenees Highway shall be roadway load class while those installed under the Castlemaine-Maryborough rail line shall be railway load class and are also required to have a minimum fill cover of 300mm to the underside of the ballast.

8.3.2 Excavation

Considering the soil profiles at the culvert locations, it is expected that excavation for the culverts will be possible using conventional earthmoving equipment.

The excavations must be in accordance with the design drawings and shall have a base width equal to the width of the base slab of the culvert plus 150 mm minimum each side.

Where the depth of excavation exceeds 1.5 m the sides of the excavation shall be temporarily battered at 1(V):1(H). While the recommended batter slope is considered safe for a temporary (less than 2 weeks) batter, the batter should be continually monitored during construction for signs of instability. If the batter shows signs of instability work should cease immediately until the slope can be inspected by a suitably qualified geotechnical engineer.

A temporary drain shall be provided at the top of the batters to divert water away from the face of the batters. Drains should also be constructed upstream of the culvert excavations to divert surface water away from excavations in the event of increased runoff during heavy and/or prolonged rainfall.

8.3.3 Foundation

Based on the site investigation it is anticipate that CLAY will be exposed at the founding depths of the culverts at 450 mm and 750 mm below existing ground surface levels. At these depths an allowable bearing pressure of 100 kPa can be adopted for the design of the culvert base slabs.

The base slabs of the culverts shall be supported by a bedding zone not less than 100 mm thick and consist either of blinding concrete or bedding material complying with VicRoads Section 812.

8.3.4 Installation of Pre Cast Units

The precast units shall be installed in accordance with AS1597.1-2010 Precast Reinforced Box Culverts.

8.3.5 Backfilling

Selected backfilling shall be placed in the side zones of the box culverts, in horizontal layers with a maximum compacted thickness of 150mm.

Backfill shall be placed simultaneously on both sides of the culvert so that the level of the fill on each side does not differ by more than 600mm. Side zone material shall be compacted to a minimum dry density ratio of 90% Standard maximum dry density or to a density index of 60%. Backfilling and compaction shall commence at the wall of the culvert and proceed away from it.

The side zone material shall have particle size distribution complying with the limits given below (Table 8-1) and shall have a Plasticity Index not exceeding 15%.

Table 8-1 Grading Limits for Select Fill in Side Zone

Sieve Size (mm)	% Passing (by mass)
75.0	100
9.5	100 to 50
2.36	100 to 30
0.6	50 to 15
0.075*	25 to 0

Side zone fill at the upstream end of the culvert can either be cement slurry fill or site derived clay won from the culvert excavation with the clay compacted to a minimum dry density ratio of 95% standard maximum dry density.

8.4 Pipe Culvert Construction

Pipe culverts are to be designed or selected to withstand working loads due to the weight of fill material above the culvert as well as any superimposed dead and live loads.

A unit weight of 19kN/m^3 can be adopted for the site derived clay backfill.

The culverts are to be constructed using Type H support conditions as detailed in AS/NZS3725.2007 Design for Installation of Buried Concrete Pipes.

8.4.1 Excavation

Considering the soil profile the excavations for the culverts will be possible using conventional earthmoving equipment.

The excavation must be in accordance with the design drawings and shall have a base width which is equal to the culvert diameter plus a minimum distance of 150 mm on each side.

Where the depth of excavation exceeds 1.5m the sides of the excavation shall be temporarily battered at 1(V):1(H). While the recommended batter slope is considered safe for a temporary (less than 2 weeks) batter, the batter should be continually monitored during construction for signs of instability. If the batter shows signs of instability work should cease immediately until the slope can be inspected by a suitably qualified geotechnical engineer.

A temporary drain shall be provided at the top of the batters to divert water away from the face of the batters. Drains should also be constructed upstream of the culvert excavations to divert surface water away from excavation in the event of increased runoff during heavy and/or prolonged rainfall.

Excavated material shall be placed far enough away from the top of the trench to allow sufficient clearance for installation operations and to prevent collapse of the trench side walls.

8.4.2 Foundation

Based on the site investigation it is anticipated that the soil profile at the proposed culvert pipe installations will be CLAY.

The foundations for the culverts should be finished to a smooth uniform surface which provides uniform support along the length of the culvert. Hard or soft spots in the foundation should be removed and replaced with compacted granular material to provide uniform support.

8.4.3 Bedding and Backfilling

Concrete pipes are to be placed on a prepared flat bedding. Bedding material is to be spread across the full trench width to the required depth and compacted to prevent differential settlement of the culvert.

Bedding material should be granular material complying with the grading limits provided in Table 8-3. It should extend up either side of the pipe to the haunch and should be compacted to give stable support to the pipe and to the embedment zone above the bedding. Chases must be cut out of the bedding material for bell socketed joints.

Table 8-3 Grading Limits for Bedding Material

Sieve Size (mm)	Mass Passing (%)
19.0	100
2.36	100 to 50
0.6	90 to 20
0.3	60 to 10
0.15	25 to 0
0.075*	10 to 0

*Material passing 0.425mm sieve should be low plasticity

Bed and haunch zones are to be compacted to a density index of 50%.

Pipe embedment is the general name given to the zone in the trench between the invert and crown of the pipe and includes the haunch zone, the side zone and overlay zone (Figure 8-1). Pipe bedding refers to the bed and haunch zones which provide the underlying support to the pipe

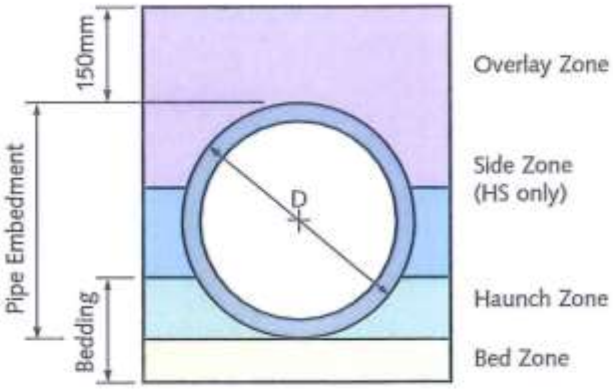


Figure 8-1 Pipe Trench Zones

The overlay zone shall be backfilled with compacted ordinary fill. Overlay material shall be compacted to a standard dry density ratio of 90% or a density index of 60%.

Compaction must be undertaken in such a manner as to avoid damage to the pipe. Heavy compaction equipment should not be used to compact materials close to the culvert or within 300 mm of the crown of the culvert. Heavy equipment should not run over the pipe until a sufficient cushion of material has been placed over the pipe, approximately 300mm for normal road vehicles and light-weight plant or non-vibrating compaction equipment and 500mm for vibrating compaction equipment.

At the upstream end of each of the drainage culverts the drainage pipes shall be encased in concrete to prevent moisture ingress. The embankment 3m either side of the drainage culverts encased in concrete shall be constructed using the blended embankment fill.

9 Implication

Recommendations and options in this report are based on data from the boreholes, test pits and insitu testing. The nature and continuity of subsoil away from the boreholes are inferred but it must be appreciated that actual conditions could vary from the assumed model.

During excavation and construction, the site should be examined by an engineer or engineering geologist competent to judge whether the exposed subsoils are compatible with the inferred conditions on which the report has been based. We would be pleased to provide this service to you and believe your project would benefit from such continuity. However, it is important that we be contacted if there is any variation in subsoil conditions from those described in the report.

10 Applicability

This report has been prepared for the benefit of Entura with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Tonkin + Taylor Pty Ltd

Report prepared by:	Authorised for Tonkin + Taylor Pty Ltd by:
....	....
Robert McKenzie	Tony Cussins
Senior Geotechnical Engineer	Project Director

RWMc
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Appendix A: Site Plan

Aerials sourced from Google Earth data (Images Copyright: 2015).

SCALE 1: 10,000
0 100 200 300 400 500 (m)

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DRAFTING CHECKED		
APPROVED		

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SCALES (AT A3 SIZE) AS SHOWN

PROJECT No. 4548.000.R1

ENTURA

GEOTECHNICAL INVESTIGATIOn
CARISBROOK FLOOD & DRAINAGE MITIGATION
Borehole & Testpit Location Plan

FIG. No. Figure 1

REV. 0

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Aerials sourced from Google Earth data (Images Copyright: 2015).

SCALE 1: 10,000
0 100 200 300 400 500 (m)

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DRAFTING CHECKED		
APPROVED		

CADFILE : \\4548-F1.dwg

SCALES (AT A3 SIZE) AS SHOWN

PROJECT No. 4548.000.R1

ENTURA
GEOTECHNICAL INVESTIGATIOn
CARISBROOK FLOOD & DRAINAGE MITIGATION
Borehole & Testpit Location Plan

FIG. No. Figure 2

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Appendix B: Engineering Field Logs

- **Engineering Terminology**
- **BH01 to BH17**
- **TP01 to TP25**

Tonkin & Taylor
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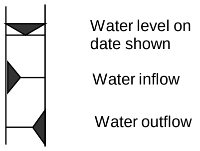
Engineering Consultants

ENGINEERING LOG TERMINOLOGY

SHEET 1 of 2

DRILLING OR EXCAVATION

WATER



CORE RECOVERY

Core recovered expressed as percentage of the length of the core run

METHOD/CASING

Shows drilling method and depth of casing
- SA - Solid Auger
- HA - Hollow Auger
- TR - Terrier
- W - Wash Boring
- NQ3 - NQ triple tube coring

FIELD TEST

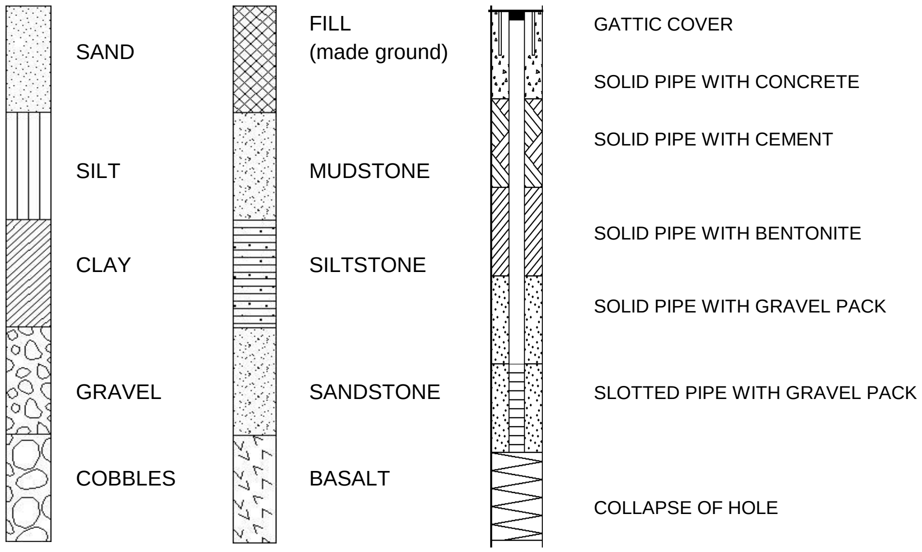
SPT	Standard Penetration Test
U63	Undistirbed Sample 63mm diameter
SV	Undrained Shear Strength as measured by field vane
PP	Twice Undrained Shear Strength as measured by pocket penetrometer
DCP	Dynamic Cone Penetrometer blows per 100mm
Field CBR	Field CBR under exisitng pavement

LABORATORY TEST

U63	Undisturbed Sample - 63mm
DS	Disturbed Sample
MC	Moisture Content % AS 1289.2.1.1
LL	Liquid Limit (%) AS 1289.3.1.2
PI	Plasticity Index AS 1289.3.3.1
LS	Linear Shrinkage (%) AS 1289.3.4.1
PID	Photoionization Detector (ppm)
CBR	California Bearing Ratio AS 1289.6.1.1

GRAPHIC LOG

(The graphic logs shows soil and rock substances, significant defects, and core loss. Soil and rock substances represented clear contrasting symbols consistant for each project.



SOIL DESCRIPTIONS

CLASSIFICATION SYMBOL

Based on USCS Unified Soil Classification Symbol Visual Method field identification. Classification symbols based on the Laboratory Method may differ

Soil and rock desriptions generally follow the "Guide to the Description Identification and Classification of Soils" and the the field guides as given in AS1726 - 1993 Geotechnical Site Investigations. When describing the soils the soils are desribed in terms of the Engineering properties.

MOISTURE CONTENT		STRENGTH			DENSITY		EASE OF EXCAVATION	
				Cu (kPa)				
D	Dry, look and feels dry	VS	Very Soft	<10	VL	Very Loose	E	Easy
M	Moist, no free water on hand	S	Soft	10 - 25	L	Loose	M	Moderate
	when remoulding	F	Firm	25 - 50	MD	Medium Dense	D	Difficult
VM	Very Moist	St	Stiff	50 - 100	D	Dense	ER	Effective Refusal
W	Wet, freee water on hand	VSt	Very Stiff	100 - 200	VD	Very Dense		
	when remoulding	H	Hard	>200				
		Fb	Friable					

ROCK DESCRIPTIONS

WEATHERING

RS	Residual Soil
XW	Extremely Weathered Rock
HW	Highly Weathered Rock
MW	Moderately Weathered Rock
DW	Distinctly Weathered Rock
SW	Slightly Weathered Rock
FR	Fresh Rock

FIELD STRENGTH

		Point Load Index (MPa) - Is(50)	Field Guide (50mm Core)
EL	Extremely Low	< 0.03	Easily remoulded by hand crumbles
VL	Very Low	> 0.03 < 0.1	Crumbles under firm blows with sharp end of pick
L	Low	> 0.1 < 0.3	A 150mm long piece may be broken hand
M	Medium	> 0.3 < 1.0	A 150mm long piece may be broken hand with difficulty
H	High	> 1 < 3	Core breaks after one blow
VH	Very High	> 3 < 10	Core breaks after more than blow
EH	Extremely High	> 10	Core breaks after many blows with pick

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ENGINEERING LOG TERMINOLOGY

SHEET 2 of 2

ROCK DESCRIPTIONS

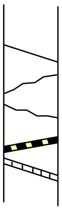
(Continued)

CLASSIFICATION OF ROCK

RQD	Rock Quality Designation	100 x Length of Core in pieces > 100mm / Length of run
	Core Recovery	Recovery of Core per drilling run

DEFECTS

Significant defects may be shown graphically

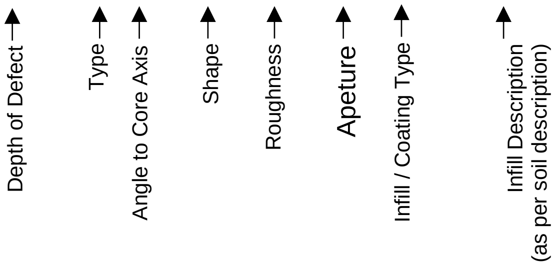


B	BEDDING
J	JOINT
SZ	SHEARED ZONE
CZ	CRUSHED SEAM / ZONE
IF	INFILLED SEAM / ZONE
XD	EXTREMELY WEATHERED SEAM

CODING

Typical Example:

30.0m, J, 60°, PL, SM, VT, CV, stiff green clay



SHAPE

CODE	TERM
PL	Planar
SC	Slightly Curved
CV	Curved
IR	Irregular
ST	Stepped
WV	Wavy

ROUGHNESS

DESCRIPTION OF JOINT SURFACE	
SL	Slickensided
SM	Smooth
DR	Defined Ridges
ST	Small Steps
R	Rough
VR	Very Rough

APERTURE

SYMBOL	TERM	DESCRIPTION (Seperation)
VT	Very Tight	< 0.1mm
T	Tight	0.1mm - 1.0mm
O	Open	1.0mm - 10.0mm
VO	Very Open	> 10mm

INFILLINGS AND COATINGS

CG	Clay Gouge	Joints have openings between opposing faces of intact rock substance in excess of 1.0mm filled with clay gouge.
CV	Clay Veneers	Joints contain clay coatings whose maximum thickness does not exceed 1mm. Note: Clay described in terms of soil properties
PL	Penetrative Limestone	Joint traces are marked in terms of well defined zones of slightly to moderately weathered ferrugunised rock - substance within the adjacent rock.
FeSt	Limonite Stained	Joint surfaces are stained or coated with limonite, although the rock substance immediately adjacent rock is fresh.
CT SC	Coated	Joints exhibit Coatings other than clay or limonite. Eg. Carbonate (CT) or silica (SC)
CL CS CC	Cemented	Joints are cemented with limonite (CL), silica (CS), or carbonates (CC).
CN	Clean	Joint Surfaces show no trace of clay, limonite, or other coatings.
ST	Stain	No visible sign of infill or coating but surfaces are discoloured by mineral staining.
V	Veneer	A visible coating or infilling of soil or mineral substance but usually unable to be measured (less than 1mm).
C	Coating	A visible coating or infilling of soil or mineral substance, greater than 1mm thick

CEMENTATION CLASSIFICATION

Uc	Uncemented	Clean grains exhibiting soil properties
Vwk	Very Weakly cemented	Cement on some grains, collapsing feel under very light finger pressure
Wk	Weakly cemented	Cement on many grains, collapsing feel under finger pressure, breaks down to individual grains
Mwk	Moderately weakly cemented	Cement on most grains, breaks down to lumps under finger pressure, can crush to individual grains under knife blade
Mo	Moderately cemented	Cement on most grains, can break fragments off by hand and crush to small lumps
We	Well cemented	Practically all grains cemented together, cannot break fragments off by hand, dull sound under hammer
Vwe	Very well cemented	Most primary pores filled with cement, requires firm blow with hammer to break off fragments, rings when struck

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BOREHOLE LOG

BOREHOLE NO: ***BH01***
SHEET: 1 OF 2

CLIENT:	***Entura***	DATE COMMENCED:	***26.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***26.5.2015***
LOCATION:	***Pyrenees Hwy - Eastbound Lane***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749109	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5895904	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests				Field Records / Comments	Water
											DCP	SV (kPa)	PP (kPa)	MC (%)		
SA			PAVEMENT			SPRAYED SEAL, 10mm	D-M									
						CRUSHED GRAVEL; Sandy GRAVEL with silt, mottled orange-brown/red-brown, fine to coarse grained, sub-angular to rounded; sand: fine to coarse grained										
		0.5														
		1.0										196				
			CASTLEMAINE GROUP FORMATION		CL	CLAY with sand, red-brown, low plasticity; sand: fine to medium grained	M	VSt-H								
		1.5										213				
		2.0										150				
		2.5										163				
					SM	Silty SAND, dark brown, fine to coarse grained; silt: low plasticity	D-M	L								
		3.0								SPT 3,3,6 N=9						
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

BOREHOLE LOG

BOREHOLE NO: ***BH01***
SHEET: 2 OF 2

CLIENT:	***Entura***	DATE COMMENCED:	***26.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***26.5.2015***
LOCATION:	***Pyrenees Hwy - Eastbound Lane***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749109	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5895904	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests				Field Records / Comments	Water
											DCP	SV (kPa)	PP (kPa)	MC (%)		
SA		4.0	CASTLEMAINE GROUP FORMATION	░	SM	Silty SAND, dark brown, fine to coarse grained; silt: low plasticity *(continued)*	D-M	L								
				▨	CH	CLAY with sand, grey, high plasticity; sand: fine to coarse grained	M	St								
		4.5		░	SM	Silty SAND, dark brown, fine to coarse grained; silt: low plasticity	M	MD		SPT 3,5,6 N=11						
		5.0 5.5		▨	CL-CI	CLAY, mottled orange-brown/grey, low to medium plasticity	M	St								
		6.0		░	SC	Clayey SAND with gravel, dark brown, fine to coarse grained; clay: low plasticity	M	MD		SPT 4,5,10 N=15						
				▨	CL-CI	CLAY, orange-brown mottled grey, low plasticity	M	St								
		6.5 7.0				**End of BH01 at 6.45m**										

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

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BOREHOLE LOG

BOREHOLE NO: ***BH02***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749150	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5895979	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
SA			PAVEMENT			SPRAYED SEAL, 25mm										
						Sandy GRAVEL, orange-brown, fine to coarse grained, sub-angular to sub-rounded; sand: fine to coarse grained	M								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION		SM	Clayey SAND, mottled orange-brown/red, fine to coarse grained; clay: low plasticity	D-M	D			17					
											20					
											10					
		0.5						MD			9	213				
											5					
											5					
								L			3					
											1					
		1.0				Gravel, fine to medium grained, minor coarse grained, sub-angular to angular					2	98				
											2					
											2					
											2					
											2					
		1.5			SC	CLAY with sand, grey-brown, low plasticity; sand: fine to coarse grained	D	L				114				
												111				
		2.0				**End of BH02 at 2.00m**										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

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BOREHOLE LOG

BOREHOLE NO: ***BH03***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749177	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896047	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained, sub-angular to rounded; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, mottled orange-brown/red, low plasticity; sand: fine to coarse grained	D-M	D								
											13					
		0.5									*14*					
											12					
											11					
											13					
											13					
		1.0						MD			*8*					
						Minor white mottling					*6*					
											7					
											8					
											7					
		1.5									*8*	*128*				
		2.0										*CNP*				
						End of BH03 at 2.00m										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

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BOREHOLE LOG

BOREHOLE NO: ***BH04***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749185	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896144	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained, sub-angular to rounded; sand: fine to coarse grained	D								River pebble aggregate. Water ponding in road formation drainage channels	
		0.5 1.0			ML	Sandy SILT, mottled red-brown/orange-brown, low plasticity; sand: fine to coarse grained	D	VSt			15 12 13 11 12 8 7					
		1.5 2.0 2.5 3.0	CASTLEMAINE GROUP FORMATION		GM	Sandy GRAVEL, mottled grey/orange-brown, fine to medium grained, sub-angular to rounded; sand: fine to coarse grained	D-M	MD			8 8 6 5 3	CNP				
		3.5				**End of BH04 at 3.00m**										

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

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BOREHOLE LOG

BOREHOLE NO: **BH05**
SHEET: 1 OF 2

CLIENT:	***Entura***	DATE COMMENCED:	***26.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***26.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749220	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896243	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
SA			CASTLEMAINE GROUP FORMATION	▨	CI	CLAY with sand, mottled red-brown/orange-brown, medium plasticity; sand: fine to medium grained	M	St-VSt								
											4					
											6					
											9					
								St			9					
		0.5									6					
											4					
											3					
											3					
											3					
		1.0									2	147				
											3					
											3					
											5					
											6					
		1.5									6	209				
		2.0		▨	CL	Sandy CLAY, mottled orange-brown/red-brown, low plasticity; sand: fine to coarse grained	M	St-VSt				147				
		2.5										140				
		3.0								SPT 3,3,6 N=9						
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

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BOREHOLE LOG

BOREHOLE NO: **BH05**
SHEET: 2 OF 2

CLIENT:	***Entura***	DATE COMMENCED:	***26.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***26.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749220	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896243	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests				Field Records / Comments	Water
											DCP	SV (kPa)	PP (kPa)	MC (%)		
SA			CASTLEMAINE GROUP FORMATION	▨	CL	Sandy CLAY, mottled orange-brown/red-brown, low plasticity; sand: fine to coarse grained *(continued)*	M	St-VSt								
				▨	CI	Grading to orange-brown mottled grey, medium plasticity	W	F								
		4.0		▨												
		4.5		▨						SPT 2,2,3 N=5						
		5.0		░	SM	Silty SAND, dark-brown, fine to coarse grained; silt: low plasticity	W	L								
		5.5		░												
				▨	CH	CLAY with sand, mottled orange-brown/grey, high plasticity; sand: fine to coarse grained	W	St								
		6.0		▨			M			SPT 3,7,6 N=13						
						End of BH05 at 6.40m										
		6.5														
		7.0														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

BOREHOLE LOG

BOREHOLE NO: ***BH06***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749228	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896351	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained, sub-angular to rounded; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, mottled orange-brown/red-brown, low plasticity; sand: fine to coarse grained	D	VSt-H								
											13					
											11					
											13					
		0.5									12	CNP				
											11					
						Gravel: fine to medium grained, sub-angular to rounded, siltstone	D				26					
											R					
		1.0										CNP				
				▨	CL	CLAY with sand, grey-brown, low plasticity; sand: fine to medium grained	M	VSt								
		1.5														
												128				
		2.0				**End of BH06 at 2.00m**										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

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BOREHOLE LOG

BOREHOLE NO: ***BH07***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749240	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896468	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	 SV (kPa)	 PP (kPa)	 MC (%)	Field Records / Comments	Water
SA		0.00	PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained; sand: fine to coarse grained	D								River pebble aggregate	
		0.05	CASTLEMAINE GROUP FORMATION		SM	Silty SAND, orange-brown/red-brown, fine to coarse grained; silt: low plasticity	D-M	MD								
		0.3									9					
		0.4									11					
		0.5									10					
		0.6									10					
		0.7									8					
		0.8			CI-CH	CLAY, grey-brown, medium to high plasticity	M	St			6					
		0.9									4					
		1.0									5	>213				
		1.1									4					
		1.2									4					
		1.3									5					
		1.4									7					
		1.5										>213				
		1.9										>213				
		2.0				**End of BH07 at 2.00m**										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

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BOREHOLE LOG

BOREHOLE NO: ***BH08***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749264	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896571	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained, sub-angular to rounded; sand: fine to coarse grained	D								River pebble aggregate	
		0.5	CASTLEMAINE GROUP FORMATION		SM	Silty SAND, orange-brown, fine to coarse grained; silt: low plasticity	D	D			9 12 11 15 20					
		1.0			ML	SILT, grey, low plasticity	D	VSt			13 13 17 16	CNP				
		1.5 2.0			CI	CLAY with sand, orange-brown, medium plasticity; sand; fine to coarse grained Grading to grey-brown	D-M	VSt			14 12 11	CNP >213				
		2.5 3.0 3.5				**End of BH08 at 2.00m**										

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

BOREHOLE LOG

BOREHOLE NO: ***BH09***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749283	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896681	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained; sand: fine to coarse grained	D									
SA			PAVEMENT		SM	Silty SAND with gravel, orange-brown, fine to coarse grained; silt: low plasticity; gravel: fine to medium grained, sub-angular to rounded, siltstone	D	MD			*8*					
SA		0.5 1.0 1.5 2.0	CASTLEMAINE GROUP FORMATION		CI	CLAY with sand, red-brown, minor white mottling, medium plasticity; sand: fine to coarse grained	D-M	VSt St			*7* *9* *9* *9* *12* *7* *4* *4* *3* *3* *4*	*>213* *>213* *128*				
		2.5 3.0 3.5				**End of BH09 at 2.00m**										

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

Tonkin & Taylor

BOREHOLE LOG

BOREHOLE NO: ***BH10***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749297	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896783	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests				Field Records / Comments	Water
											DCP	SV (kPa)	PP (kPa)	MC (%)		
SA			PAVEMENT	○		Sandy GRAVEL, orange-brown, fine to coarse grained; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION	▨	CL	CLAY with sand, grey, low plasticity; sand: fine to coarse grained	D	VSt								
											10					
						Grades to grey-brown, medium plasticity	M	St			*10*					
		0.5									*8*					
											6					
											6					
											5					
											5					
		1.0									*4*	*202*				
											6					
											4					
											3					
											3					
		1.5										*196*				
				▥	ML	Sandy SILT, mottled orange-brown/red-brown, low plasticity; sand: fine to coarse grained	M	St								
												114				
		2.0														
						End of BH10 at 2.00m										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

BOREHOLE LOG

BOREHOLE NO: ***BH11***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749317	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896890	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION		CI	CLAY with sand, grey-brown, medium plasticity; sand: fine to medium grained	D-M	VSt								
											12					
											9					
		0.5									10					
											7					
								St			6					
											6					
											7					
		1.0				Some cream-white mottling					6	203				
											4					
											4					
											5					
											8					
		1.5										193				
												196				
		2.0				**End of BH11 at 2.00m**										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

Tonkin & Taylor

BOREHOLE LOG

BOREHOLE NO: ***BH12***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749337	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5896992	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
SA			PAVEMENT	○		Sandy GRAVEL, orange-brown, fine to coarse grained; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION	▨	CL	CLAY with sand, grey-brown, medium plasticity; sand: fine to coarse grained	M	VSt								
											9					
		0.5									8					
											8					
											7					
								St			5					
											7					
		1.0									7					
											6	>213				
											5					
											6					
											6					
		1.5									5	>213				
		2.0										190				
						End of BH12 at 2.00m										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

BOREHOLE LOG

BOREHOLE NO: ***BH13***
SHEET: 1 OF 1

CLIENT: ***Entura***
PROJECT: ***Carisbrook Flood & Drainage Mitigation***
LOCATION: ***Pleasant Street***
JOB NUMBER: ***4548.000***

DATE COMMENCED: ***25.5.2015***
DATE COMPLETED: ***25.5.2015***
LOGGED BY: ***TSCC***
CHECKED BY: ***RWMC***

Drill Contractor: CGEO
Drill Model: Hanjib D&B
Bore Size: 100mm
Drill Fluid: N/A
Hole Angle: -90°
Bearing:
Easting: 749350
Northing: 5897090
Surface R.L.:
Offset:

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION		CL-CI	CLAY, grey mottled orange-brown, low to medium plasticity	M	VSt								
											9					
		0.5									7					
											6					
											7					
								St			5					
											6					
											4					
		1.0									5	183				
											5					
											4					
											4					
											5					
		1.5										>213				
												>213				
		2.0				**End of BH13 at 2.00m**										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

Tonkin & Taylor

BOREHOLE LOG

BOREHOLE NO: ***BH14***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***25.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***25.5.2015***
LOCATION:	***Pleasant Street***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749369	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5897201	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained, sub-angular to rounded; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION		CI	CLAY, red-brown, medium plasticity	M	St								
											8					
											6					
		0.5									6					
											13					
											5					
											5					
											5					
		1.0									4	>213				
											5					
						Some cream-white mottling					5					
											6					
								VSt			8					
		1.5										193				
						Low plasticity										
												164				
		2.0				**End of BH14 at 2.00m**										
		2.5														
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

Tonkin & Taylor

BOREHOLE LOG

BOREHOLE NO: **BH15**
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***26.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***26.5.2015***
LOCATION:	***Williams Road***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749268	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5894184	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	 SV (kPa)	 PP (kPa)	 MC (%)	Field Records / Comments	Water
SA			PAVEMENT	○		Sandy GRAVEL, orange-brown, fine to coarse grained; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION	▨	CL	CLAY with sand, mottled orange-brown/grey, low plasticity; sand: fine to coarse grained	D-M	VSt								
											12					
		0.5									*12*					
											13					
											10					
											10					
											9					
		1.0									*8*					
											9	*>213*				
											10					
								St			*6*					
											4					
											4					
		1.5										*213*				
		2.0										*170*				
												213				
		2.5				**End of BH15 at 2.50m**										
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

Tonkin & Taylor

BOREHOLE LOG

BOREHOLE NO: ***BH16***
SHEET: 1 OF 1

CLIENT: ***Entura***
PROJECT: ***Carisbrook Flood & Drainage Mitigation***
LOCATION: ***Williams Road***
JOB NUMBER: ***4548.000***

DATE COMMENCED: ***26.5.2015***
DATE COMPLETED: ***26.5.2015***
LOGGED BY: ***TSCC***
CHECKED BY: ***RWMC***

Drill Contractor: CGEO
Drill Model: Hanjib D&B
Bore Size: 100mm
Drill Fluid: N/A
Hole Angle: -90°
Bearing:
Easting: 749365
Northing: 5894166
Surface R.L.:
Offset:

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	SV (kPa)	PP (kPa)	MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL, orange-brown, fine to coarse grained, sub-angular to rounded; sand: fine to coarse grained	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION		CL-CI	CLAY with sand, mottled orange-brown/grey, low to medium plasticity; sand: fine to coarse grained	D-M	St			12					
		0.5									6					
											7					
											8					
											6					
											8					
		1.0									7	CNP				
								VSt			11					
											10					
											11					
											8					
		1.5										CNP				
		2.0				Some gravel: fine to medium grained, sub-angular to rounded, siltstone						CNP				
												172				
		2.5														
					SC	Clayey SAND, dark brown, fine to coarse grained; clay: low to medium plasticity	M	MD								
		3.0														
						End of BH16 at 3.00m										
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

Tonkin & Taylor

BOREHOLE LOG

BOREHOLE NO: ***BH17***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***26.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***26.5.2015***
LOCATION:	***Williams Road***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	749436	**Surface R.L.:**	
Drill Model:	Hanjib D&B	**Drill Fluid:**	N/A	**Bearing:**		**Northing:**	5894157	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
SA			PAVEMENT			Sandy GRAVEL with trace clay, orange-brown, fine to coarse grained, sub-angular to rounded; sand: fine to coarse grained; clay: low plasticity	D								River pebble aggregate	
			CASTLEMAINE GROUP FORMATION		CL-CI	CLAY with sand and gravel, red-brown mottled orange-brown, low to medium plasticity; sand: fine to coarse grained; gravel: fine to medium grained, sub-angular to rounded, siltstone	D-M	VSt								
		0.5									7					
											11					
											10					
											8					
		1.0						St			6					
											5	CNP				
											4					
											5					
											7					
		1.5				Low plasticity					7	CNP				
		2.0										CNP				
					SM	Silty SAND, dark-brown, fine to coarse grained; silt: low plasticity	M									
		2.5				**End of BH17 at 2.50m**										
		3.0														
		3.5														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

TEST PIT LOG

TESTPIT NO: **TP01**
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***28.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***28.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749059	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5894385	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe					ML	Sandy SILT, grey mottled orange-brown, low plasticity; sand: fine to coarse grained	D	St-VSt			4					
											7					
											8					
											13					
			CASTLEMAINE GROUP FORMATION		CL-CI	Sandy CLAY with gravel, mottled red-brown/orange-brown, low to medium plasticity; sand: fine to coarse grained; gravel: fine to coarse grained, sub-angular to sub-rounded, siltstone	D-M	VSt			14					
		0.5									13					
											15					
											14					
						Boulders and cobbles, sub-angular, siltstone					10				Easily crushed with back hoe. Gravel sized fragments broken by hand.	
											7					
		1.0									8	>213				
											7					
											7					
						Some pink/grey mottling					12					
											19					
		1.5									R	>213				
		2.0														
						End of TP01 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: **TP02**
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***28.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***28.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:** 2.5m	**Trench Bearing:**	**Easting:**	749073	**Surface R.L.:**	
Model:		**Trench Width:** 0.45m	Depth above/below existing pavement surface:	**Northing:**	5894467	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe			FILL	▩		FILL; Sandy GRAVEL with cobbles and clay, grey-white, fine to coarse grained, sub-angular to sub-rounded, pebbles; sand: fine to coarse grained; cobbles: sub-rounded, pebbles; clay: low plasticity	D								Driveway along fence line used as alternate path when main driveway is wet.	
		0.5	CASTLEMAINE GROUP FORMATION	▨	CL-CI	CLAY with sand, grey, low to medium plasticity; sand: fine to coarse grained	D	VSt			3 8 15 13					
		1.0		░	SC	Clayey SAND/Sandy CLAY with gravel, mottled red-brown/orange-brown, fine to coarse grained; clay: low to medium plasticity; gravel: fine to coarse grained, sub-angular to sub-rounded, siltstone, pebbles	D	D			12 17 12 12 12 10 11 9 8 10	CNP				
		1.5 2.0				Grading to orange-brown	M				10	>213 >213				
		2.5 3.0				**End of TP02 at 2.00m**										

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: *TP03*
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***28.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***28.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:** 2.5m	**Trench Bearing:**	**Easting:**	749090	**Surface R.L.:**	
Model:		**Trench Width:** 0.45m	Depth above/below existing pavement surface:	**Northing:**	5894572	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe		0.0–0.2	FILL			FILL; Sandy GRAVEL with cobbles and clay, grey-white, fine to coarse grained, sub-angular to sub-rounded, pebbles; sand: fine to coarse grained; cobbles: sub-rounded, pebbles; clay: low plasticity	D								Driveway along fence line used as alternate path when main driveway is wet.	
		0.2–0.3	CASTLEMAINE GROUP FORMATION		CI	CLAY with sand mottled grey/orange-brown/red-brown, medium plasticity; sand: fine to coarse grained	D	St			2					
		0.3–0.4									5					
		0.4–0.5									7					
		0.5–0.6									4					
		0.6–0.7					M				4					
		0.7–0.8									5					
		0.8–0.9									6					
		0.9–1.0						VSt			7					
		1.0–1.1									9	>213				
		1.1–1.2									9					
		1.2–1.3									9					
		1.3–1.4				Grading to orange-brown, fine to medium grained, sub-angular to rounded gravel	D-M				9					
		1.4–1.5									9					
		1.5–1.6									8	>213				
		1.6–1.7									9					
		1.9–2.0										>213				
		2.0–3.0				**End of TP03 at 2.00m**										

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: **TP04**
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***28.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***28.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749104	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	**Depth above/below existing pavement surface:**		**Northing:**	5894668	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, orange-brown, low plasticity; sand: fine to coarse grained	D	St			3 4 5 6					
		0.5 1.0 1.5 2.0			CL	CLAY with sand, grey mottled orange-brown, low plasticity; sand: fine to coarse grained Grading to orange-brown mottled grey, fine to medium grained, sub-angular to sub-rounded gravel	D	St-VSt			5 6 5 5 7 7 7 6 5 4 4	180 186 160				
		2.5 3.0				**End of TP04 at 2.00m**										

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: **TP05**

SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***Borrow pit***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749050	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5894794	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	 SV (kPa)	 PP (kPa)	 MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, grey, low plasticity; sand: fine to coarse grained	D-M	F-St			2					
											6					
											4					
					CH	CLAY with sand, mottled orange-brown/grey, high plasticity; sand: fine to coarse grained	M	St			3					
		0.5									3					
											3					
											4					
											3					
											3					
		1.0									6					
											6	>213				
						Grading to orange-brown					7					
											8					
											5					
		1.5									3					
											3	180				
		2.0										199				
							M-W								Trace water	
		2.5										203				
												209				
		3.0														

End of TP05 at 3.00m

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP06***

SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749145	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5894883	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests				Field Records / Comments	Water
											DCP	SV (kPa)	PP (kPa)	MC (%)		
Backhoe				▥	ML	Sandy SILT, grey-brown, low plasticity; sand: fine to coarse grained	D	St-VSt			2 12 12 10				Abundant trees in the vicinity with one 40m high tree next to pit location	
		0.5 1.0 1.5	CASTLEMAINE GROUP FORMATION	▨	CI	CLAY with sand, red-brown, medium plasticity; sand: fine to coarse grained	D-M	VSt			14 14 17 11 10 4 9 5 3 5 8	>213 CNP			Roots	
		2.0		⁘	SP-SW	Gravelly SAND with clay, red-brown, fine to coarse grained; gravel: fine to medium grained, sub-angular to rounded, pebbles; clay: low plasticity	M	D								
		2.5 3.0				**End of TP06 at 2.00m**										

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: *TP07*
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749158	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	**Depth above/below existing pavement surface:**		**Northing:**	5894987	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, grey-brown, low plasticity; sand: fine to coarse grained	D	St-VSt			*2* *9* *12* *12*					
		0.5 1.0			CI	CLAY with sand, orange-brown, medium plasticity; sand: fine to coarse grained Red-brown mottling	D	VSt			*20* *22* *R*	*CNP*				
		1.5			SC	Clayey SAND with gravel, red-brown, fine to coarse grained; clay: low plasticity; gravel: fine to coarse grained, sub-angular to sub-rounded	D-M	D								
		2.0			SP-SW	Gravelly SAND, red-brown, fine to coarse grained; gravel: fine to medium grained; sub-angular to sub-rounded, pebbles	M	D								
		2.5 3.0				**End of TP07 at 2.00m**										

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP08***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749177	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5895100	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CL-CI	CLAY with sand, grey, low to medium plasticity; sand: fine to coarse grained	D	St-VSt			2 4 7 8					
		0.5				Gravel: fine grained, sub-angular to sub-rounded					13 15 13 12 15 16					
		1.0									10 8 9	>213				
						Grading to red-brown	M	St			5 4					
		1.5										167				
		2.0										180				
						End of TP08 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

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Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP09***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749190	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5895208	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	 SV (kPa)	 PP (kPa)	 MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CL-CI	CLAY with sand, grey mottled orange-brown/red-brown, low to medium plasticity	D	St			4				Roots	
											5					
								VSt-H			8					
											10					
		0.5									15					
											16					
											18					
											16					
						Grading to orange-brown					17					
		1.0									23					
											R	>213				
		1.5										>213				
		2.0										>213				
						End of TP09 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: *TP10*
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749214	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5895316	**Offset:**	

												Tests					
Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	DCP	SV (kPa)	PP (kPa)	MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, grey-brown, low plasticity; sand: fine to coarse grained	D	St-VSt			*3*					
											5					
											6					
											9					
		0.5			CI	CLAY with sand, mottled orange-brown/red-brown, medium plasticity; sand: fine to coarse grained	D	VSt-H			*14*					
											14					
											20					
											15					
											16					
											17					
		1.0									*17*	*>213*				
								VSt			*12*					
											10					
											7					
											8					
		1.5										*>213*				
												>213				
		2.0				**End of TP10 at 2.00m**										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: *TP11*
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749231	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5895416	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	 SV (kPa)	 PP (kPa)	 MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CI-CH	CLAY with sand and gravel, grey mottled orange-brown, medium to high plasticity; sand: fine to coarse grained; gravel: fine to medium grained, sub-angular to rounded, river pebbles	D-M	St-VSt			2					
											4					
											6					
						Some red-brown and white mottling					11					
		0.5									19					
											14					
											13					
											13					
											11					
		1.0									10					
						Grading to orange-brown					8	213				
											10					
											13					
											17					
		1.5									19	>213				
		2.0										>213				
						End of TP11 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP12***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***Borrow pit***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749166	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	**Depth above/below existing pavement surface:**		**Northing:**	5895429	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▥	ML	Sandy SILT with gravel, grey-brown, low plasticity; sand: fine to coarse grained; gravel: fine to medium grained, sub-angular to sub-rounded	D	St			*4*				Farm dam approximately 10m away	
											6					
											5					
											6					
		0.5									*6*					
											7					
				▨	CI-CH	CLAY with sand, mottled red-brown/orange-brown, medium to high plasticity	M	VSt			*8*					
											10					
											7					
								St			*5*					
		1.0									*6*	*>213*				
											5					
											4					
											4					
		1.5				Grading to orange-brown mottled grey					*3*	*160*				
		2.0										*>213*				
		2.5										*>213*				
		3.0										*>213*				

End of TP12 at 3.00m

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: *TP13*
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749182	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5895502	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	SV (kPa)	PP (kPa)	MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CI-CH	CLAY with gravel, mottled orange-brown/grey, medium to high plasticity; gravel: fine to medium grained, minor coarse grained, sub-angular to sub-rounded, pebbles	D-M	St			3				Farm dam approximately 40m away	
											6					
											4					
											5					
		0.5									7					
								VSt			11					
											7					
											7					
											10					
		1.0									12					
											12	>213				
											11					
											8					
											8					
		1.5									10	>213				
						Grading to orange brown, low plasticity										
		2.0										>213				
						End of TP13 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP14***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749122	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5895584	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, grey mottled orange-brown, low plasticity; sand: fine to coarse grained	D	St-VSt			*5* *9* *10* *13*					
		0.5			CI-CH	CLAY with sand and minor gravel, mottled grey/orange-brown, medium to high plasticity; sand: fine to coarse grained; gravel: fine to coarse grained, sub-angular, siltstone, pebbles	D-M	H			*19* *21* *18* *22* *R*					
		1.0				Grading to orange-brown, minor grey mottling, low plasticity										
		1.5										*CNP*				
		2.0										*CNP*				
						End of TP14 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP15***
SHEET: 1 OF 1

CLIENT: ***Entura***
PROJECT: ***Carisbrook Flood & Drainage Mitigation***
LOCATION: ***As per site plan***
JOB NUMBER: ***4548.000***
DATE COMMENCED: ***27.5.2015***
DATE COMPLETED: ***27.5.2015***
LOGGED BY: ***TSCC***
CHECKED BY: ***RWMC***

Equipment: Shay Excavations
Model:
Trench Length: 2.5m
Trench Width: 0.45m
Trench Bearing:
Depth above/below existing pavement surface:
Easting: 749072
Northing: 5895671
Surface R.L.:
Offset:

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▥	ML	Sandy SILT, grey mottled orange-brown, low plasticity; sand: fine to coarse grained	D	St-VSt			3 5 8 10					
		0.5 1.0 1.5		▨	CI	CLAY with sand, red-brown, medium plasticity; sand: fine to coarse grained Grading to orange-brown, low plasticity	D-M	VSt			13 12 15 11 12 11 8 9 10 8 11					
		2.0		⁘	SC	Clayey SAND/Sandy CLAY with gravel, orange-brown, low plasticity; sand: fine to coarse grained; gravel: fine to medium grained, sub-angular to sub-rounded, siltstone	D	MD				>213 >213				
		2.5 3.0				**End of TP15 at 2.00m**										

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP16***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749086	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5895776	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, grey mottled orange-brown, low plasticity; sand: fine to coarse grained	D	St-VSt			4 6 10 13					
		0.5 1.0 1.5 2.0		▨	CI	CLAY with sand, red-brown, medium plasticity; sand: fine to coarse grained Grading to orange-brown, low plasticity	D	VSt			12 17 17 14 10 10 9 9 6 7 10	CNP CNP			Roots	
		2.5 3.0				**End of TP16 at 2.00m**										

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: *TP17*
SHEET: 1 OF 1

CLIENT: ***Entura***
PROJECT: ***Carisbrook Flood & Drainage Mitigation***
LOCATION: ***As per site plan***
JOB NUMBER: ***4548.000***
DATE COMMENCED: ***27.5.2015***
DATE COMPLETED: ***27.5.2015***
LOGGED BY: ***TSCC***
CHECKED BY: ***RWMC***

Equipment: Shay Excavations
Model:
Trench Length: 2.5m
Trench Width: 0.45m
Trench Bearing:
Depth above/below existing pavement surface:
Easting: 749103
Northing: 5895877
Surface R.L.:
Offset:

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests				Field Records / Comments	Water
											DCP	SV (kPa)	PP (kPa)	MC (%)		
Backhoe			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, grey, low plasticity; sand: fine to coarse grained	D-M	St			2					
											5					
											4					
					CL-CI	CLAY with sand, red-brown, low to medium plasticity; sand: fine to coarse grained	D-M	VSt			7					
		0.5									6					
											7					
								St			6					
						Grading to orange-brown, low plasticity					4					
											3					
		1.0									2					
											3					
											3					
											4					
											5					
		1.5									4					
											4	127				
		2.0										190				
						End of TP17 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: *TP18*
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***Borrow pit***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	748885	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	**Depth above/below existing pavement surface:**		**Northing:**	5897439	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CI-CH	CLAY with sand and gravel, orange-brown mottled grey, medium to high plasticity; sand: fine to coarse grained; gravel: fine grained, sub-angular	D	St-VSt			*5*					
											5					
											13					
											10					
		0.5									*8*					
											9					
								St			*5*					
											5					
											5					
		1.0						VSt			*8*					
											20	*CNP*				
											10					
						Grading to orange-brown, low plasticity					*8*					
											7					
		1.5									*13*	*CNP*				
				▨	CL	Gravelly CLAY, orange/brown, low plasticity, fine to coarse gravel, some cobbles: sub-angular, siltstone	D	H							Soft rock. Easily crushed by backhoe	
		2.0														
						Grading to mottled pink/orange-brown/white										
		2.5				Boulders, sub-angular, siltstone										
		3.0														

End of TP18 at 3.00m

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: **TP19**
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***27.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***27.5.2015***
LOCATION:	***Racecourse Drainage***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749045	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	**Depth above/below existing pavement surface:**		**Northing:**	5897301	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CI-CH	CLAY, dark brown, medium to high plasticity	D-M	St-VSt			4					
											5					
											7					
											8					
		0.5									8					
											8					
								St			5					
											4					
											3					
		1.0				Grading to orange-brown, low plasticity					3					
											2					
											3					
											3					
											4					
		1.5									3					
											5					
		2.0														
						End of TP19 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: *TP20*
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***28.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***28.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749578	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	**Depth above/below existing pavement surface:**		**Northing:**	5894138	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION		ML	Sandy SILT, grey-brown, low plasticity; sand: fine to coarse grained	D	VSt			4 8 8					
				▨	CI	CLAY with sand and gravel, red-brown mottled orange-brown, medium plasticity; sand: fine to coarse grained; gravel: fine to medium grained, siltstone	M	VSt			9 10 12 13 7 7 7 7	>213				
				▨				St			6					
				▨		Grading to mottled orange-brown/grey, low plasticity					6 6 6	>213 >213				
						End of TP20 at 2.00m										

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Library Template: TTAUS V1.1.GLB; Report Template: TTAUS LOG PHOTOS

File: T:\SOUTH MELBOURNE\PROJECTS\4548\WORKING MATERIAL\GINT\4548 LOGS.GPJ

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP21***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***28.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***28.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749692	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	**Depth above/below existing pavement surface:**		**Northing:**	5894114	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CI-CH	CLAY with sand, low plasticity; sand: fine to coarse grained	D	VSt			7 15 10 10					
		0.5				Grading to red-brown mottled orange-brown, medium to high plasticity; gravel: fine to medium grained, sub-angular, siltstone	M				10 13 13 13 12					
		1.0				Grading to orange-brown, low plasticity					11 10 10 9 10 7	196 202				
		1.5			SC	Clayey SAND, orange-brown, fine to coarse grained; clay: low plasticity	M	MD								
		2.0				**End of TP21 at 2.00m**										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP22***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***28.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***28.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	749807	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	Depth above/below existing pavement surface:		**Northing:**	5894089	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CL	CLAY with sand, grey, low plasticity; sand: fine to coarse grained	D	St			*3*				Two adjacent farm dams approximately 30m away from test pit location	
											3					
											4					
											4					
		0.5				Grading to mottled red-brown/orange-brown, medium to high plasticity	M				*5*					
											4					
											6					
											6					
											5					
		1.0									*4*					
											4	*213*				
											4					
											7					
											3					
		1.5				Grading to orange-brown mottled grey, low plasticity					*4*	*154*				
				⛆	SC	Clayey SAND, orange-brown mottled white, fine to coarse grained; clay: low plasticity	M	MD								
		2.0										*196*				
						End of TP22 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP23***
SHEET: 1 OF 1

CLIENT: ***Entura***
PROJECT: ***Carisbrook Flood & Drainage Mitigation***
LOCATION: ***As per site plan***
JOB NUMBER: ***4548.000***

DATE COMMENCED: ***28.5.2015***
DATE COMPLETED: ***28.5.2015***
LOGGED BY: ***TSCC***
CHECKED BY: ***RWMC***

Equipment: Shay Excavations
Model:
Trench Length: 2.5m
Trench Width: 0.45m
Trench Bearing:
Depth above/below existing pavement surface:
Easting: 749902
Northing: 5894078
Surface R.L.:
Offset:

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	SV (kPa)	PP (kPa)	MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CL	CLAY with sand, grey, low plasticity; sand: fine to coarse grained	D	VSt			5					
											9					
											9					
						Grading to red-brown, medium to high plasticity	M				9					
											8					
		0.5						St			6					
											6					
											3					
						Grading to orange-brown					4					
											6					
		1.0									6	>213				
											7					
											6					
											6					
											6					
		1.5										>213				
												>213				
		2.0				**End of TP23 at 2.00m**										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP24***
SHEET: 1 OF 1

CLIENT: ***Entura***
PROJECT: ***Carisbrook Flood & Drainage Mitigation***
LOCATION: ***As per site plan***
JOB NUMBER: ***4548.000***
DATE COMMENCED: ***28.5.2015***
DATE COMPLETED: ***28.5.2015***
LOGGED BY: ***TSCC***
CHECKED BY: ***RWMC***

Equipment: Shay Excavations
Model:
Trench Length: 2.5m
Trench Width: 0.45m
Trench Bearing:
Depth above/below existing pavement surface:
Easting: 750009
Northing: 5894064
Surface R.L.:
Offset:

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	 SV (kPa)	 PP (kPa)	 MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CL-CI	CLAY with sand, grey, low to medium plasticity; sand: fine to coarse grained	D	VSt			7					
											9					
											7					
						Grades to mottled red-brown/grey/orange-brown, medium to high plasticity	M				8					
		0.5									7					
											6					
											9					
											8					
						Grading to orange-brown, some gravel: fine to medium grained, sub-angular to rounded					12					
		1.0									11					
											13	>213				
											7					
											7					
											6					
		1.5				Some light grey and white mottling, low plasticity					7	>213				
		2.0										>213				
						End of TP24 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Tonkin & Taylor

TEST PIT LOG

TESTPIT NO: ***TP25***
SHEET: 1 OF 1

CLIENT:	***Entura***	DATE COMMENCED:	***28.5.2015***
PROJECT:	***Carisbrook Flood & Drainage Mitigation***	DATE COMPLETED:	***28.5.2015***
LOCATION:	***As per site plan***	LOGGED BY:	***TSCC***
JOB NUMBER:	***4548.000***	CHECKED BY:	***RWMC***

Equipment:	Shay Excavations	**Trench Length:**	2.5m	**Trench Bearing:**		**Easting:**	750130	**Surface R.L.:**	
Model:		**Trench Width:**	0.45m	**Depth above/below existing pavement surface:**		**Northing:**	5894042	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests DCP	Tests SV (kPa)	Tests PP (kPa)	Tests MC (%)	Field Records / Comments	Water
Backhoe			CASTLEMAINE GROUP FORMATION	▨	CL-CI	CLAY with sand, mottled red-brown/grey, low to medium plasticity; sand: fine to coarse grained	D	VSt			5				Approximately 100m away from Mccallum Creek	
											8					
											8					
											7					
		0.5						St			5					
						Grades to red-brown	M				4					
											2					
											3					
											3					
		1.0				Grading to mottled orange-brown/ red-brown, low plasticity					5					
											5	>213				
											5					
											5					
											6					
		1.5									7	>213				
		2.0										196				
						End of TP25 at 2.00m										
		2.5														
		3.0														

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Appendix C: Laboratory Test Results

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK
GEOTECHNICS

QUALITY OF MATERIALS REPORT

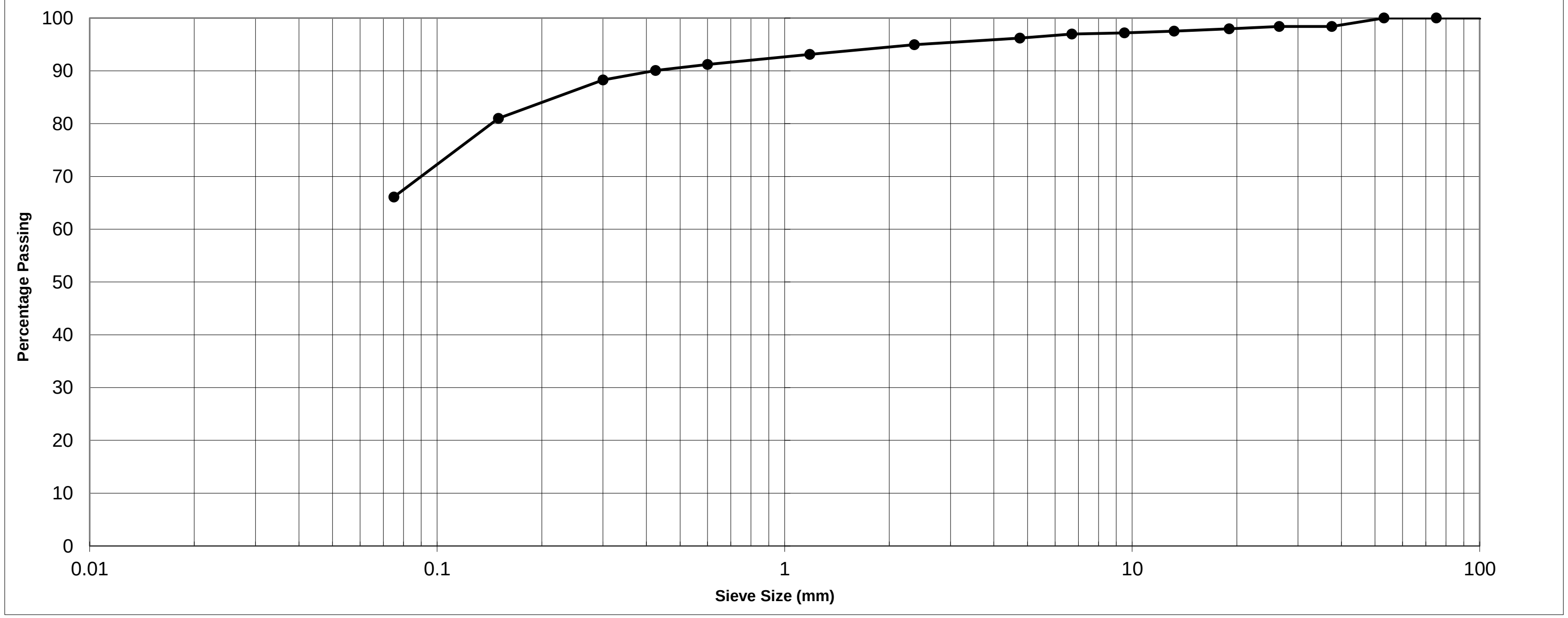
Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/05/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 1 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505754**
ID No.:	1
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	11/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	BH01 1.2-2.0m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	12.0
Liquid Limit (%) AS 1289.3.1.2	22
Plastic Limit (%) AS 1289.3.2.1	14
Plasticity Index AS 1289.3.3.1	8
Linear Shrinkage (%) AS 1289.3.4.1	4.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	720
L.S. x % Passing 0.425mm	360
Ratio of % Passing (0.075/0.425)	0.73

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	98	98	98	98	97	97	96	95	93	91	90	88	81	66

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CL
Grading Specification:

Remarks:

NATA
WORLD RECOGNISED ACCREDITATION

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

APPROVED SIGNATORY

J Lamont

NATA Accreditation No. 12719

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

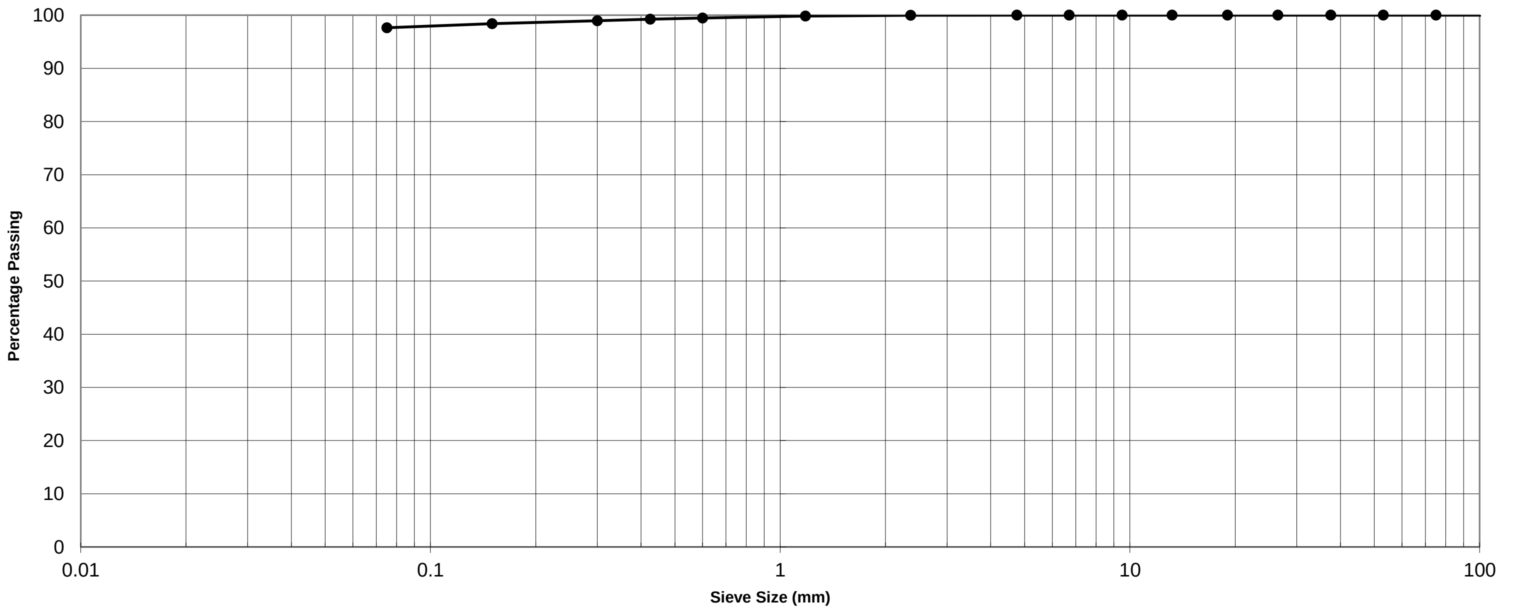
Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 2 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505757**
ID No.:	4
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	11/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	BH01 4.7-6.0m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	28.7
Liquid Limit (%) AS 1289.3.1.2	54
Plastic Limit (%) AS 1289.3.2.1	28
Plasticity Index AS 1289.3.3.1	26
Linear Shrinkage (%) AS 1289.3.4.1	7.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	2580
L.S. x % Passing 0.425mm	695
Ratio of % Passing (0.075/0.425)	0.98

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	100	99	99	99	98	98

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CH Grading Specification:

Remarks:

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CHADWICK
GEOTECHNICS

QUALITY OF MATERIALS REPORT

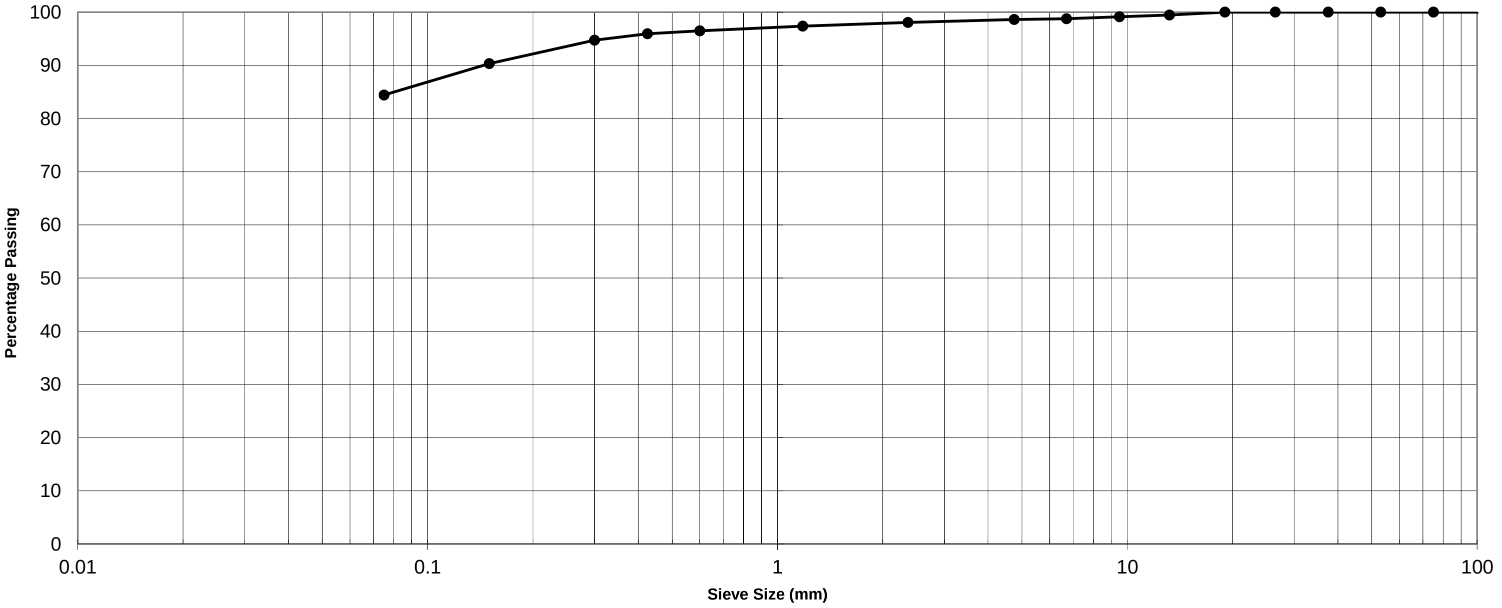
Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 3 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505761**
ID No.:	8
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	11/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	BH05 0.3-1.5m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	17.4
Liquid Limit (%) AS 1289.3.1.2	30
Plastic Limit (%) AS 1289.3.2.1	16
Plasticity Index AS 1289.3.3.1	14
Linear Shrinkage (%) AS 1289.3.4.1	6.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	1343
L.S. x % Passing 0.425mm	576
Ratio of % Passing (0.075/0.425)	0.88

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	99	99	99	99	98	97	96	96	95	90	84

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CL
Grading Specification:

Remarks:

NATA
WORLD RECOGNISED ACCREDITATION

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NATA Accreditation No. 12719

Form No: CG.329.002

Issue Date: 19/02/2013

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KEYSBOROUGH VIC 3173

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CHADWICK
GEOTECHNICS

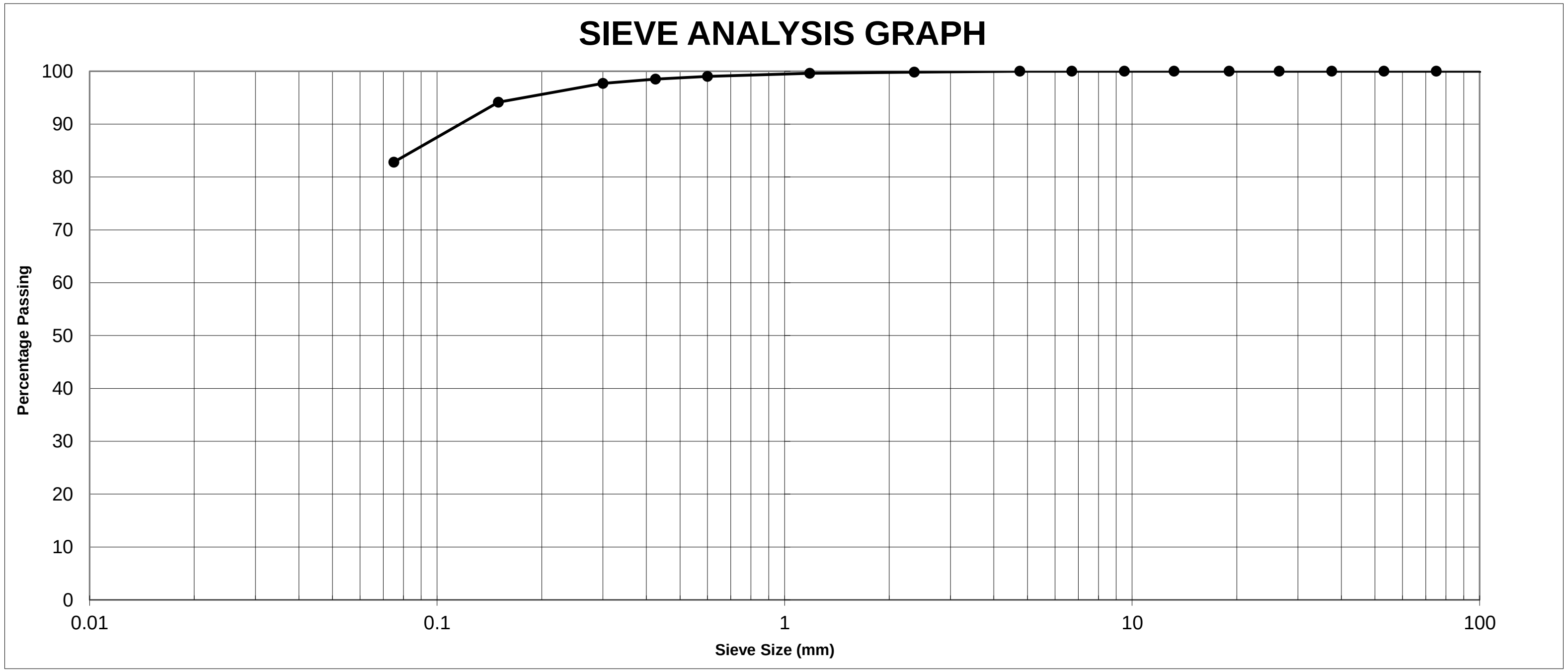
QUALITY OF MATERIALS REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 4 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505763**
ID No.:	10
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	11/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	BH05 3.6-4.5m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	24.3
Liquid Limit (%) AS 1289.3.1.2	26
Plastic Limit (%) AS 1289.3.2.1	17
Plasticity Index AS 1289.3.3.1	9
Linear Shrinkage (%) AS 1289.3.4.1	5.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	887
L.S. x % Passing 0.425mm	493
Ratio of % Passing (0.075/0.425)	0.84



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	100	99	99	98	94	83

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CL
Grading Specification:

Remarks:

NATA
WORLD RECOGNISED ACCREDITATION

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APPROVED SIGNATORY

J Lamont

NATA Accreditation No. 12719

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

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Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

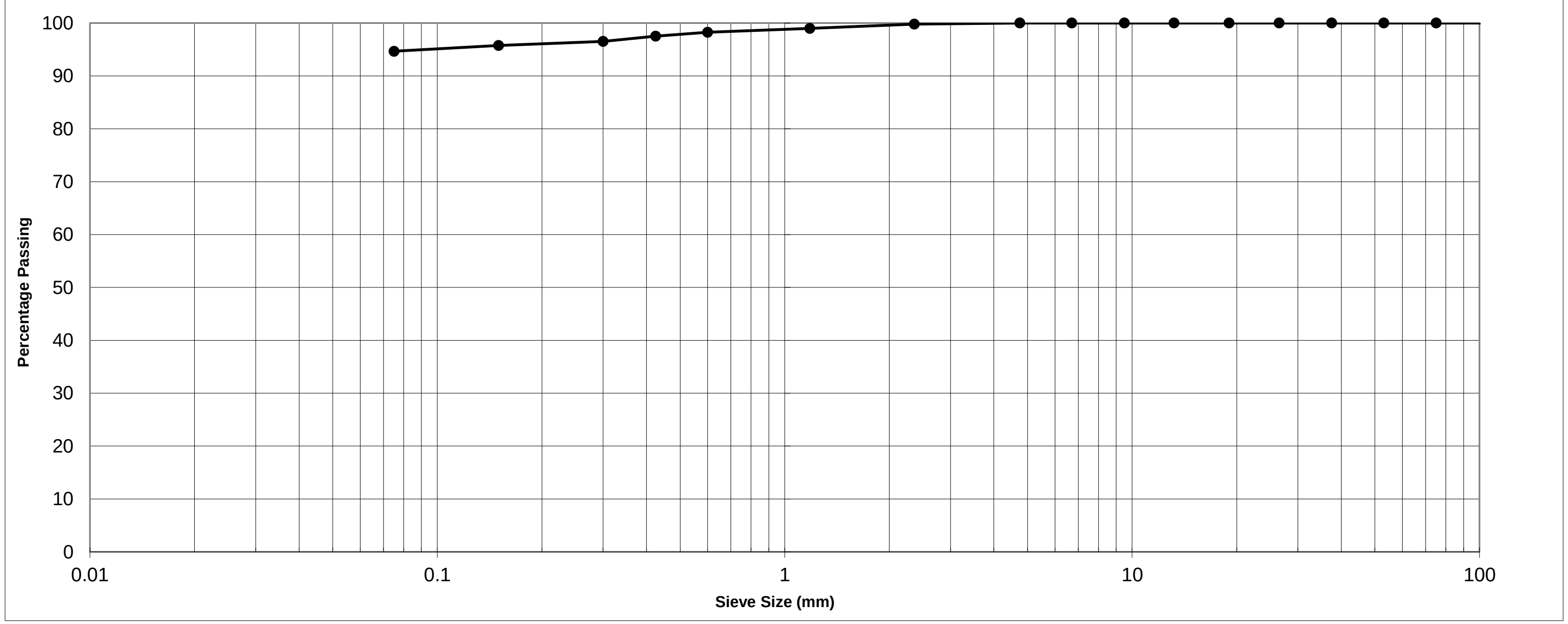
Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 5 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505771**
ID No.:	18
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	11/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	BH11 0.5-2.0m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	23.3
Liquid Limit (%) AS 1289.3.1.2	43
Plastic Limit (%) AS 1289.3.2.1	19
Plasticity Index AS 1289.3.3.1	24
Linear Shrinkage (%) AS 1289.3.4.1	9.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	2341
L.S. x % Passing 0.425mm	878
Ratio of % Passing (0.075/0.425)	0.97

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	99	98	98	97	96	95

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CI Grading Specification:

Remarks:

NATA WORLD RECOGNISED ACCREDITATION

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APPROVED SIGNATORY

J Lamont

NATA Accreditation No. 12719

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
32 Fiveways Boulevard
KEYSBOROUGH VIC 3173

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK
GEOTECHNICS

QUALITY OF MATERIALS REPORT

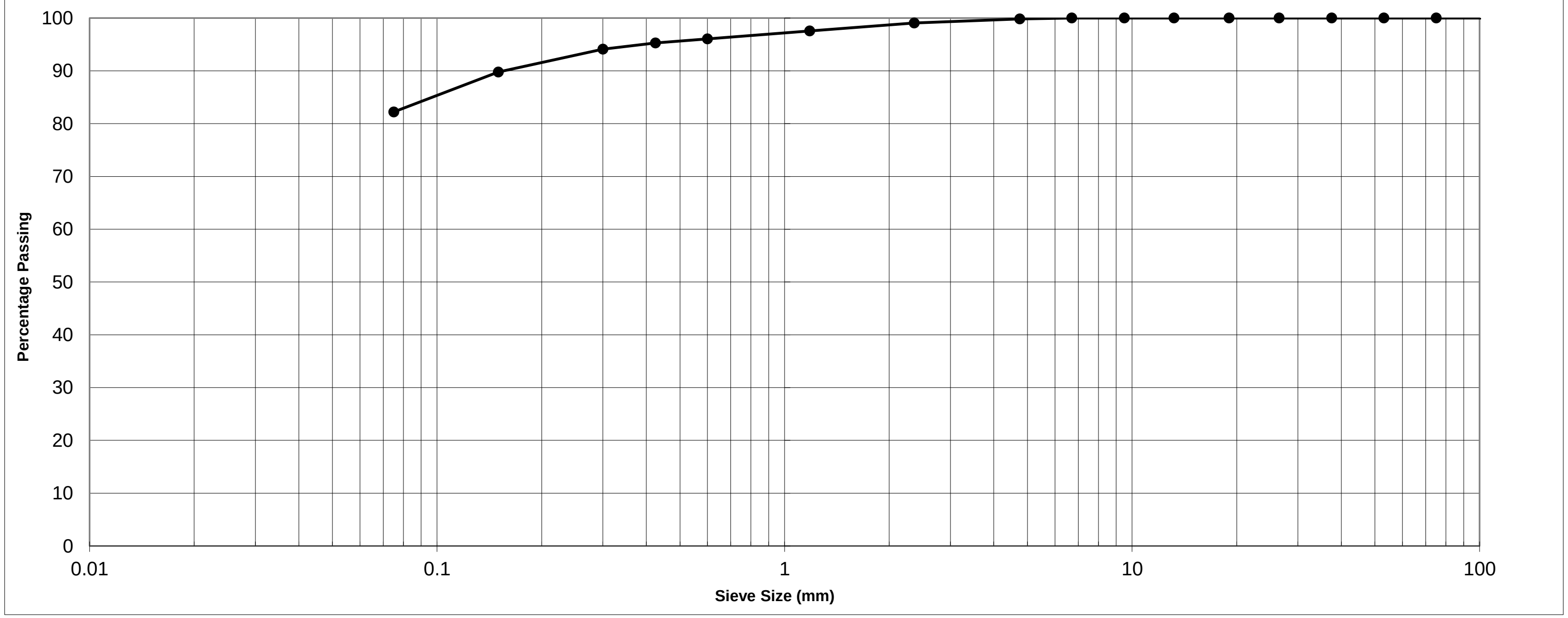
Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 6 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505773**
ID No.:	20
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	11/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	BH16 0.5-1.5m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	14.2
Liquid Limit (%) AS 1289.3.1.2	23
Plastic Limit (%) AS 1289.3.2.1	13
Plasticity Index AS 1289.3.3.1	10
Linear Shrinkage (%) AS 1289.3.4.1	5.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	953
L.S. x % Passing 0.425mm	476
Ratio of % Passing (0.075/0.425)	0.86

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
									100	100	99	98	96	95	94	90	82

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CL Grading Specification:

Remarks:

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CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

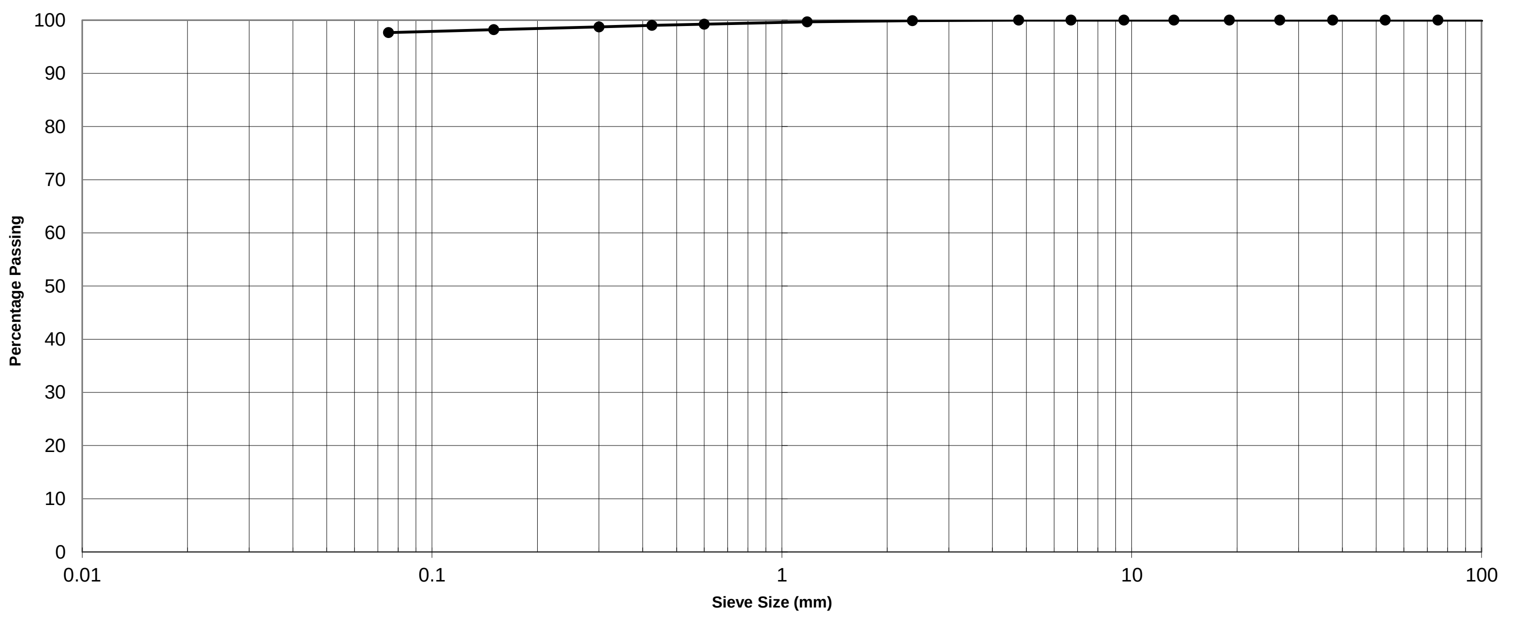
Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 7 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505776**
ID No.:	23
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	12/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP05 0.3-1.1m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	22.2
Liquid Limit (%) AS 1289.3.1.2	51
Plastic Limit (%) AS 1289.3.2.1	21
Plasticity Index AS 1289.3.3.1	30
Linear Shrinkage (%) AS 1289.3.4.1	9.5
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	2970
L.S. x % Passing 0.425mm	941
Ratio of % Passing (0.075/0.425)	0.99

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	100	99	99	99	98	98

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CH Grading Specification:

Remarks:

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CHADWICK
GEOTECHNICS

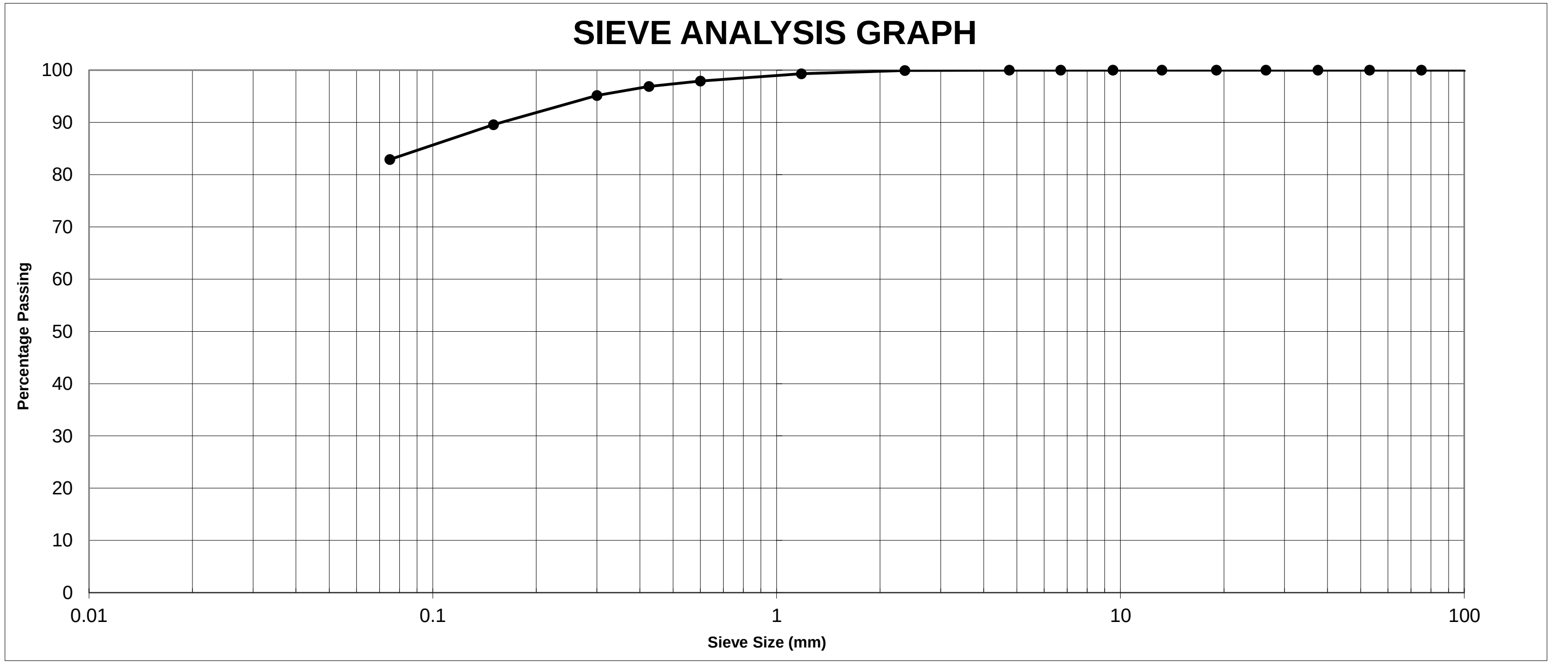
QUALITY OF MATERIALS REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 8 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505777**
ID No.:	24
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	12/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP05 2.2-3.0m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	25.8
Liquid Limit (%) AS 1289.3.1.2	27
Plastic Limit (%) AS 1289.3.2.1	16
Plasticity Index AS 1289.3.3.1	11
Linear Shrinkage (%) AS 1289.3.4.1	4.5
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	1066
L.S. x % Passing 0.425mm	436
Ratio of % Passing (0.075/0.425)	0.86



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	99	98	97	95	90	83

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CL
Grading Specification:

Remarks:

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CHADWICK
GEOTECHNICS

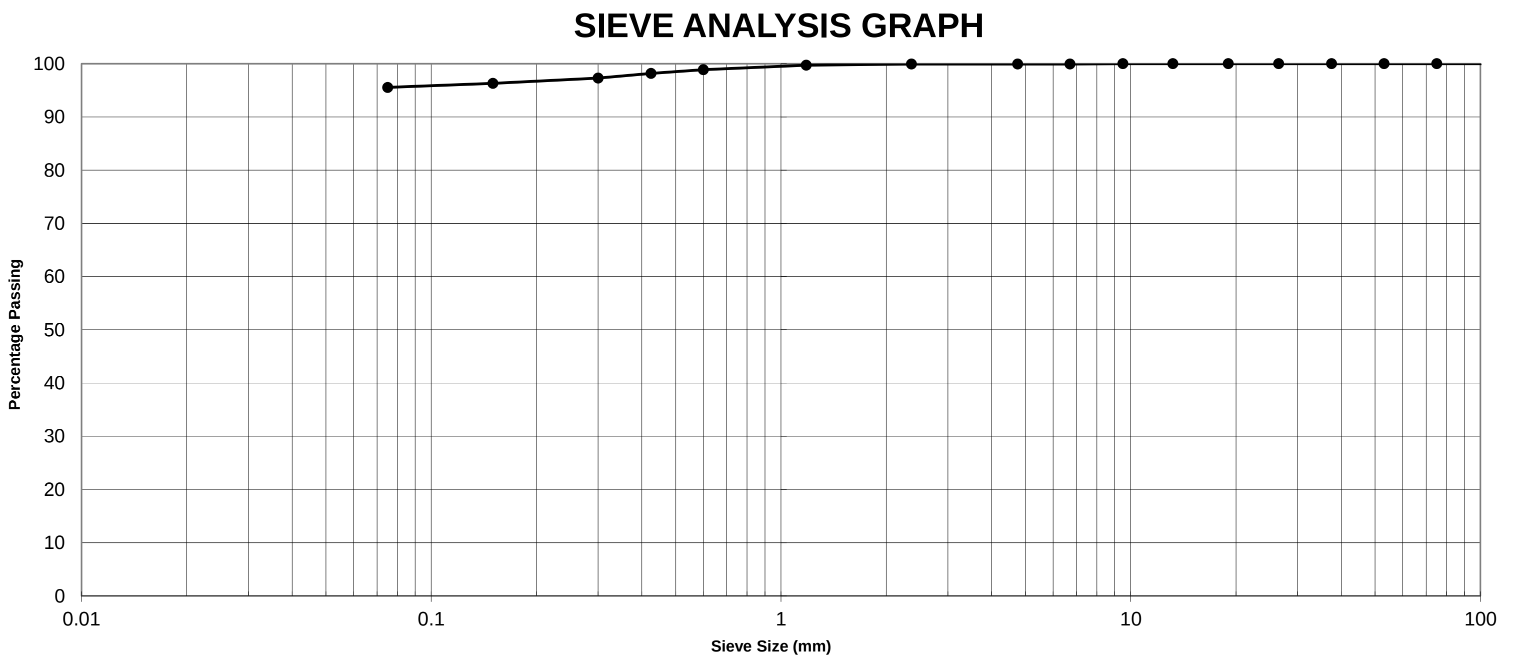
QUALITY OF MATERIALS REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** - 1
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 9 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505780**
ID No.:	27
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	12/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP12 0.6-1.4m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	21.1
Liquid Limit (%) AS 1289.3.1.2	45
Plastic Limit (%) AS 1289.3.2.1	20
Plasticity Index AS 1289.3.3.1	25
Linear Shrinkage (%) AS 1289.3.4.1	9.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	2454
L.S. x % Passing 0.425mm	883
Ratio of % Passing (0.075/0.425)	0.97



SIEVE ANALYSIS GRAPH

300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
								100	100	100	100	100	99	98	97	96	96

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC | CI | Grading Specification:

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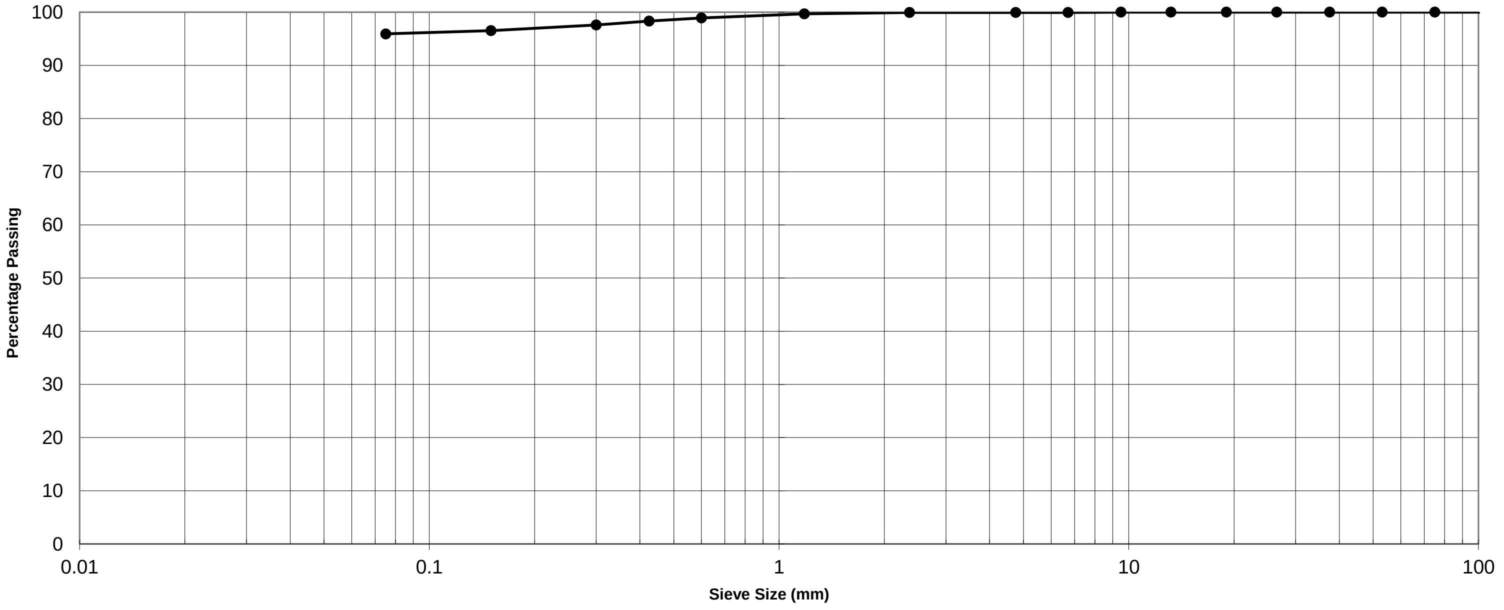
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 10 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505781**
ID No.:	28
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	13/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP12 2-3.0m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	26.0
Liquid Limit (%) AS 1289.3.1.2	41
Plastic Limit (%) AS 1289.3.2.1	21
Plasticity Index AS 1289.3.3.1	20
Linear Shrinkage (%) AS 1289.3.4.1	7.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	1967
L.S. x % Passing 0.425mm	688
Ratio of % Passing (0.075/0.425)	0.98

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
								100	100	100	100	100	99	98	98	97	96

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CI Grading Specification:

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CHADWICK
GEOTECHNICS

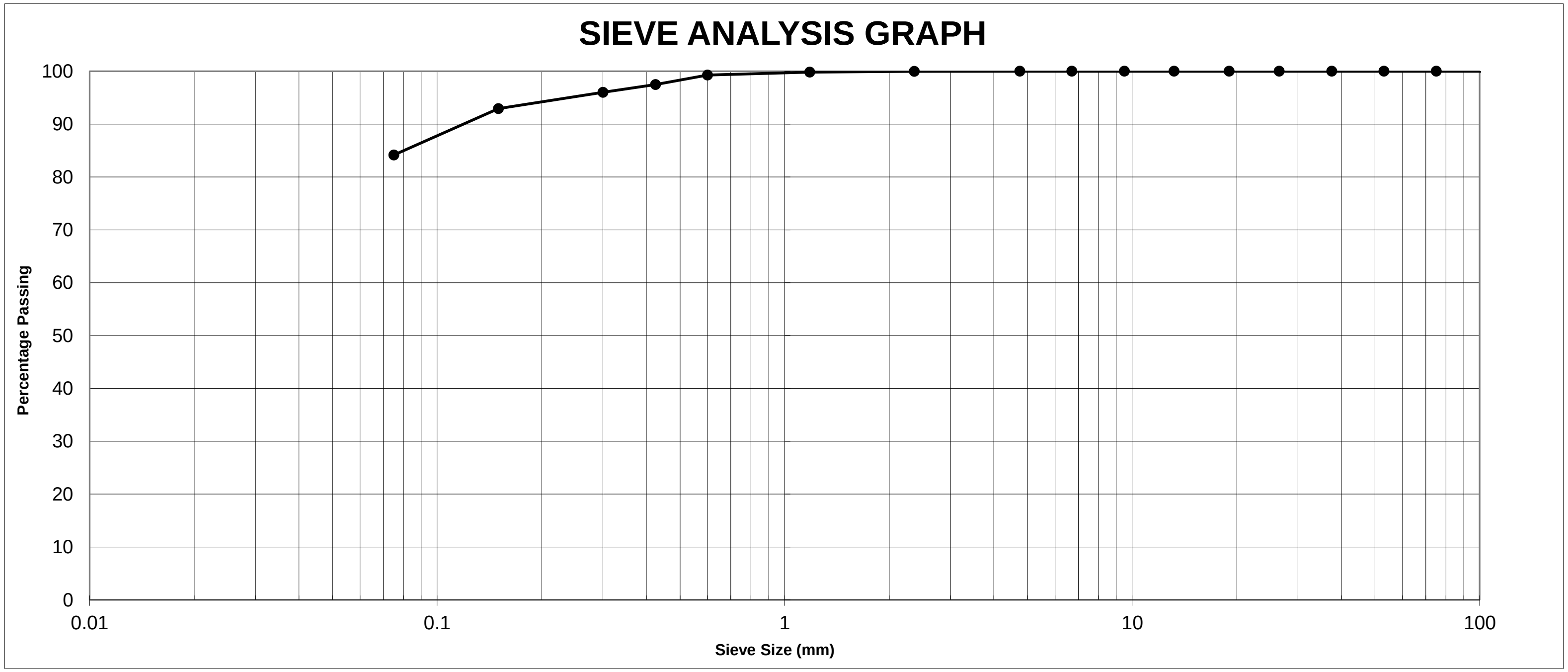
QUALITY OF MATERIALS REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 11 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505782**
ID No.:	29
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	12/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP16 0.4-1.1m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	10.7
Liquid Limit (%) AS 1289.3.1.2	36
Plastic Limit (%) AS 1289.3.2.1	15
Plasticity Index AS 1289.3.3.1	21
Linear Shrinkage (%) AS 1289.3.4.1	9.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	2047
L.S. x % Passing 0.425mm	877
Ratio of % Passing (0.075/0.425)	0.86



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	100	99	97	96	93	84

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CI Grading Specification:

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CHADWICK GEOTECHNICS

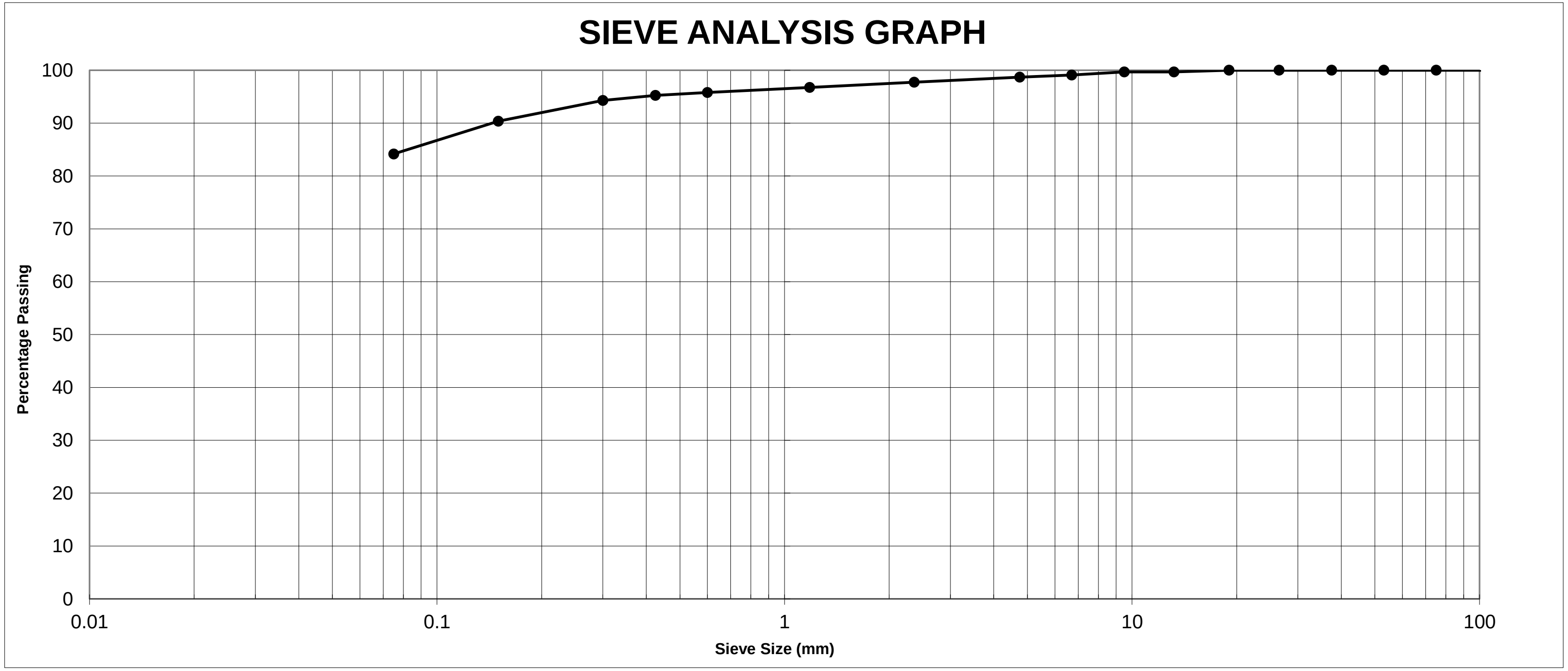
QUALITY OF MATERIALS REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 12 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505783**
ID No.:	30
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	12/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP18 0-1.5m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	19.1
Liquid Limit (%) AS 1289.3.1.2	44
Plastic Limit (%) AS 1289.3.2.1	18
Plasticity Index AS 1289.3.3.1	26
Linear Shrinkage (%) AS 1289.3.4.1	8.5
Cracking, Curling, Crumbling (1,2,3)	1, 2
P.I. x % Passing 0.425mm	2476
L.S. x % Passing 0.425mm	810
Ratio of % Passing (0.075/0.425)	0.88



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	100	100	99	99	98	97	96	95	94	90	84

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CI

Grading Specification:

Remarks:

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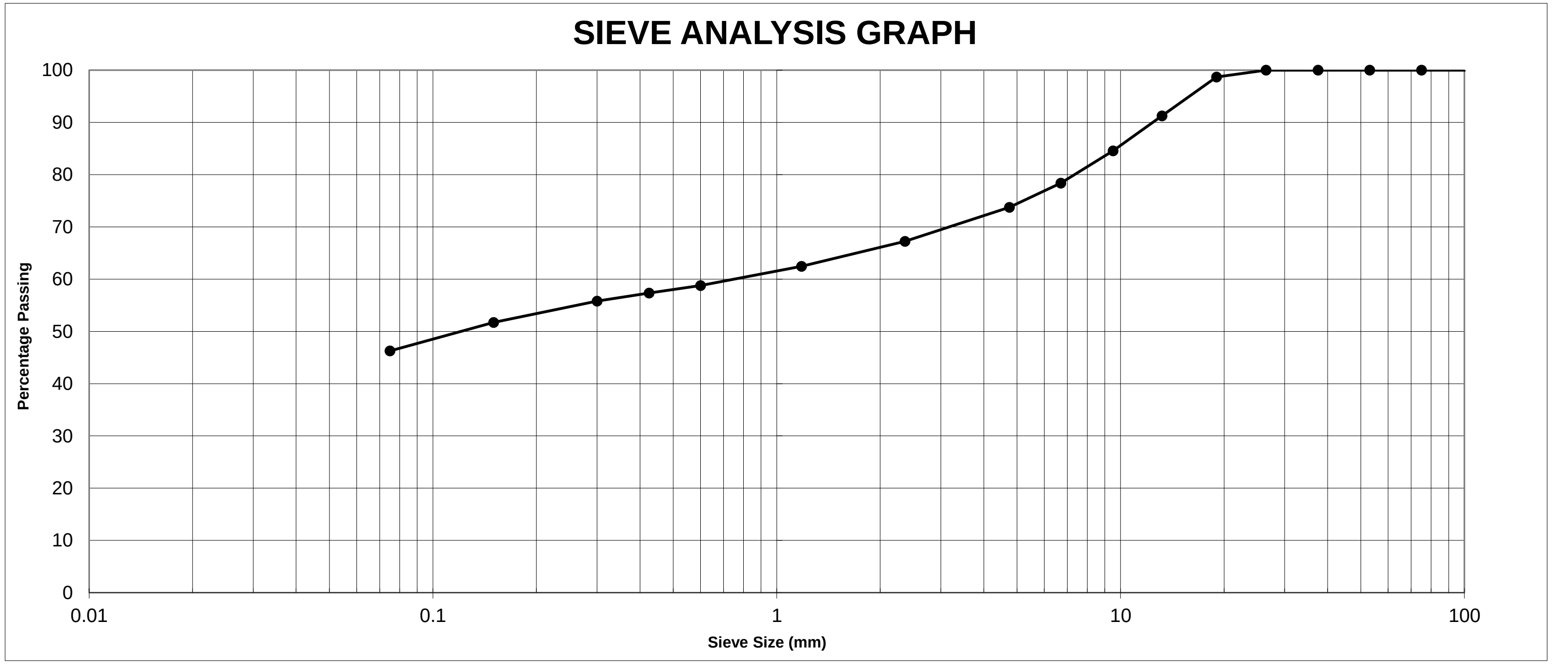
QUALITY OF MATERIALS REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 13 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505784**
ID No.:	31
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	12/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP18 1.5-2.2m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	12.8
Liquid Limit (%) AS 1289.3.1.2	28
Plastic Limit (%) AS 1289.3.2.1	22
Plasticity Index AS 1289.3.3.1	6
Linear Shrinkage (%) AS 1289.3.4.1	3.5
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	344
L.S. x % Passing 0.425mm	201
Ratio of % Passing (0.075/0.425)	0.81



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
					100	99	91	85	78	74	67	62	59	57	56	52	46

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC GM-GC Grading Specification:

Remarks:

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CHADWICK
GEOTECHNICS

QUALITY OF MATERIALS REPORT

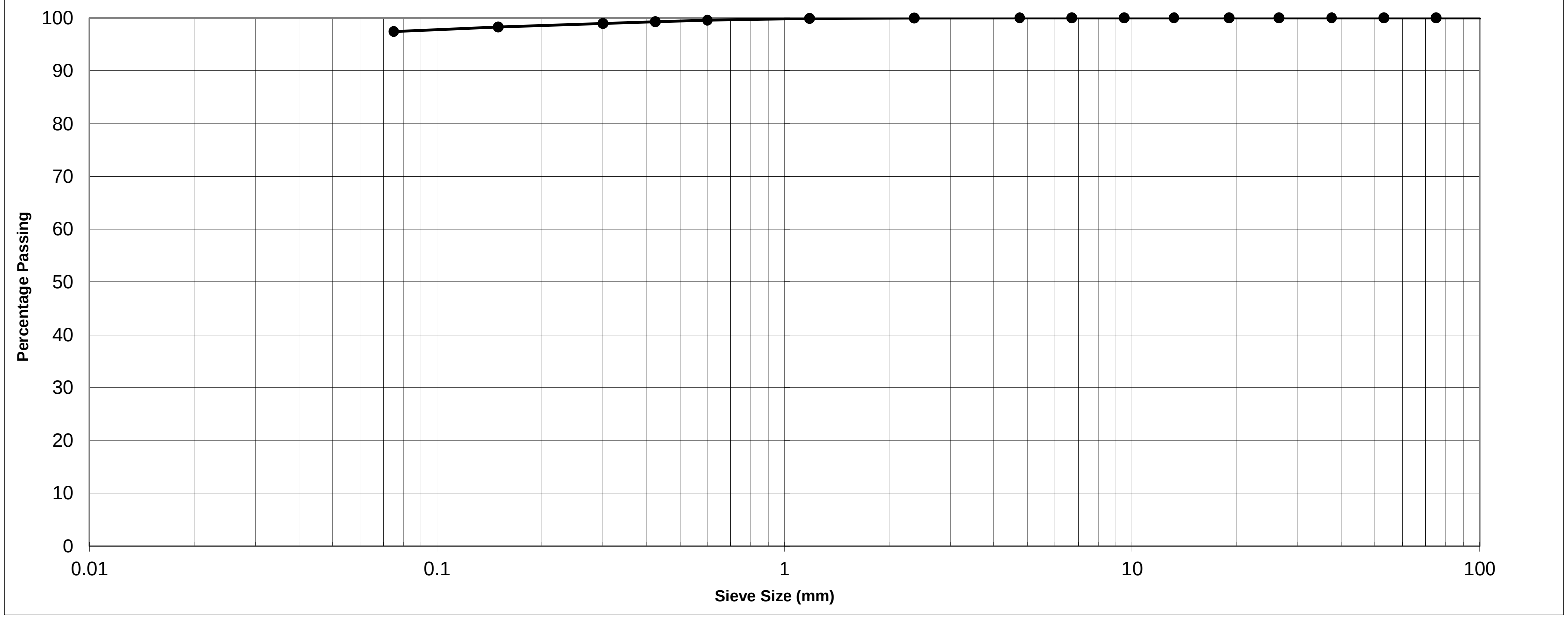
Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 14 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505785**
ID No.:	32
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	12/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP19 0-0.9m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	20.4
Liquid Limit (%) AS 1289.3.1.2	42
Plastic Limit (%) AS 1289.3.2.1	19
Plasticity Index AS 1289.3.3.1	23
Linear Shrinkage (%) AS 1289.3.4.1	12.0
Cracking, Curling, Crumbling (1,2,3)	1, 2
P.I. x % Passing 0.425mm	2283
L.S. x % Passing 0.425mm	1191
Ratio of % Passing (0.075/0.425)	0.98

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	100	100	99	99	98	97

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CI Grading Specification:

Remarks:

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KEYSBOROUGH VIC 3173

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CHADWICK
GEOTECHNICS

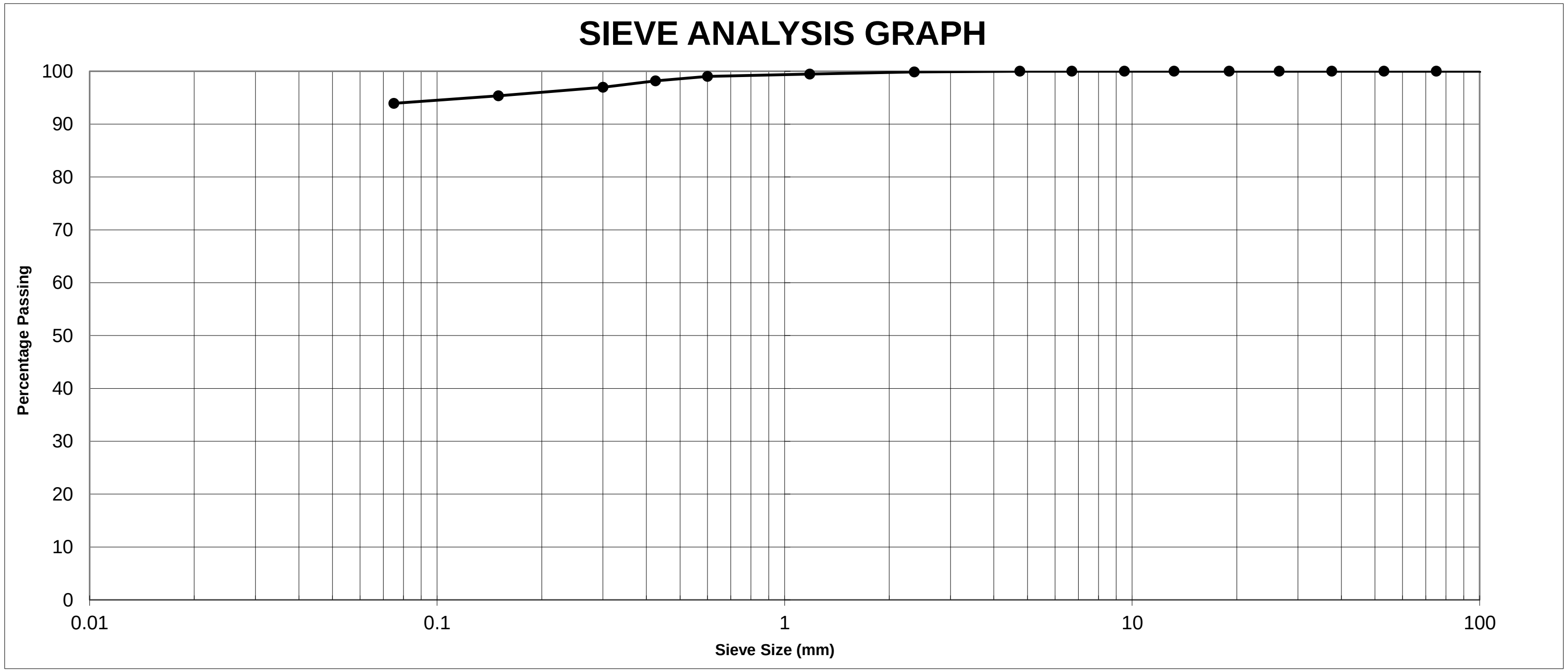
QUALITY OF MATERIALS REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 1**
Report Date: 16/06/15
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 15 of 15

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505787**
ID No.:	34
Lot No.:	-
Date Sampled:	27/05/2015
Time Sampled:	am/pm
Date Tested:	12/06/2015
Material Source:	Insitu
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP22 0.4-1.2m
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	AS1289.1.2.1.6.5.3
Moisture Content (%) AS 1289 2.1.1	20.7
Liquid Limit (%) AS 1289.3.1.2	42
Plastic Limit (%) AS 1289.3.2.1	19
Plasticity Index AS 1289.3.3.1	23
Linear Shrinkage (%) AS 1289.3.4.1	7.5
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	2258
L.S. x % Passing 0.425mm	736
Ratio of % Passing (0.075/0.425)	0.96



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
										100	100	99	99	98	97	95	94

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CI Grading Specification:

Remarks:

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APPROVED SIGNATORY

J Lamont

NATA Accreditation No. 12719

Form No: CG.329.002

Issue Date: 19/02/2013

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KEYSBOROUGH VIC 3173

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CHADWICK GEOTECHNICS

CALIFORNIA BEARING RATIO REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 2**
Report Date: 16/06/15
Request No: -
Test Method: AS 1289.6.1.1
Page: 1 of 1

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505783**	**1505785**			
ID No.:	30	32			
Lot No.:	-	-			
Date Sampled:	27/05/2015	27/05/2015			
Time Sampled:	am/pm	am/pm			
Date Tested:	15/06/15	15/06/15			
Material Source:	Insitu	Insitu			
Material Description:	Clay	Clay			
To Be Used As:	Material Analysis	Material Analysis			
Sample Location :	TP18 0-1.5m	TP19 0-0.9m			
Layer Depth (mm):	-	-			
Test Depth (mm):	-	-			
Sampling Procedure:	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3			
MDD (t/m3) AS1289.5.1.1 :	1.62	1.55			
OMC (%) AS1289.5.1.1 :	21.5	20.0			
Compactive Effort :	Standard	Standard			
Nominated % MDD Compaction :	98	98			
Nominated % OMC Compaction :	100	100			
Achieved Density Ratio (%) :	99	99			
Achieved Moisture Ratio (%) :	97	100			
Test Condition (Soaked/Unsoaked) :	Soaked	Soaked			
Test Condition Soaking Period (Days) :	4	4			
Swell (%)	1.5	2.0			
Surcharge (kg) :	4.5	4.5			
Achieved Dry Density before Soak (t/m^3) :	1.61	1.52			
Dry Density after Soak (t/m^3) :	1.60	1.50			
Density Ratio after Soak (%) :	99	97			
Moisture Content AS1289.2.1.1					
Initial Moisture Content (%):	18.8	19.4			
Achieved Moisture Content (%) :	21.1	19.8			
Moisture Content after Soak (%) :	24.0	25.5			
Moisture Content (Top) after Penetration (%) :	25.4	26.0			
% retained on 19mm:	0	0			
CBR Penetration (mm) :	5.0	2.5			
CBR Value (%) :	**4.5**	**2.5**			

Remarks: **All oversize was excluded**

If the specimen was soaked, then an additional 1kg surcharge weight was added at the penetration stage as per AS1289.6.1.1 8(a)

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Issue Date: 19/02/2013

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CHADWICK GEOTECHNICS

MOISTURE CONTENT REPORT

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978** **- 3**
Report Date: 17/06/15
Request No: -
Test Method: AS 1289 2.1.1
Page: 1 of 1

Testing performed and reported at our Keysborough Laboratory

Sample No.:	1505758	1505759	1505766	1505768						
ID No.:	5	6	13	15						
Lot No.:	-	-	-	-						
Date Sampled:	27/05/2015	27/05/2015	27/05/2015	27/05/2015						
Time Sampled:	am/pm	am/pm	am/pm	am/pm						
Date Tested:	9/06/2015	9/06/2015	9/06/2015	9/06/2015						
Material Source:	Insitu	Insitu	Insitu	Insitu						
Material Description:	Sand	Clay	Clay	Clay						
To Be Used As:	Material Analysis	Material Analysis	Material Analysis	Material Analysis						
Sample Location :	BH01 3.0-3.450m	BH01 4.7-4.9m	BH05 3-3.4m	BH05 6.1-6.4m						
Layer Depth (mm):	-	-	-	-						
Test Depth (mm):	-	-	-	-						
Sampling Procedure:	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3						
Moisture Content (%):	**8.6**	**26.8**	**14.5**	**23.2**						

Remarks:

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Form No.: **CG.319.001**
Issue Date: 19/02/2013

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CHADWICK
GEOTECHNICS

EMERSON CLASS NUMBER

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978 - 4**
Report Date: 17/06/15
Request No: -
Test Method: AS 1289.3.8.1
Page: 1 of 2

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505771**	**1505773**	**1505776**	**1505777**	**1505780**
ID No.:	18	20	23	24	27
Lot No.:	-	-	-	-	-
Date Sampled:	27/05/2015	27/05/2015	27/05/2015	27/05/2015	27/05/2015
Time Sampled:	am/pm	am/pm	am/pm	am/pm	am/pm
Date Tested:	10/06/2015	10/06/2015	12/06/2015	10/06/2015	10/06/2015
Material Source:	Insitu	Insitu	Insitu	Insitu	Insitu
Material Description:	Clay	Clay	Clay	Clay	Clay
To Be Used As	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis
Sample Location :	BH11 0.5-2.0m	BH16 0.5-1.5m	TP05 0.3-1.1m	TP05 2.2-3.0m	TP12 0.6-1.4m
Layer Depth (mm):	-	-	-	-	-
Test Depth (mm):	-	-	-	-	-
Sampling Procedure:	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3
Distilled Water:	✓	✓	✓	✓	✓
Reservoir Water:					
Water Temperature:	20 ° C	20 ° C	19 ° C	20 ° C	20 ° C
Air Dried Crumbs:					
Start Time:	8:35am	8:26am	10:20am	8:31am	8:32am
Time Dispersion Commences:	8:39am	N/A	10:28am	N/A	8:39am
Time Dispersion Completed:	1:00pm	N/A	12:00pm	N/A	12:30pm
Remoulded Material:					
Start Time:		9:20am		9:20am	
Time Dispersion Commences:		9:25am		9:25am	
Time Dispersion Completed:		1:00pm		1:00pm	
Immersion of Air Dried Crumbs:					
Slakes:	✓	✓	✓	✓	✓
Swell:					
Complete Dispersion:					
Partial Dispersion:	✓		✓		✓
Immersion of Remoulded Material:					
Disperses:		✓		✓	
Calcite or Gypsum:					
Present:					
Vigorous Shaking:					
Disperses:					
Flocculates:					
Emerson Class Number:	**2**	**3**	**2**	**3**	**2**

Remarks: **None**

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Form No.: **CG.313.001**
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CHADWICK
GEOTECHNICS

EMERSON CLASS NUMBER

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Carisbrook Flood and Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: **307978 - 4**
Report Date: 17/06/15
Request No: -
Test Method: AS 1289.3.8.1
Page: 2 of 2

Testing performed and reported at our Keysborough Laboratory

Sample No.:	**1505781**	**1505782**	**1505783**	**1505784**	**1505787**
ID No.:	28	29	30	31	34
Lot No.:	-	-	-	-	-
Date Sampled:	27/05/2015	27/05/2015	27/05/2015	27/05/2015	27/05/2015
Time Sampled:	am/pm	am/pm	am/pm	am/pm	am/pm
Date Tested:	10/06/2015	10/06/2015	10/06/2015	12/06/2015	10/06/2015
Material Source:	Insitu	Insitu	Insitu	Insitu	Insitu
Material Description:	Clay	Clay	Clay	Clay	Clay
To Be Used As	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis
Sample Location :	TP12 2-3.0m	TP16 0.4-1.1m	TP18 0-1.5m	TP18 1.5-2.2m	TP22 0.4-1.2m
Layer Depth (mm):	-	-	-	-	-
Test Depth (mm):	-	-	-	-	-
Sampling Procedure:	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3	AS1289.1.2.1.6.5.3
Distilled Water:	✓	✓	✓	✓	✓
Reservoir Water:					
Water Temperature:	19 º C	20 º C	20 º C	18 º C	20 º C
Air Dried Crumbs:					
Start Time:	8:27am	8:24am	8:25am	10:15am	8:30am
Time Dispersion Commences:	8:34am	N/A	8:30am	N/A	8:35am
Time Dispersion Completed:	1:00pm	N/A	1:00pm	n/A	1:00pm
Remoulded Material:					
Start Time:		9:20am		11:00am	
Time Dispersion Commences:		N/A		11:05am	
Time Dispersion Completed:		N/A		12:30pm	
Immersion of Air Dried Crumbs:					
Slakes:	✓	✓	✓	✓	✓
Swell:					
Complete Dispersion:					
Partial Dispersion:	✓		✓		✓
Immersion of Remoulded Material:					
Disperses:				✓	
Calcite or Gypsum:					
Present:					
Vigorous Shaking:					
Disperses:		✓			
Flocculates:					
Emerson Class Number:	**2**	**5**	**2**	**3**	**2**

Remarks: **None**

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CHADWICK
GEOTECHNICS

COEFFICIENT OF PERMEABILITY

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floo. 95 Coventry Street, Southbank, Vic 3205
Project: Carisbrook Flood & Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: 307978 - 5
Report Date: 22/06/2015
Request No: -
Test Method: AS1289.6.7.3
Page: 1 of 2

Testing performed and reported at our Keysborough Laboratory

Sample No.:	1505776	1505777	1505780
Date Tested:	9 - 11/06/2015	11 - 13/06/2015	11 - 13/06/2015
ID No:	23	24	27
Sample Description:	Clay	Clay	Clay
Sample Location	TP05 0.3 - 1.1m	TP05 2.2 - 3.0m	TP12 0.6 - 1.4m
Date Sampled:	27/05/15	27/05/2015	27/05/2015
Sampled By:	TSCC	TSCC	TSCC
Sampling Procedure:	AS1289 1.2.1.6.5.3	AS1289 1.2.1.6.5.3	AS1289 1.2.1.6.5.3
Sample Type:	remoulded	remoulded	remoulded
Compaction details			
Maximum Dry Density - MDD (t/m^3) **AS1289 5.1.1**	1.55	1.56	1.64
Optimum Moisture Content - OMC (%) **AS1289.5.1.1** :	25.5	22.5	22
Compactive Effort **AS1289.5.1.1** :	standard	standard	standard
Oversize material retained on 19.0mm sieve (%):	0	0	0
Moulding details			
No of layers	3	3	3
Length of specimen	63.7	63.2	63.8
Diameter of specimen	64.1	64.4	64.3
Length to diameter ratio	~1 : 1	~1 : 1	~1 : 1
Nominated % Maximum Dry Density Compaction :	98	98	98
Nominated % Moisture Content Compaction :	100	100	100
Initial Dry Density (t/m^3) :	1.54	1.53	1.58
Achieved Percentage of Density Ratio (%) :	99.0	98.0	96.5
Initial Moisture Content (%) :	22.1	27.3	20.7
Moulded Moisture Content (%) :	24.2	22.8	22.4
Achieved Percentage of Moisture Ratio (%) :	95.0	100.5	102.5
Specimen details after test			
Moisture content (%)	29.1	26.9	28.9
Mean effective stress (kPa)	100	50	50
Permeant used	De-aired Water	De-aired Water	De-aired Water
Permeability (k) m/sec	**1×10^{-10}**	**4×10^{-10}**	**4×10^{-10}**

Remarks:

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A Catton

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Form No.: CG.325.002

Issue Date: 19/02/2013

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CHADWICK
GEOTECHNICS

COEFFICIENT OF PERMEABILITY

Customer: Tonkin & Taylor Pty Ltd
Customer Address: Ground Floo. 95 Coventry Street, Southbank, Vic 3205
Project: Carisbrook Flood & Drain Mitigation
Location: Carisbrook
Customer Order No.: 4548

Report Number: 307978 - 5
Report Date: 22/06/2015
Request No: -
Test Method: AS1289.6.7.3
Page: 2 of 2

Testing performed and reported at our Keysborough Laboratory

Sample No.:	1505781	1505783	1505784
Date Tested:	15 - 17/06/2015	16 - 18/06/2015	18 - 20/06/2015
ID No:	28	30	31
Sample Description:	Clay	Clay	Clay
Sample Location	TP12 2.0 - 3.0m	TP18 0 - 1.5m	TP18 1.5 - 2.2m
Date Sampled:	27/05/15	27/05/2015	27/05/2015
Sampled By:	TSCC	TSCC	TSCC
Sampling Procedure:	AS1289 1.2.1.6.5.3	AS1289 1.2.1.6.5.3	AS1289 1.2.1.6.5.3
Sample Type:	remoulded	remoulded	remoulded
Compaction details			
Maximum Dry Density - MDD (t/m^3) **AS1289 5.1.1**	1.54	1.62	1.85
Optimum Moisture Content - OMC (%) **AS1289.5.1.1** :	27.0	21.5	15.5
Compactive Effort **AS1289.5.1.1** :	standard	standard	standard
Oversize material retained on 19.0mm sieve (%):	0	0	1
Moulding details			
No of layers	3	3	3
Length of specimen	63.8	63.6	63.8
Diameter of specimen	64.2	64.1	64.5
Length to diameter ratio	~1 : 1	~1 : 1	~1 : 1
Nominated % Maximum Dry Density Compaction :	98	98	98
Nominated % Moisture Content Compaction :	100	100	100
Initial Dry Density (t/m^3) :	1.52	1.6	1.77
Achieved Percentage of Density Ratio (%) :	98.5	98.5	96
Initial Moisture Content (%) :	26.0	18.9	13.5
Moulded Moisture Content (%) :	25.3	20.8	16.0
Achieved Percentage of Moisture Ratio (%) :	94.5	96.0	102.0
Specimen details after test			
Moisture content (%)	30.0	28.4	25.1
Mean effective stress (kPa)	50	75	40
Permeant used	De-aired Water	De-aired Water	De-aired Water
Permeability (k) m/sec	**1×10^{-9}**	**3×10^{-10}**	**6×10^{-9}**

Remarks:

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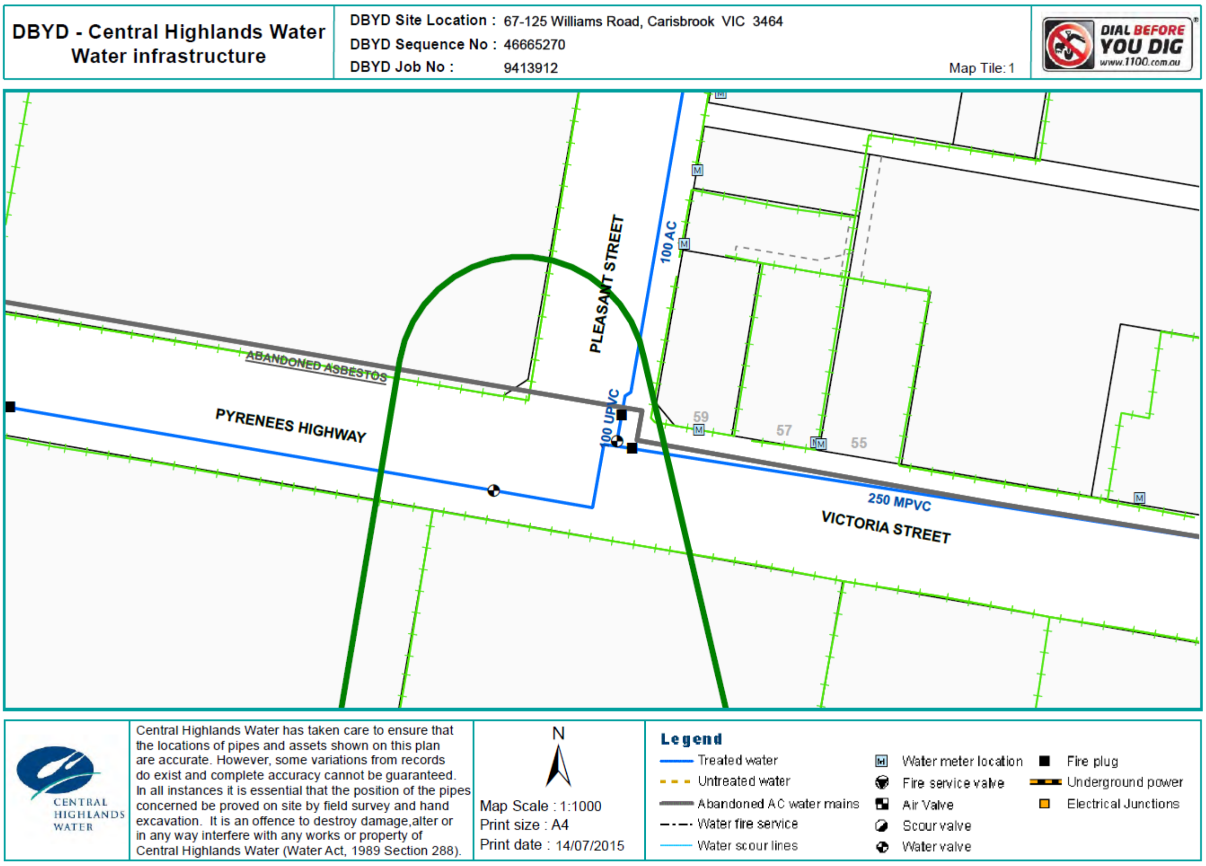
Issue Date: 19/02/2013

D Affected Services

D.1 Water and sewerage pipes (Central Highlands Water)



DBYD - Central Highlands Water
Water infrastructure

DBYD Site Location : 67-125 Williams Road, Carisbrook VIC 3464
DBYD Sequence No : 46665270
DBYD Job No : 9413912
Map Tile: 1

Central Highlands Water has taken care to ensure that the locations of pipes and assets shown on this plan are accurate. However, some variations from records do exist and complete accuracy cannot be guaranteed. In all instances it is essential that the position of the pipes concerned be proved on site by field survey and hand excavation. It is an offence to destroy damage,alter or in any way interfere with any works or property of Central Highlands Water (Water Act, 1989 Section 288).

Map Scale : 1:1000
Print size : A4
Print date : 14/07/2015

Legend

Treated water	Water meter location	Fire plug
Untreated water	Fire service valve	Underground power
Abandoned AC water mains	Air Valve	Electrical Junctions
Water fire service	Scour valve	
Water scour lines	Water valve	

DBYD - Central Highlands Water
Water infrastructure

DBYD Site Location : 4 Pleasant Street, Carisbrook VIC 3464
DBYD Sequence No : 46665444
DBYD Job No : 9413943
Map Tile: 8

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CENTRAL HIGHLANDS WATER

Central Highlands Water has taken care to ensure that the locations of pipes and assets shown on this plan are accurate. However, some variations from records do exist and complete accuracy cannot be guaranteed. In all instances it is essential that the position of the pipes concerned be proved on site by field survey and hand excavation. It is an offence to destroy damage,alter or in any way interfere with any works or property of Central Highlands Water (Water Act, 1989 Section 288).

N

Map Scale : 1:1000
Print size : A4
Print date : 14/07/2015

Legend
- Treated water
- Untreated water
- Abandoned AC water mains
- Water fire service
- Water scour lines
- Water meter location
- Fire service valve
- Air Valve
- Scour valve
- Water valve
- Fire plug
- Underground power
- Electrical Junctions

DBYD - Central Highlands Water
Water infrastructure

DBYD Site Location : 4 Pleasant Street, Carisbrook VIC 3464
DBYD Sequence No : 46665444
DBYD Job No : 9413943
Map Tile: 7

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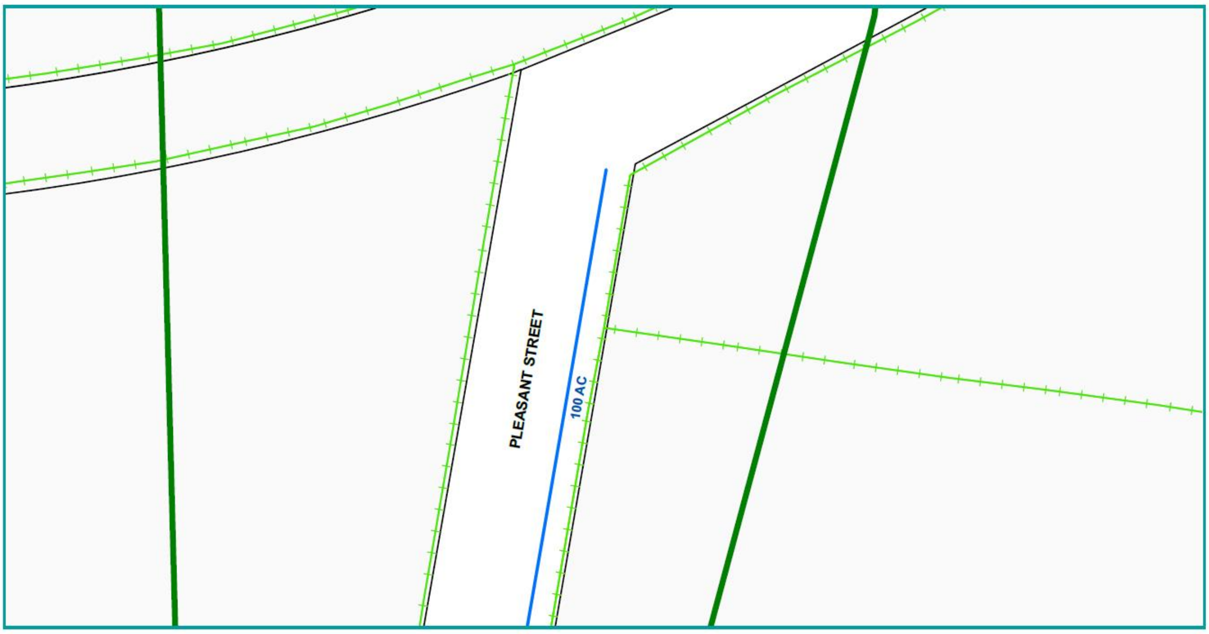


CENTRAL HIGHLANDS WATER

Central Highlands Water has taken care to ensure that the locations of pipes and assets shown on this plan are accurate. However, some variations from records do exist and complete accuracy cannot be guaranteed. In all instances it is essential that the position of the pipes concerned be proved on site by field survey and hand excavation. It is an offence to destroy damage,alter or in any way interfere with any works or property of Central Highlands Water (Water Act, 1989 Section 288).

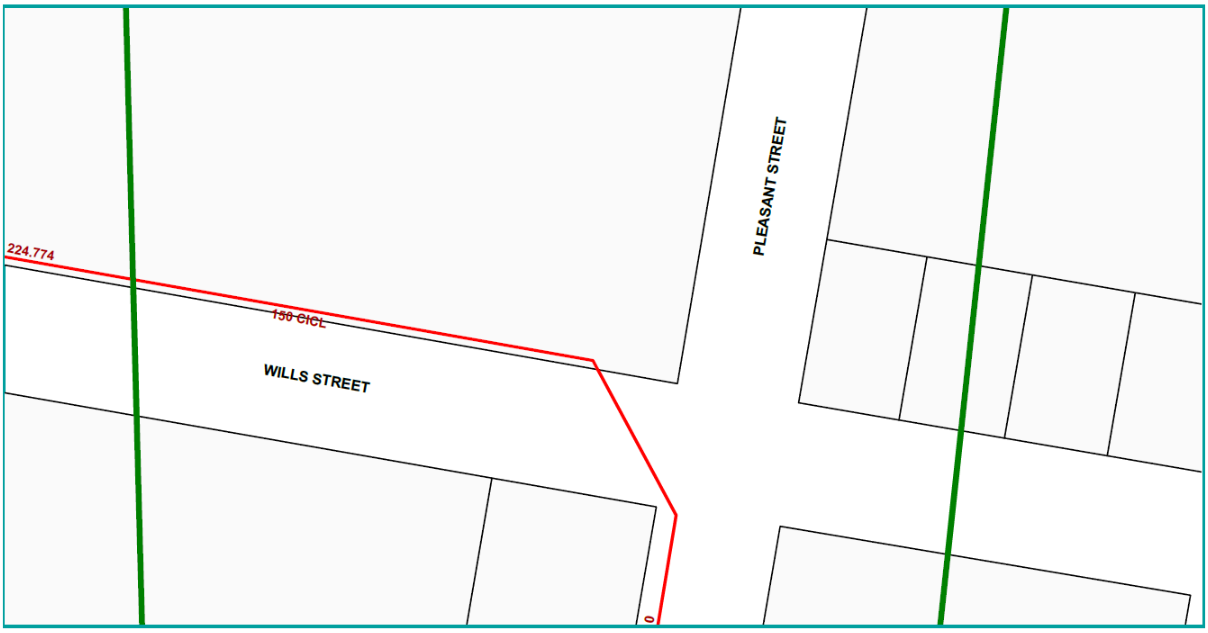
N

Map Scale : 1:1000
Print size : A4
Print date : 14/07/2015

Legend
- Treated water
- Untreated water
- Abandoned AC water mains
- Water fire service
- Water scour lines
- Water meter location
- Fire service valve
- Air Valve
- Scour valve
- Water valve
- Fire plug
- Underground power
- Electrical Junctions

DBYD - Central Highlands Water
Sewerage infrastructure

DBYD Site Location : 4 Pleasant Street, Carisbrook VIC 3464
DBYD Sequence No : 46665444
DBYD Job No : 9413943
Map Tile: 5



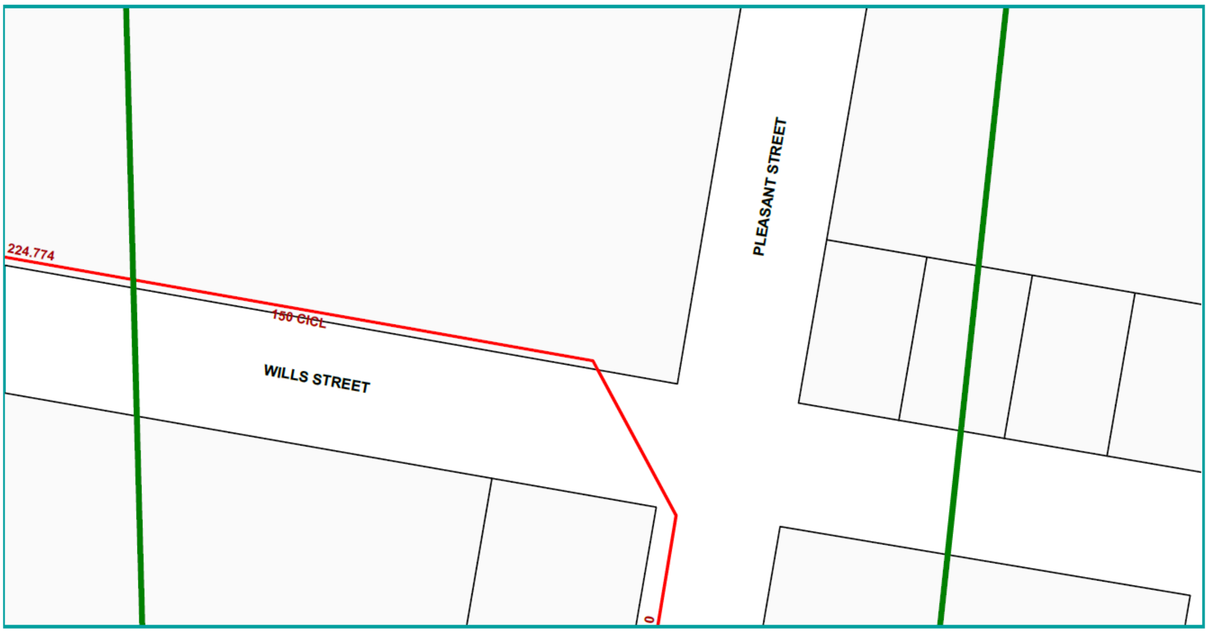
Central Highlands Water has taken care to ensure that the locations of pipes and assets shown on this plan are accurate. However, some variations from records do exist and complete accuracy cannot be guaranteed. In all instances it is essential that the position of the pipes concerned be proved on site by field survey and hand excavation. It is an offence to destroy damage,alter or in any way interfere with any works or property of Central Highlands Water (Water Act, 1989 Section 288).

N
Map Scale : 1:1000
Print size : A4
Print date : 14/07/2015

Legend
→ Sewerage mains
— Sewerage sideline
- - - Sewerage scour line
PS Sewerage pump
⊗ Sewerage valve
⊗ Sewerage scour valve
● Sewerage manholes
• Sewerage connection point
▬ Underground Power
□ Electrical junctions

DBYD - Central Highlands Water
Sewerage infrastructure

DBYD Site Location : 4 Pleasant Street, Carisbrook VIC 3464
DBYD Sequence No : 46665444
DBYD Job No : 9413943
Map Tile: 5

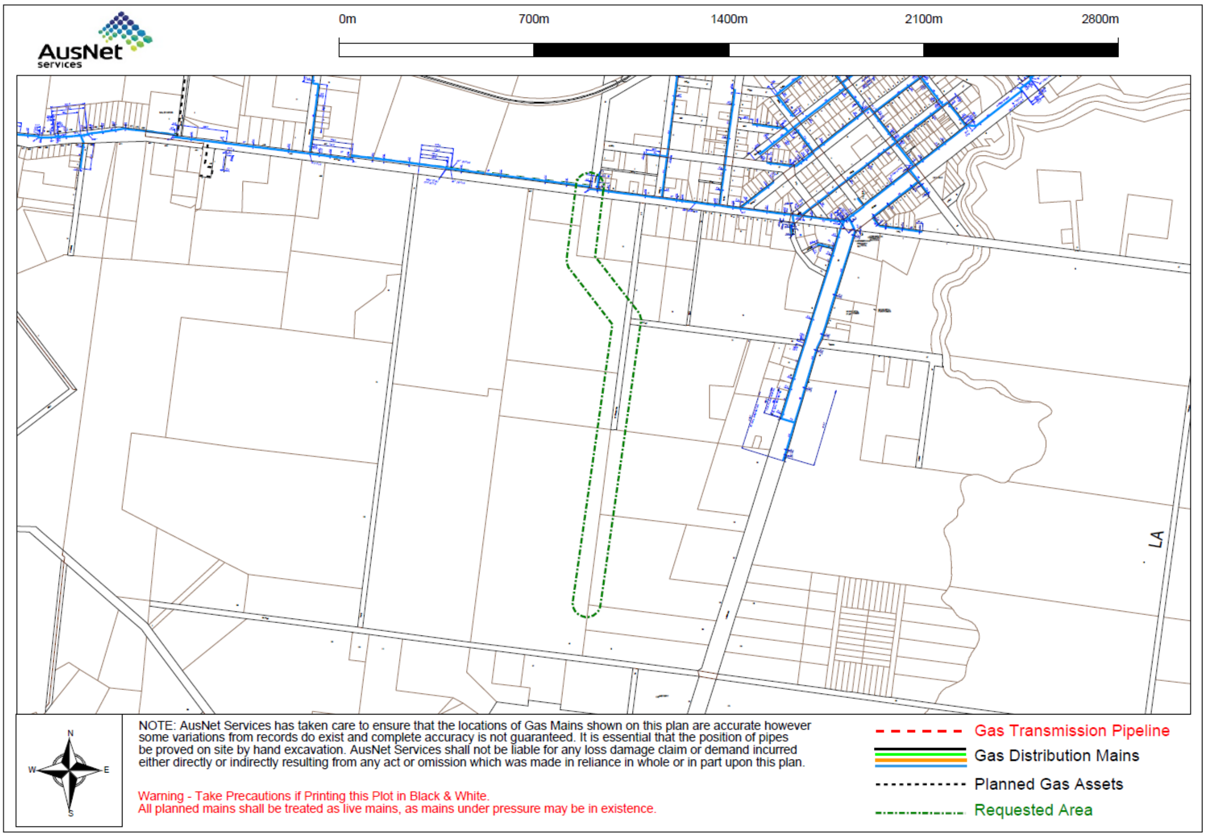


Central Highlands Water has taken care to ensure that the locations of pipes and assets shown on this plan are accurate. However, some variations from records do exist and complete accuracy cannot be guaranteed. In all instances it is essential that the position of the pipes concerned be proved on site by field survey and hand excavation. It is an offence to destroy damage,alter or in any way interfere with any works or property of Central Highlands Water (Water Act, 1989 Section 288).

N
Map Scale : 1:1000
Print size : A4
Print date : 14/07/2015

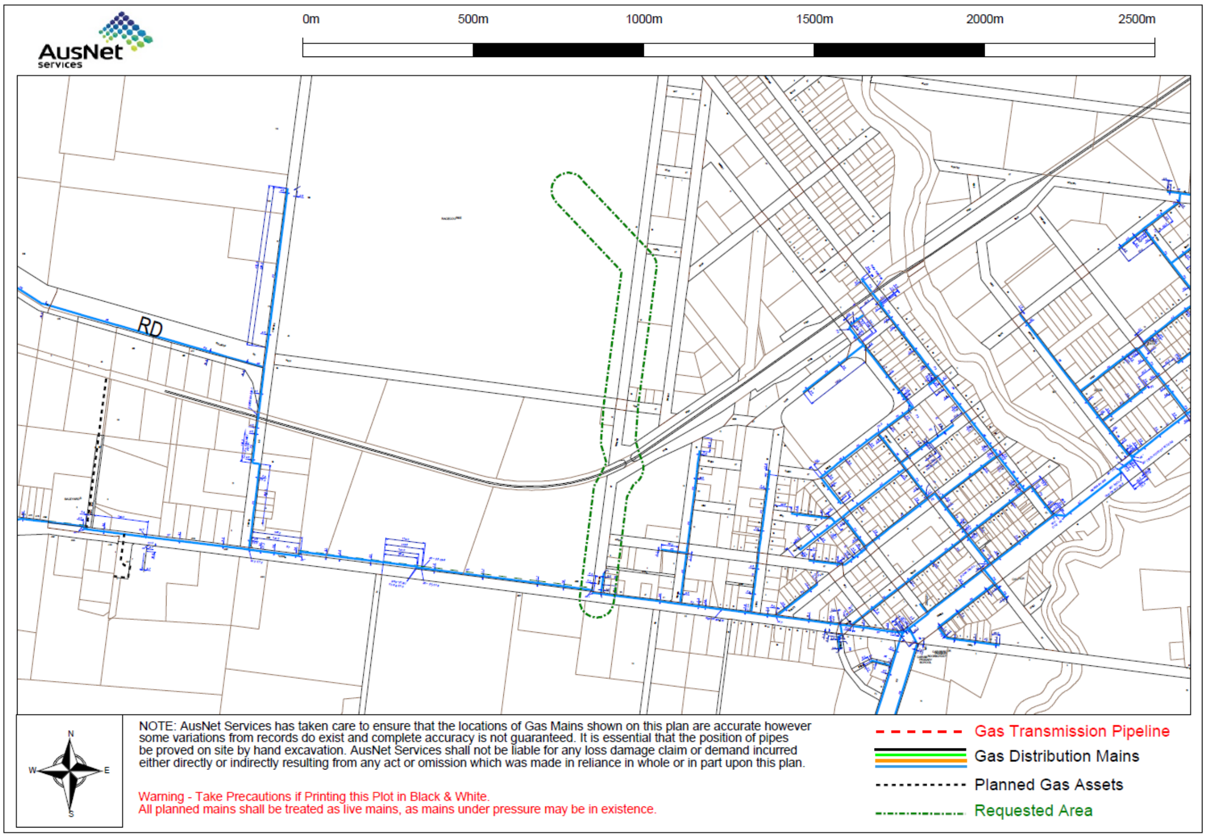
Legend
→ Sewerage mains
— Sewerage sideline
- - - Sewerage scour line
PS Sewerage pump
⊗ Sewerage valve
⊗ Sewerage scour valve
● Sewerage manholes
• Sewerage connection point
▬ Underground Power
□ Electrical junctions

D.2 Gas pipes (Ausnet Services)



NOTE: AusNet Services has taken care to ensure that the locations of Gas Mains shown on this plan are accurate however some variations from records do exist and complete accuracy is not guaranteed. It is essential that the position of pipes be proved on site by hand excavation. AusNet Services shall not be liable for any loss damage claim or demand incurred either directly or indirectly resulting from any act or omission which was made in reliance in whole or in part upon this plan.

Warning - Take Precautions if Printing this Plot in Black & White.
All planned mains shall be treated as live mains, as mains under pressure may be in existence.

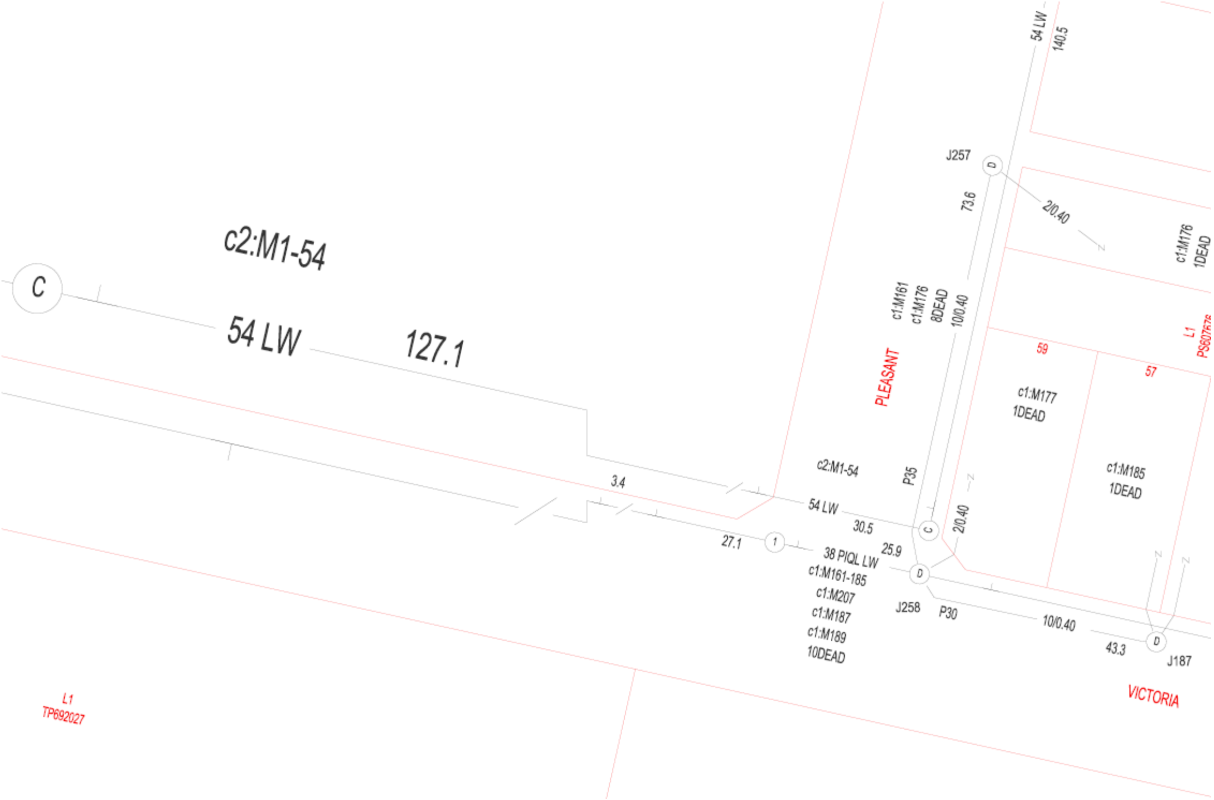


NOTE: AusNet Services has taken care to ensure that the locations of Gas Mains shown on this plan are accurate however some variations from records do exist and complete accuracy is not guaranteed. It is essential that the position of pipes be proved on site by hand excavation. AusNet Services shall not be liable for any loss damage claim or demand incurred either directly or indirectly resulting from any act or omission which was made in reliance in whole or in part upon this plan.

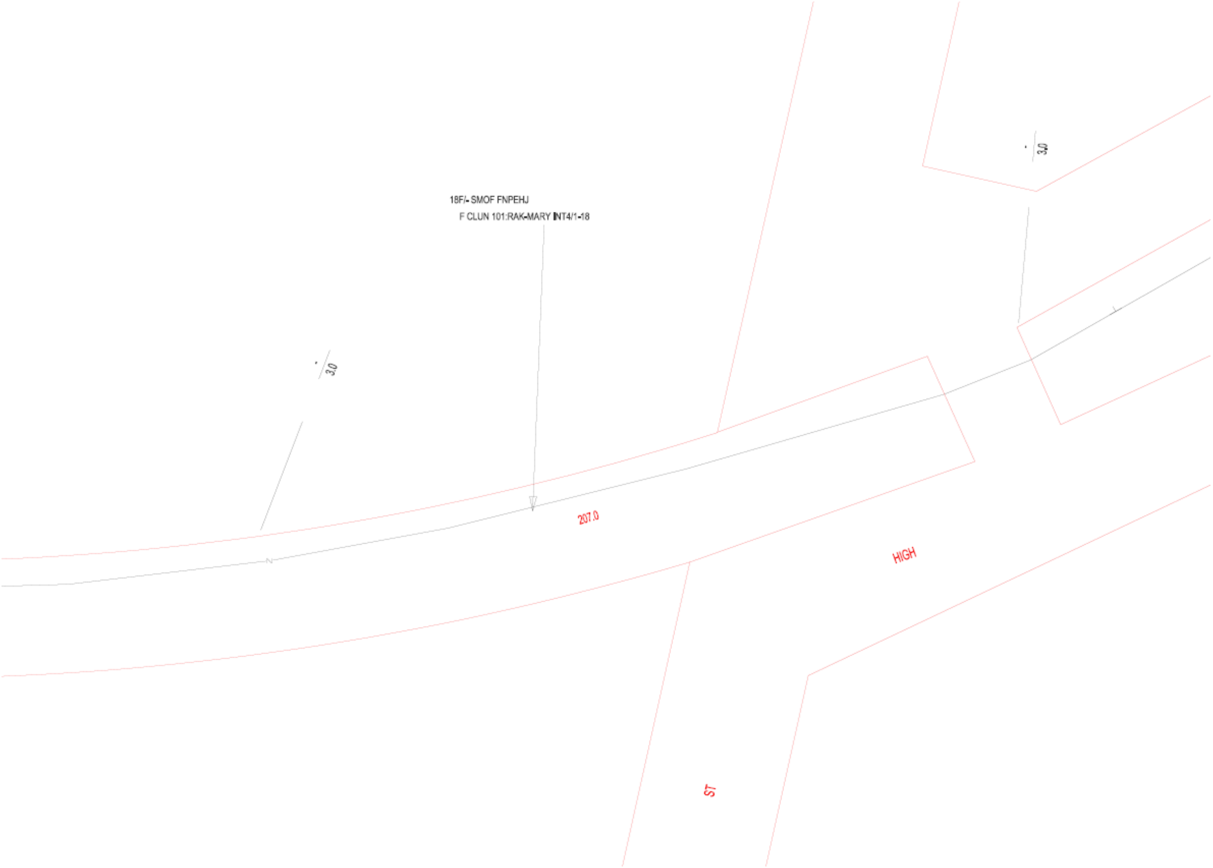
Warning - Take Precautions if Printing this Plot in Black & White.
All planned mains shall be treated as live mains, as mains under pressure may be in existence.

D.3 Telstra cables

At Pyrenees Highway:



At railway:


3.0
18F/- SMOF FNPEHJ
F CLUN 101:RAK-MARY INT4/1-18
3.0
207.0
HIGH
ST

E Drawings

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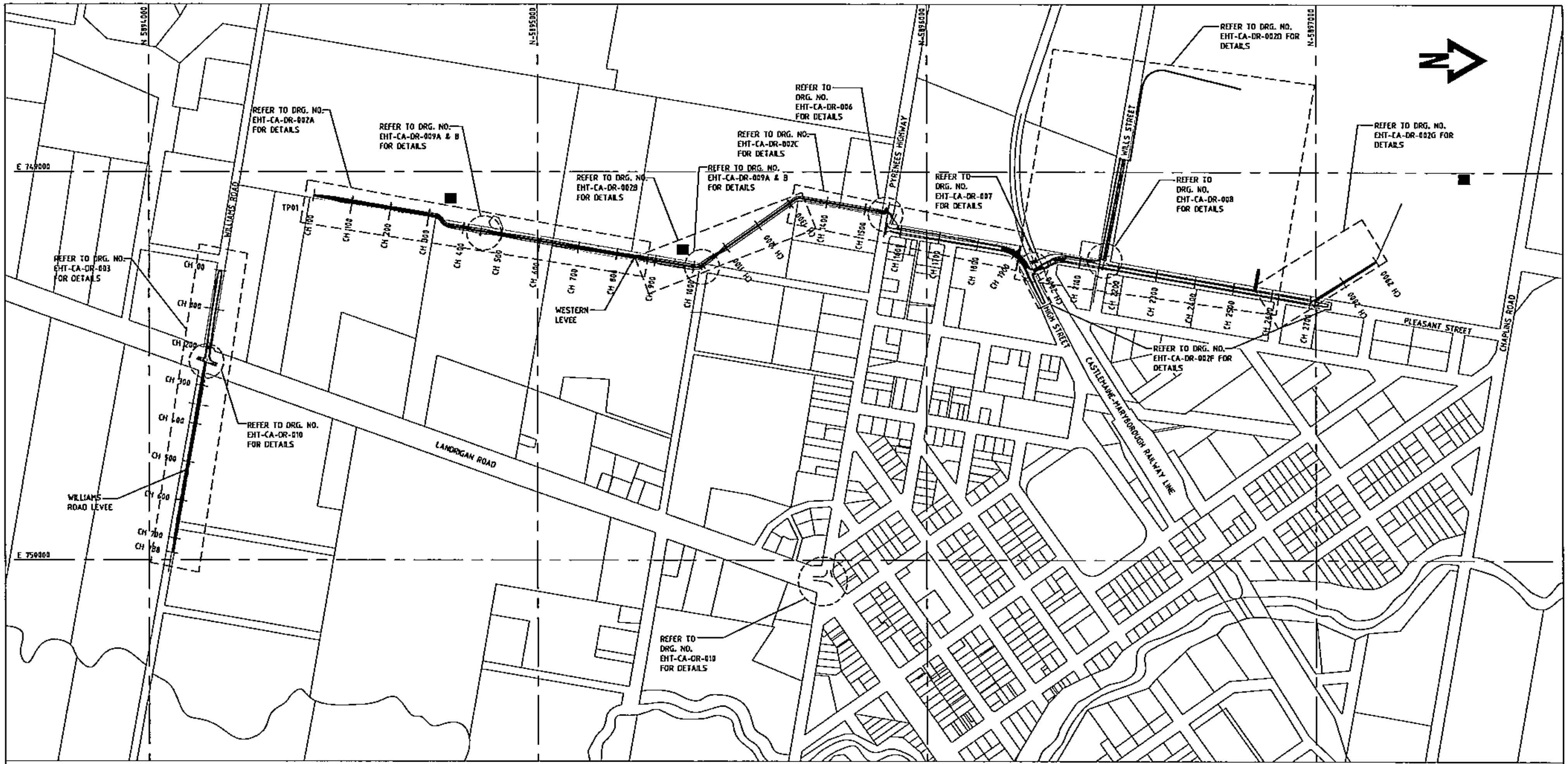

PLAN

SCALE 1:10000

LEGEND :

———	LEVEE FOOTPRINT
———	LEVEE CREST
———	CULVERTS
■	PROPOSED BORROW AREA

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS.
3. FOR SET OUT POINTS & DETAILS REFER TO OTHER RELEVANT DRAWINGS.
4. THE CHANNEL ON THE WESTERN SIDE OF WESTERN LEVEE IS NOT SHOWN FOR CLARITY.
5. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

1 2 3 4 5 6 7 8

ALTERATIONS	PROJ. No.	
ORIGINAL ISSUE	501436	
CLIENT COMMENTS ADDRESSED	501436	1 BDS 13/05/16

100 50 0 100 200 300m

SCALE 1:10000

NO PART OF THIS DRAWING MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM IN ANY FORM, OR TRANSMITTED BY ANY MEANS, WITHOUT THE PRIOR PERMISSION OF ENTURA.

REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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www.entura.com.au

CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639

TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

GENERAL ARRANGEMENT
PLAN

SCALE 1:10000
SIZE A3

DWG No. EHT-CA-DR-001A SHT. – REV. 1

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010SAVED.DWG

PLAN

SCALE 1:10000

LEGEND :

―	LEVEE FOOTPRINT
―	LEVEE CREST
―	CULVERTS
●	BOREHOLES
▨	TEST PITS
■	PROPOSED BORROW AREA

NOTES:

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4. THE CHANNEL ON THE WESTERN SIDE OF WESTERN LEVEE IS NOT SHOWN FOR CLARITY.
7. BORROW AREA, LOCATION TO BE CONFIRMED WITH SUPERINTENDENT.
8. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

1 2 3 4 5 6 7 8

ALTERATIONS

PROJ. No. 501436

ORIGINAL ISSUE

CLIENT COMMENTS ADDRESSED

PROJ. No. 501436
ENGAGEMENT No 304639
REV. 1
DRN. BDS
DESGN.
APP'D. PS
DATE 13/05/16

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CLIENT APP'D.
DATE

100 50 0 100 200 300m

SCALE 1:10000

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CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No E304639

TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

LOCALITY
PLAN/GEOTECH DETAILS

SCALE 1:10000

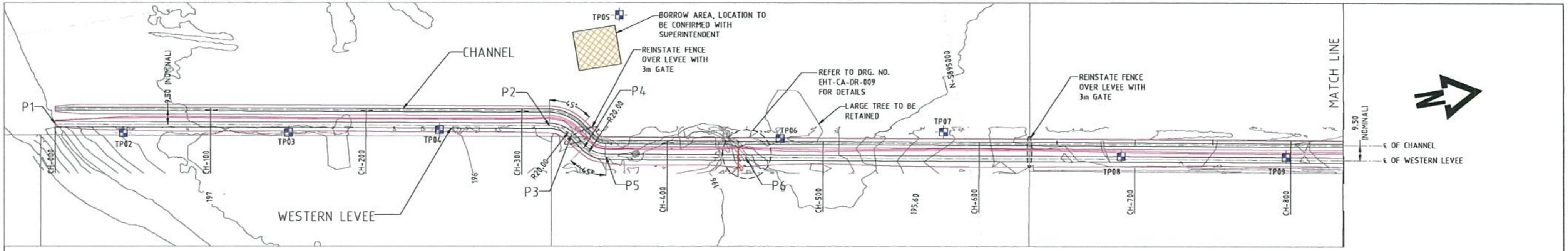
SIZE A3

DRG No. EHT-CA-DR-001B

SHT. –

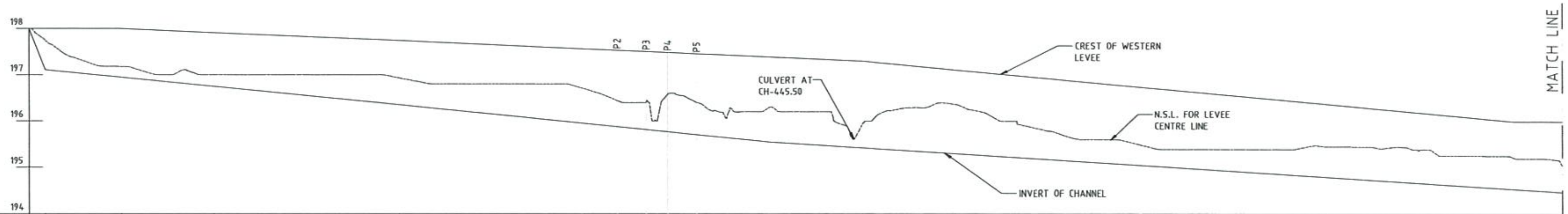
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010SAVED.DWG



PLAN

SCALE 1:2500



TOP OF THE LEVEE	198.00	198.00 197.745 8.85	198.00 197.91 50.00	197.91	197.74	197.56	197.39	197.30 195.69 450.00	197.11	196.74	196.37	196.00
LEVEE GRADING		HORIZONTAL		0.00175				0.00371				
INVERT LEVEL OF CHANNEL	198.00	197.11		196.75	196.35	195.95	195.55		195.30	195.05	194.80	194.55
CHANNEL GRADING	0.1	0.004						0.0025				
LEVEE SURFACE	GRAVEL											

LONGITUDINAL SECTION

SCALE 1:2500 (HORIZONTAL)
SCALE 1:100 (VERTICAL)

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P1	749060.19	5894424.76	198.00	Ch. 0.00
P2	749112.97	5894738.04	197.53	START OF BEND Ch. 317.70
P3	749121.09	5894751.02	197.50	END OF BEND Ch. 333.40
P4	749130.42	5894757.65	197.48	START OF BEND Ch.344.85
P5	749138.54	5894770.61	197.45	END OF BEND Ch. 360.54
P6	749152.71	5894854.38	197.30	CULVERT AT Ch. 445.50

LEGEND :

—	LEVEE FOOTPRINT
—	LEVEE CREST
—	CULVERTS
▨	TEST PITS
▨	PROPOSED BORROW AREA

ISSUED FOR TENDER

NOTES:

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2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION.
3. FOR THE TYPICAL CROSS SECTION SEE DRG. EHT-CA-DR-004.
4. THE 1m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY. THE FEATURE SURVEY (0.2m INTERVAL) UNDERTAKEN BY ENTURA WAS USED FOR THE DESIGN.
5. CHAINAGE ARE DEFINED IN REFERENCE TO THE CENTRELINE OF LEVEE.
6. THE GROUND LEVELS SHALL BE SURVEYED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
7. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

1 2 3 4 5 6 7 8

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
ENGAGEMENT № 304639
APP'D PS
DATE 13/05/16
PROJ. NO. 501436
REV. 1
DRN. BOS
DESIGN
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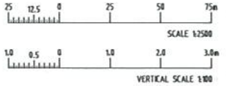
CLIENT APPD.
DATE



REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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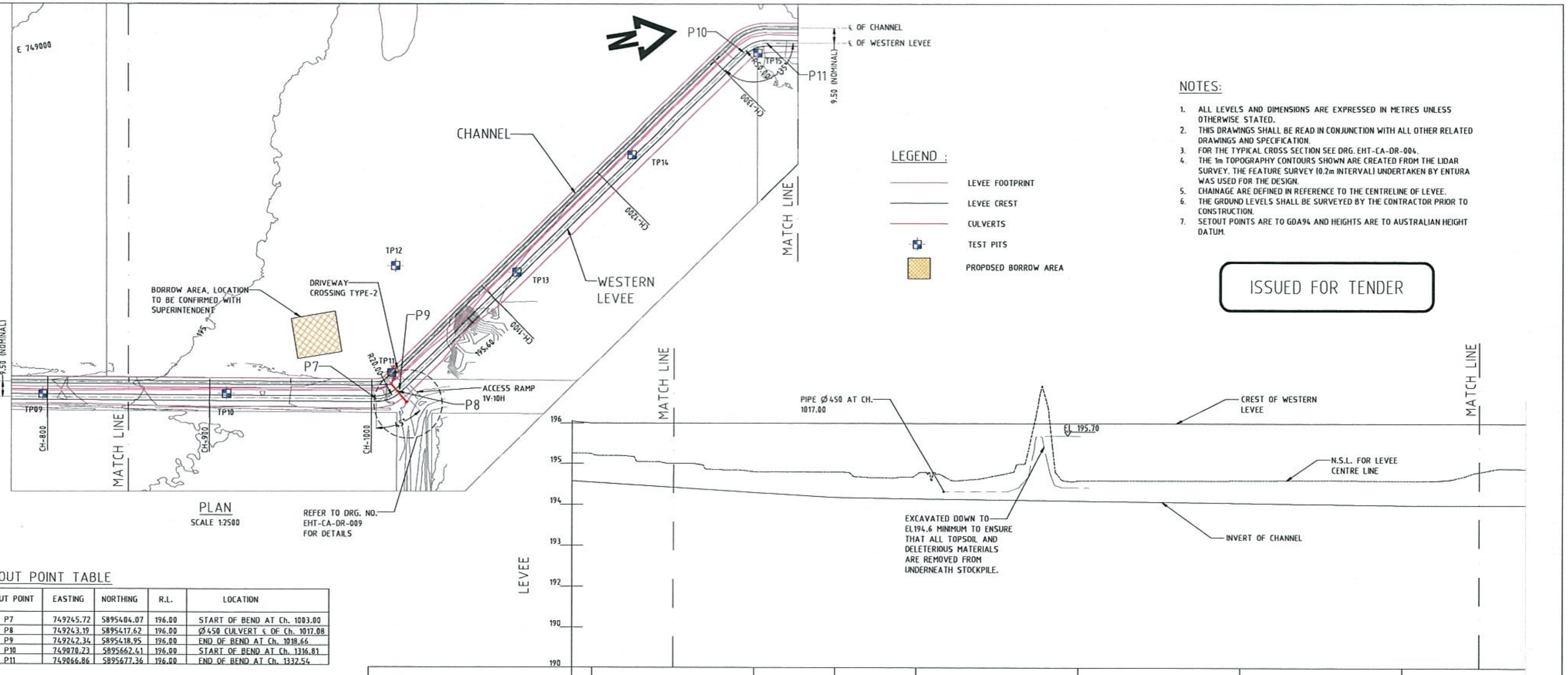
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT № E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WESTERN LEVEE
PLAN AND PROFILE
SCALE AS SHOWN
SIZE A3
DRG No. EHT-CA-DR-002A
SHT. 1/7
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010(TENDER).DWG



PLAN

SCALE 1:2500

LEGEND :

—	LEVEE FOOTPRINT
—	LEVEE CREST
—	CULVERTS
▨	TEST PITS
▨	PROPOSED BORROW AREA

NOTES:

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2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION.
3. FOR THE TYPICAL CROSS SECTION SEE DRG. EHT-CA-DR-004.
4. THE 1m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY. THE FEATURE SURVEY (0.2m INTERVAL) UNDERTAKEN BY ENTURA WAS USED FOR THE DESIGN.
5. CHAINAGE ARE DEFINED IN REFERENCE TO THE CENTRELINE OF LEVEE.
6. THE GROUND LEVELS SHALL BE SURVEYED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
7. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P7	749245.72	5895404.07	196.00	START OF BEND AT Ch. 1003.00
P8	749243.19	5895417.62	196.00	Ø450 CULVERT ℄ OF Ch. 1017.08
P9	749242.34	5895418.95	196.00	END OF BEND AT Ch. 1018.66
P10	749070.23	5895662.41	196.00	START OF BEND AT Ch. 1316.81
P11	749066.86	5895677.36	196.00	END OF BEND AT Ch. 1332.54

LEVEE CHAINAGES			950.00					
EXISTING GROUND LEVELS								
TOP OF THE LEVEE	196.00	196.00	196.00	196.00	196.00	196.00	196.00	
LEVEE GRADING		HORIZONTAL						
INVERT LEVEL OF CHANNEL	194.55	194.30	194.18	194.15	194.10	194.05	194.00	
CHANNEL GRADING	0.0025			0.0005				0.00003
LEVEE SURFACE	GRAVEL							

LONGITUDINAL SECTION

SCALE 1:2500 (HORIZONTAL)
SCALE 1:100 (VERTICAL)

ALTERATIONS			
PROJ. No.	501436	501436	
	ORIGINAL ISSUE	CLIENT COMMENTS ADDRESSED	
REV.		1	
ENGAGEMENT №		304639	
DRN.		BOS	
DESIGN			
APP'D		PS	
DATE		13/05/16	

25 12.5 0 25 50 75m
SCALE 1:2500

1.0 0.5 0 1.0 2.0 3.0m
VERTICAL SCALE 1:100

REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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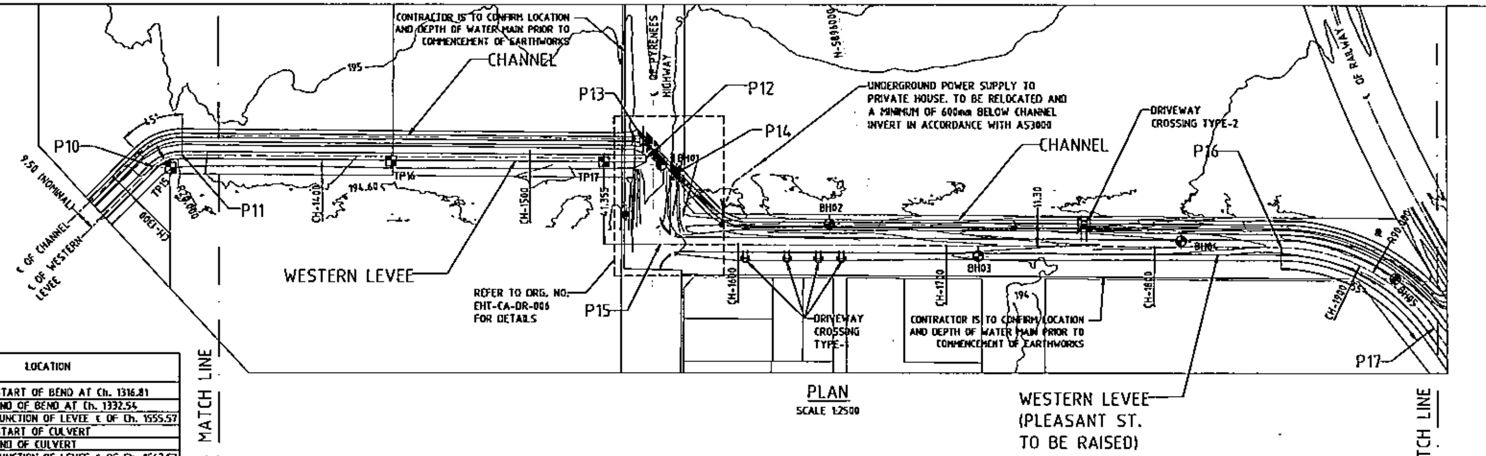
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT №: E304639
TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WESTERN LEVEE
PLAN AND PROFILE
SCALE: AS SHOWN
SIZE: A3
DRG №: EHT-CA-DR-002B
SHT. 2/7
REV. 1



PLAN
SCALE 1:2500

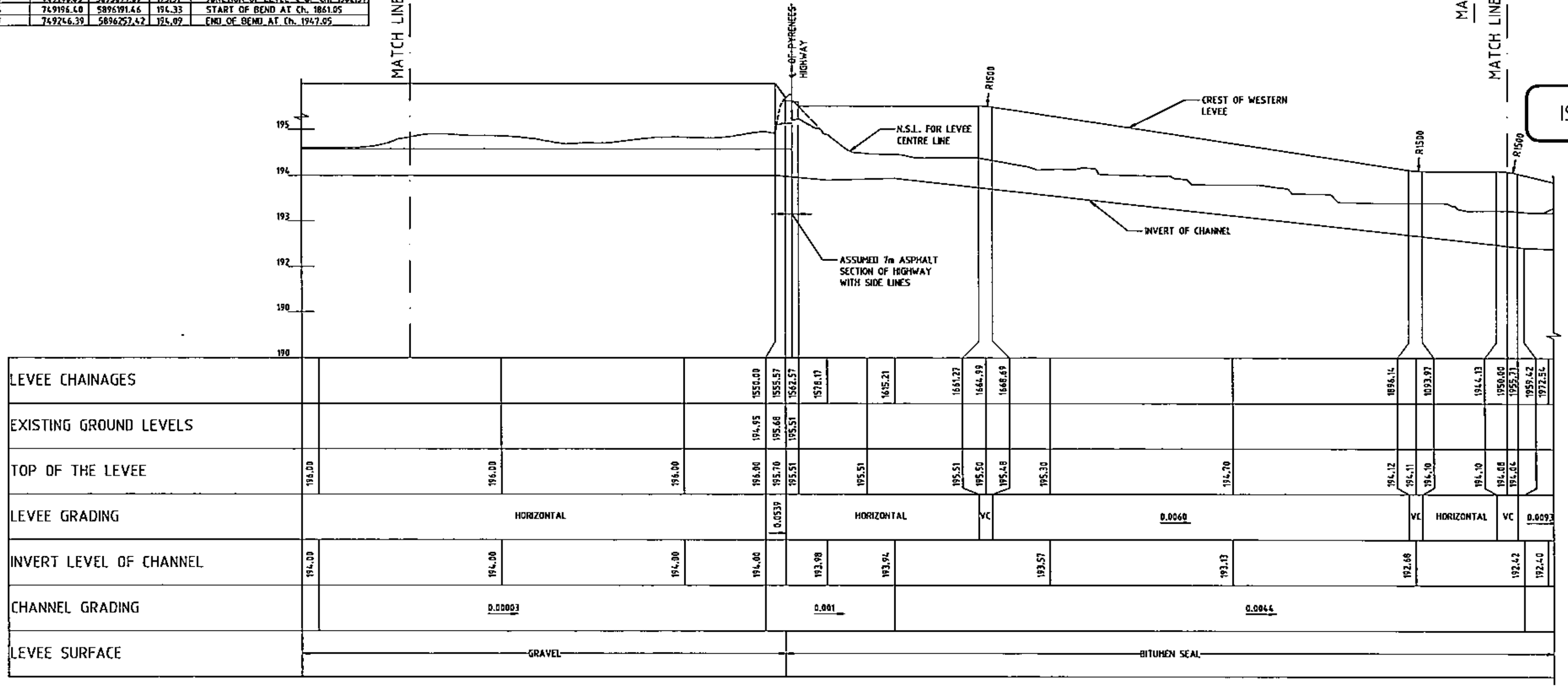
LEGEND :

─	LEVEE FOOTPRINT
─	LEVEE CREST
─	CULVERTS
⊕	BOREHOLES
⊞	TEST PITS
•	POWER POLES

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P10	749070.23	5895662.41	196.00	START OF BEND AT Ch. 1316.81
P11	749066.86	5895677.36	196.00	END OF BEND AT Ch. 1332.54
P12	749104.76	5895897.14	195.70	JUNCTION OF LEVEE ℄ OF Ch. 1555.57
P13	749095.14	5895897.26	194.00	START OF CULVERT
P14	749114.14	5895910.67	193.98	END OF CULVERT
P15	749146.63	5895897.09	195.51	JUNCTION OF LEVEE ℄ OF Ch. 1562.57
P16	749196.40	5896191.46	194.33	START OF BEND AT Ch. 1861.05
P17	749246.39	5896257.42	194.09	END OF BEND AT Ch. 1947.05

ISSUED FOR TENDER



LONGITUDINAL SECTION
SCALE 1:2500 (HORIZONTAL)
SCALE 1:100 (VERTICAL)

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES UNLESS OTHERWISE STATED.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION.
3. FOR THE TYPICAL CROSS SECTION SEE DRG. EHT-CA-DR-004.
4. THE 1m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY. THE FEATURE SURVEY (0.2m INTERVAL) UNDERTAKEN BY ENTURA WAS USED FOR THE DESIGN.
5. CHAINAGE ARE DEFINED IN REFERENCE TO THE CENTRELINE OF LEVEE.
6. THE GROUND LEVELS SHALL BE SURVEYED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
7. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ALTERATIONS

PROJ. No.		
501436	ORIGINAL ISSUE	
	CLIENT COMMENTS ADDRESSED	ENGAGEMENT № 304639 APPD PS DATE 13/05/16 REV. 1 BDS

25 12.5 0 25 50 75m
SCALE 1:2500

1.0 0.5 0 1.0 2.0 3.0m
VERTICAL SCALE 1:100

REFERENCES

DRAWN	S.B.
CHECKED	H.H.
REVIEWED	H.H.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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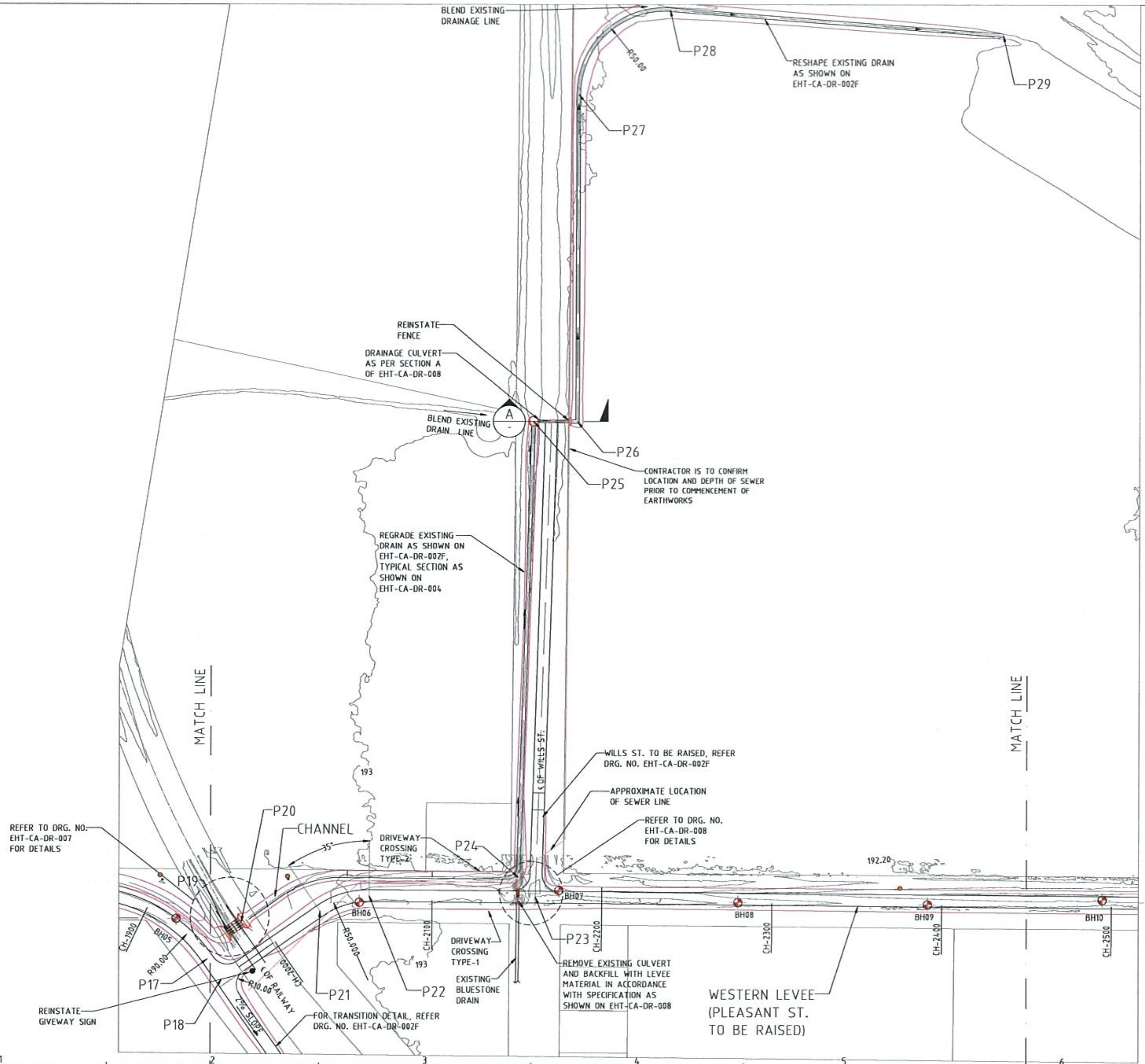
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT № E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WESTERN LEVEE
PLAN AND PROFILE
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-002C
SHT. 3/7
REV. 1

FILENAME: P:\MELBOURNE\CONSULTON\E304XXX\E3046XX\E304639\P589364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010(TENDER).DWG



PLAN

SCALE 1:2500

LEGEND :

─	LEVEE FOOTPRINT
─	LEVEE CREST
─	CULVERTS
⊕	BOREHOLES
●	POWER POLES

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P18	749259.52	5896263.67	193.96	T-JUNCTION OF LEVEE ℄ OF Ch. 1961.59
P19	749232.75	5896271.42	192.40	START OF CULVERT
P20	749228.45	5896280.45	192.39	END OF CULVERT
P21	749229.18	5896327.37	193.91	START OF BEND AT Ch. 2032.13
P22	749225.05	5896357.35	193.88	END OF BEND AT Ch. 2062.88
P23	749241.66	5896453.73	193.80	INTERSECTION OF PLEASANT ST. AND WILLS ST.
P24	749228.58	5896445.63	192.20	START OF WILLS ST. DRAIN
P25	748964.82	5896497.55	191.93	CHANGE DIRECTION WILLS ST. DRAIN
P26	748969.20	5896522.99	191.90	CHANGE DIRECTION WILLS ST. DRAIN
P27	748778.68	5896554.68	191.71	START OF BEND WILLS ST. DRAIN
P28	748738.30	5896615.83	191.63	END OF BEND WILLS ST. DRAIN
P29	748784.81	5896806.98	191.47	END OF DRAIN WILLS ST. DRAIN

NOTES:

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ISSUED FOR TENDER

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
PROJ. NO. 501436 ENGAGEMENT No 304639
REV. 1 DRN. BDS DESGN. APP'D. PS DATE 13/05/16
entura Hydro Tasmania | The power of natural thinking
CLIENT APP'D. DATE

25 12.5 0 25 50 75m
SCALE 1:2500

1.0 0.5 0 1.0 2.0 3.0m
VERTICAL SCALE 1:100

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CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No: E304639
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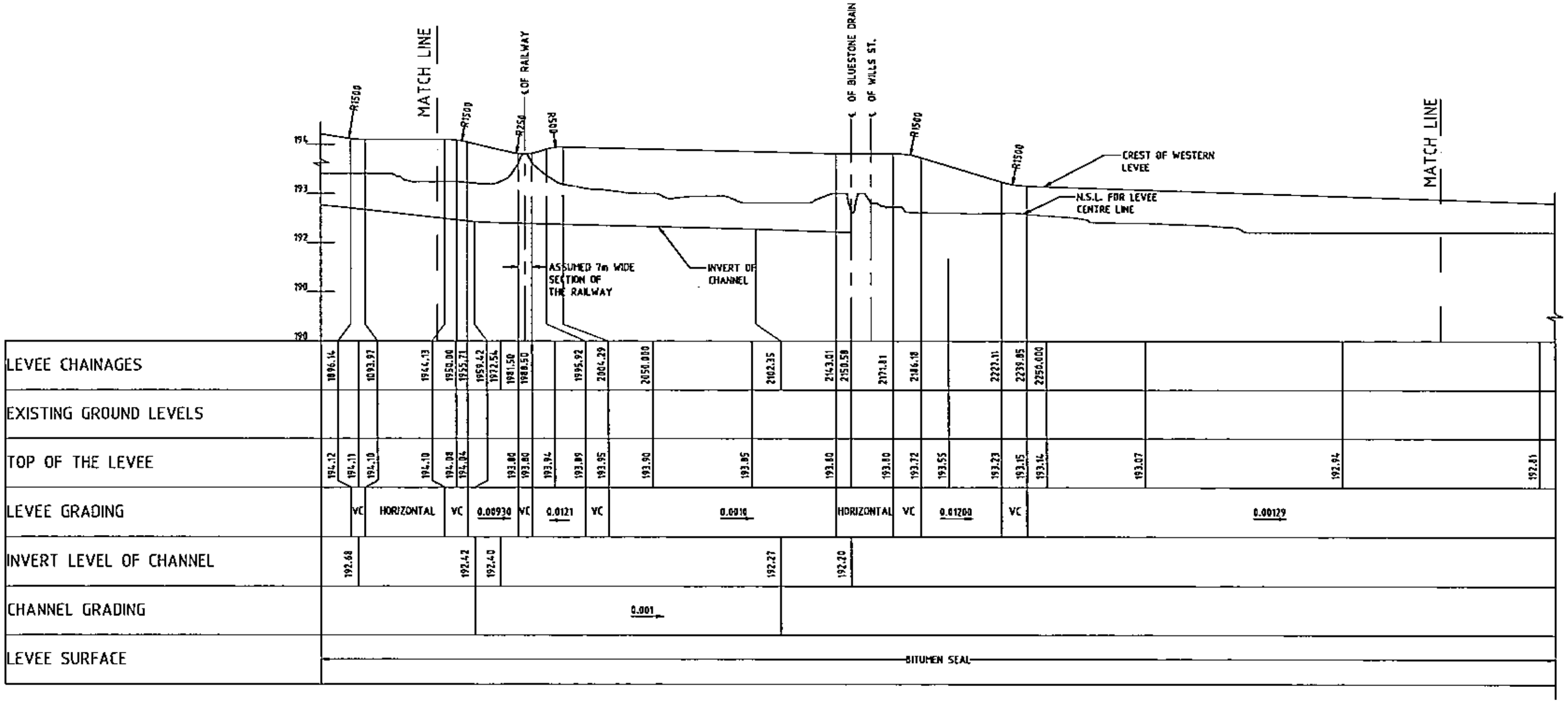
WESTERN LEVEE
PLAN AND PROFILE
SCALE: AS SHOWN
SIZE: A3
DRG No. EHT-CA-DR-002D
SHT. 4/7
REV. 1

FILENAME: P:\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010(TENDER).DWG



LONGITUDINAL SECTION
SCALE 1:2500 (HORIZONTAL)
SCALE 1:100 (VERTICAL)

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3. FOR THE TYPICAL CROSS SECTION SEE DRG. EHT-CA-DR-004.
4. THE 1m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY. THE FEATURE SURVEY (0.2m INTERVAL) UNDERTAKEN BY ENTURA WAS USED FOR THE DESIGN.
5. CHAINAGE ARE DEFINED IN REFERENCE TO THE CENTRELINE OF LEVEE.
6. THE GROUND LEVELS SHALL BE SURVEYED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
7. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

LEGEND :

VC VERTICAL CURVE

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED

25 12.5 0 25 50 75m
SCALE 1:2500

1.0 0.5 0 1.0 2.0 3.0m
VERTICAL SCALE 1:100

NO PART OF THIS DRAWING MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM IN ANY FORM, OR TRANSMITTED BY ANY MEANS, WITHOUT THE PRIOR PERMISSION OF ENTURA

REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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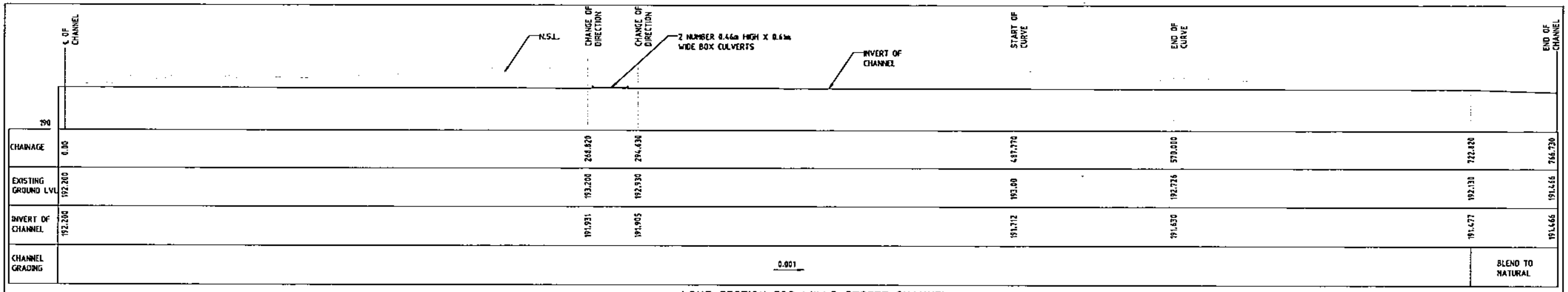
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL DOCUMENT No. E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WESTERN LEVEE
PLAN AND PROFILE
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-002E
SHT. 5/7
REV. 1

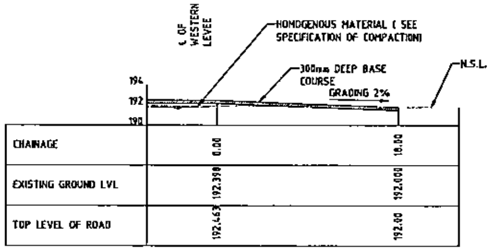
FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-001(TENDER).DWG



CHAINAGE	0.00	268.820	294.630	487.770	570.000	722.820	766.730
EXISTING GROUND LVL	192.200	193.200	192.930	193.00	192.726	192.130	191.466
INVERT OF CHANNEL	192.200	191.931	191.905	191.712	191.630	191.477	191.466
CHANNEL GRADING	0.001						BLEND TO NATURAL

LONG SECTION FOR WILLS STREET CHANNEL

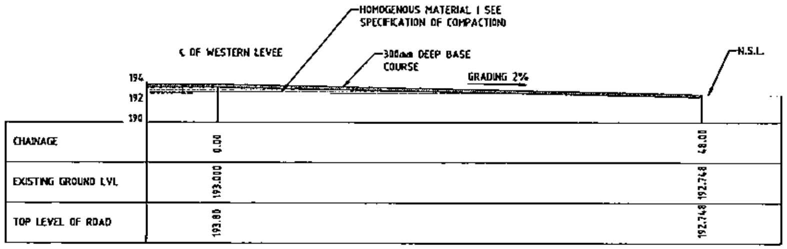
SCALE 1:2000 (HORIZONTAL)
SCALE 1:200 (VERTICAL)



CHAINAGE	0.00	18.00
EXISTING GROUND LVL	192.398	192.000
TOP LEVEL OF ROAD	192.463	192.00

LONG SECTION FOR PLEASANT STREET TRANSITION

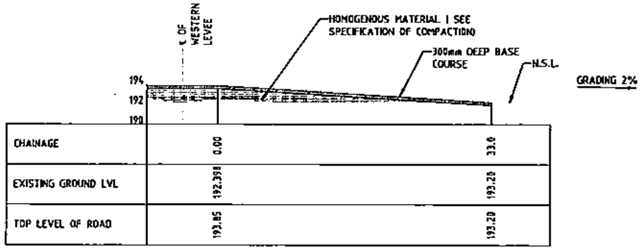
SCALE 1:500



CHAINAGE	0.00	48.00
EXISTING GROUND LVL	193.000	192.748
TOP LEVEL OF ROAD	193.00	192.748

LONG SECTION FOR WILLS STREET TRANSITION

SCALE 1:500



CHAINAGE	0.00	33.0
EXISTING GROUND LVL	192.398	193.20
TOP LEVEL OF ROAD	193.85	193.20

LONG SECTION FOR HIGH STREET TRANSITION

SCALE 1:500

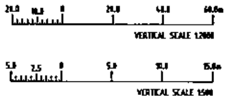
ISSUED FOR TENDER

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE IN METRES.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION.
3. FOR TOP OF THE LEVEE AND CHANNEL INVERT LEVELS REFER TO EHT-CA-DR-002A TO EHT-CA-DR-002E.
4. FOR PROPERTIES OF HOMOGENOUS MATERIAL & BASE COURSE TYPE A & B REFER TO THE SPECIFICATION.
5. PLEASANT ST. IS TO BE RAISED & REINSTATED BASED ON SECTION 12 OF THE INFRASTRUCTURE DESIGN MANUAL, AUSTROADS GUIDE TO ROAD DESIGN, VICROADS GUIDELINES & SPECIFICATION.
6. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

1 2 3 4 5 6 7 8

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
E304639
DATE 13/05/16
501436
1



NO PART OF THIS DRAWING MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM IN ANY FORM, OR TRANSMITTED BY ANY MEANS, WITHOUT THE PRIOR PERMISSION OF ENTURA

REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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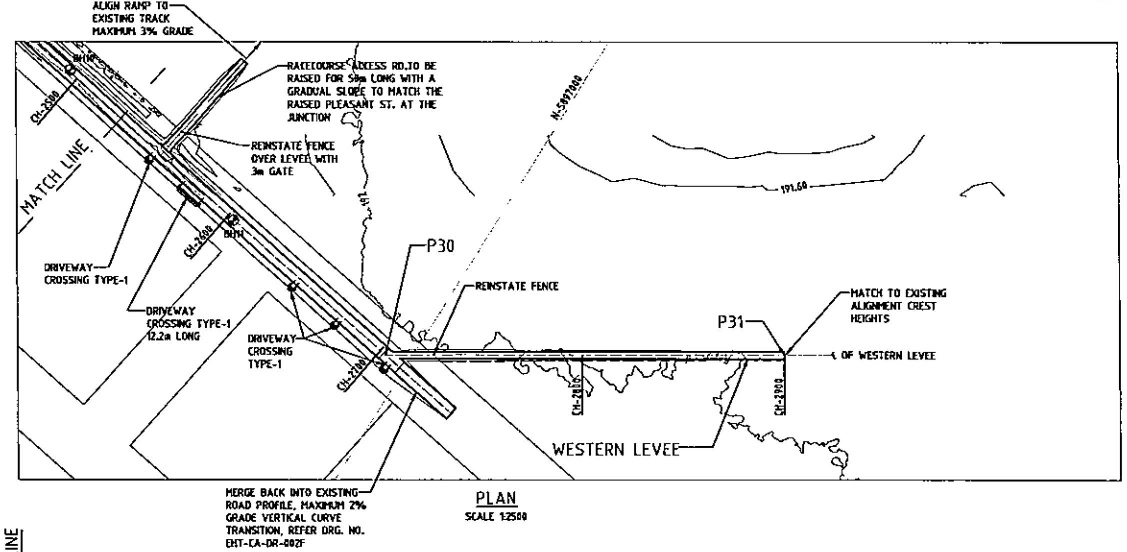
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
DOCUMENT No. E304639

TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WILLS ST. CHANNEL, HIGH STREET
& PLEASANT STREET TRANSITION
LONG SECTIONS

SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-002F
SHT. 6/7
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509344\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-001(TENDER).DWG



PLAN
SCALE 1:2500

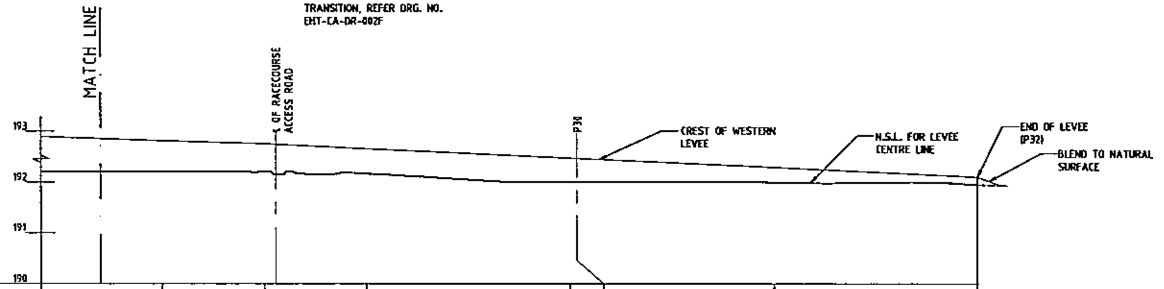
N

LEGEND :

——	LEVEE FOOTPRINT
——	LEVEE CREST
- - -	CULVERTS
-⊕-	BOREHOLES

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P30	749333.70	5896988.53	192.46	CHANGE DIRECTION OF LEVEE Ch. 2703.34
P31	749229.81	5897154.57	192.10	END OF LEVEE Ch. 2900



LEVEE CHAINAGES	2500.00	2550.00	2600.00	2700.00	2703.34	2800.00	2900.00
EXISTING GROUND LEVELS	192.20	192.20	192.20	192.00		191.98	192.00
TOP OF THE LEVEE	192.81	192.75	192.66	192.47		192.29	192.10
LEVEE GRADING	0.00129		0.00186				
LEVEE SURFACE	BITUMEN SEAL					GRAVEL	

LONGITUDINAL SECTION
SCALE 1:2500 (HORIZONTAL)
SCALE 1:100 (VERTICAL)

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES UNLESS OTHERWISE STATED.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION.
3. FOR THE TYPICAL CROSS SECTION SEE DRG. EHT-CA-DR-004.
4. THE 1m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY. THE FEATURE SURVEY (0.2m INTERVAL) UNDERTAKEN BY ENTURA WAS USED FOR THE DESIGN.
5. CHAINAGE ARE DEFINED IN REFERENCE TO THE CENTRELINE OF LEVEE.
6. THE GROUND LEVELS SHALL BE SURVEYED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
7. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED

SCALE 1:2500
VERTICAL SCALE 1:100

NO PART OF THIS DRAWING MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM OR ANY FORM, OR TRANSMITTED BY ANY MEANS, WITHOUT THE PRIOR PERMISSION OF ENTURA.

REFERENCES

DRAWN	S.B.
CHECKED	H.M.
DESIGNED	H.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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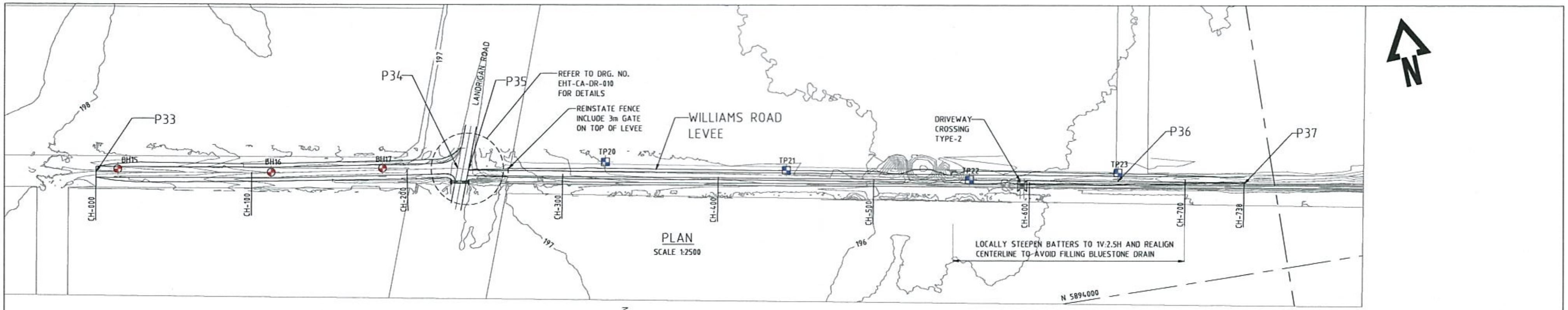
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WESTERN LEVEE
PLAN AND PROFILE
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-002G
SHT. 7/7
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTDH\E304XXX\E3046XX\E304639\P509344\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-001SAVED.DWG

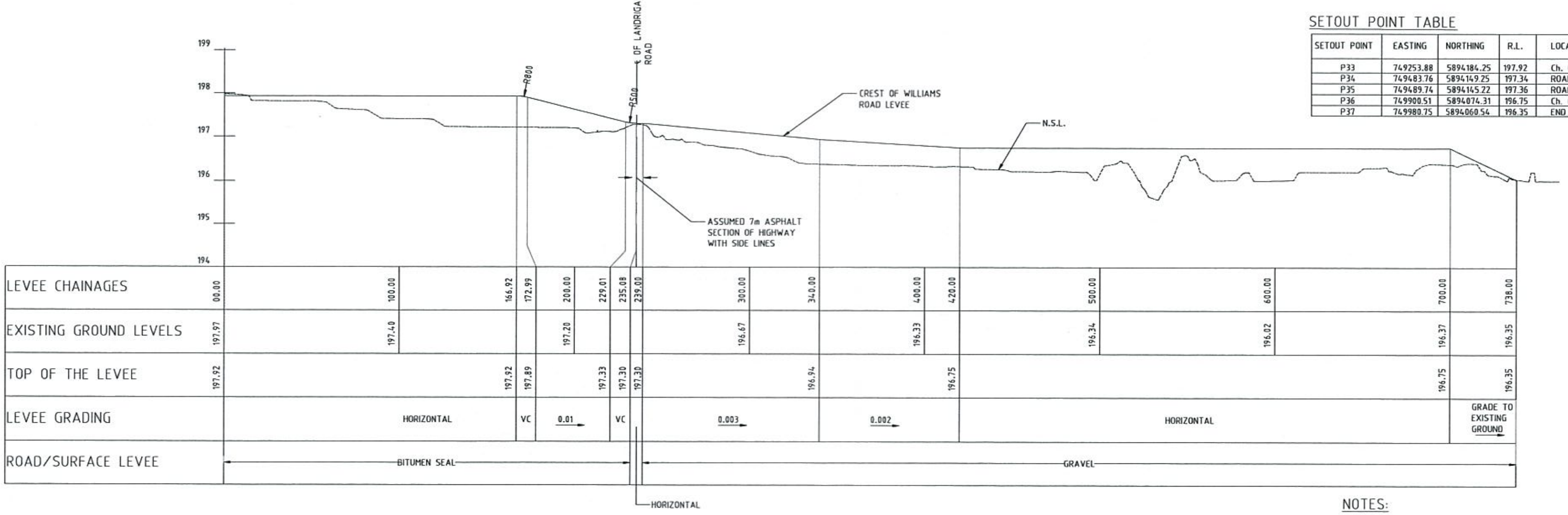


PLAN

SCALE 1:2500

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P33	749253.88	5894184.25	197.92	Ch. 0.00
P34	749483.76	5894149.25	197.34	ROAD LINE Ch 232.53
P35	749489.74	5894145.22	197.36	ROAD LINE Ch. 239.74
P36	749900.51	5894074.31	196.75	Ch. 656.59
P37	749980.75	5894060.54	196.35	END OF LEVEE 738.00



LONGITUDINAL SECTION

SCALE 1:2500 (HORIZONTAL)
SCALE 1:100 (VERTICAL)

LEGEND :

───	LEVEE FOOTPRINT
───	LEVEE CREST
───	CULVERTS
⊕	BOREHOLES
▣	TEST PITS

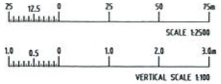
NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES UNLESS OTHERWISE STATE.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION.
3. FOR THE TYPICAL CROSS SECTION SEE DRG. EHT-CA-DR-004.
4. THE 1m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY. THE FEATURE SURVEY (0.2m INTERVAL) UNDERTAKEN BY ENTURA WAS IN GENERAL AGREEMENT WITH THE LIDAR THE OUTCOME OF WHICH WAS USED FOR THE DESIGN PRIMARILY.
5. CHAINAGE ARE DEFINED IN REFERENCE TO THE CENTRELINE OF LEVEE.
6. THE GROUND LEVELS SHALL BE SURVEYED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
7. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

1 2 3 4 5 6 7 8

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
PROJ. No. 501436 ENGAGEMENT No 304639
REV. 1 DN. BDS DESGN. APP'D. PS DATE 13/05/16
entura The power of natural thinking
CLIENT APP'D. DATE



REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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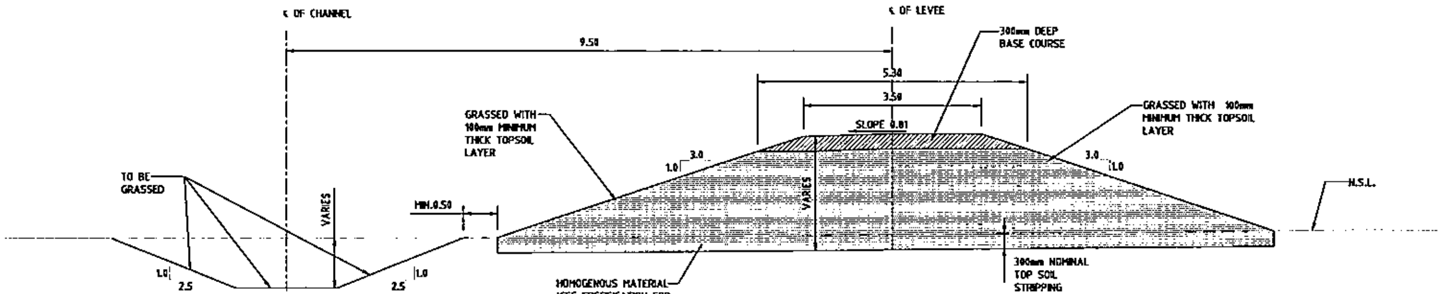
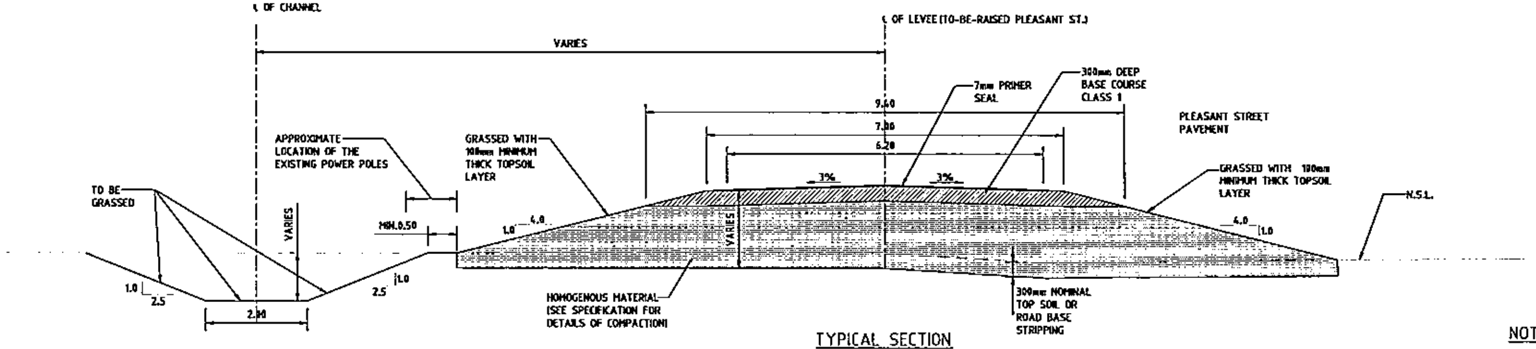
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No E
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WILLIAMS ROAD LEVEE LEVEE
PLAN AND PROFILE
SCALE AS SHOWN
SIZE A3
DRG No. EHT-CA-DR-003
SHT. -
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010SAVED.DWG



TYPICAL SECTION FOR LEVEE

SCALE 1:100
(FROM CH. 0.00m TO CH. 1555.57
FROM CH. 2703.34m TO CH. 3064.60)



TYPICAL SECTION FOR ROAD LEVEE

SCALE 1:100
(FROM CH. 1562.57 TO CH. 2703.34)

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE IN METRES.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION .
3. FOR TOP OF THE LEVEE AND CHANNEL INVERT LEVELS REFER TO EHT-CA-DR-002A TO EHT-CA-DR-002G.
4. FOR PROPERTIES OF HOMOGENOUS MATERIAL & BASE COURSE REFER TO THE SPECIFICATION.
5. PLEASANT ST. IS TO BE RAISED & REINSTATED BASED ON SECTION 12 OF THE INFRASTRUCTURE DESIGN MANUAL, AUSTROADS GUIDE TO ROAD DESIGN, VICROADS GUIDELINES & SPECIFICATION.

ISSUED FOR TENDER

1 2 3 4 5 6 7 8

ALTERATIONS	PROJ. No.	501436
ORIGINAL ISSUE		
CLIENT COMMENTS ADDRESSED		

1.0 0.5 0 1.0 2.0 3.0m
SCALE 1:100

REFERENCES

DRAWN	S.B.
CHECKED	K.N.
DESIGNED	HM
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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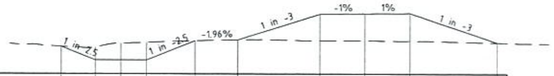
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No. E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WESTERN LEVEE
CROSS SECTIONS
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-004
SHT. -
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTON\E304XXX\E3046XX\E304639\PS09364\DRAWINGS\FINAL DRAWING-06-05-2016\EHT-CA-DR-004(TENDER).DWG

CL LEVEE
X = 749145.12
Y = 5894809.52
RL = 197.39

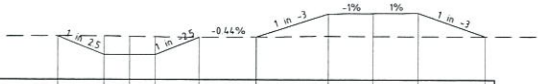


DATUM RL 195.000

DESIGN	196.08	195.55	195.55	195.55	196.31	196.34	197.37	197.39	197.41	196.23
EXISTING SURFACE	196.08	196.05	196.2	196.24	196.31	196.34	196.31	196.31	196.3	196.23
OFFSET	-11.83	-10.50	-9.50	-8.50	-6.61	-4.95	-1.75	0.00	1.75	5.16

CHAINAGE 400

CL LEVEE
X = 749110.03
Y = 5894720.59
RL = 197.56

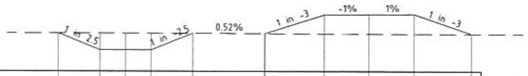


DATUM RL 195.000

DESIGN	196.67	195.95	195.95	195.95	196.63	196.64	197.54	197.56	197.58	196.67
EXISTING SURFACE	196.67	196.67	196.66	196.64	196.63	196.64	196.68	196.67	196.67	196.67
OFFSET	-12.31	-10.50	-9.50	-8.50	-6.79	-4.56	-1.75	0.00	1.75	4.36

CHAINAGE 300

CL LEVEE
X = 749093.41
Y = 5894621.98
RL = 197.74

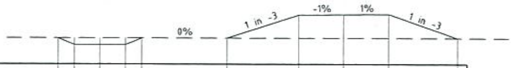


DATUM RL 195.500

DESIGN	197.00	196.35	196.35	196.35	197.00	196.98	197.72	197.74	197.76	196.97
EXISTING SURFACE	197	197	197	197	197	196.98	196.97	196.97	196.97	196.97
OFFSET	-12.13	-10.50	-9.50	-8.50	-6.87	-4.06	-1.75	0.00	1.75	4.00

CHAINAGE 200

CL LEVEE
X = 749076.8
Y = 5894523.37
RL = 197.91

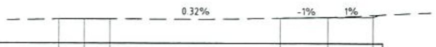


DATUM RL 196.000

DESIGN	197.00	196.75	196.75	196.75	197.00	197.00	197.89	197.91	197.93	197.00
EXISTING SURFACE	197	197	197	197	197	197	197	197	197	197
OFFSET	-11.13	-10.50	-9.50	-8.50	-7.87	-4.54	-1.75	0.00	1.75	4.44

CHAINAGE 100

CL LEVEE
X = 749060.19
Y = 5894424.76
RL = 198

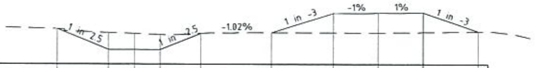


DATUM RL 197.000

DESIGN	197.93	197.93	197.93	197.98	198.00	197.98
EXISTING SURFACE	197.93	197.93	197.93	197.98	198.02	198.1
OFFSET	-10.50	-9.50	-8.50	-1.87	0.00	1.75

CHAINAGE 0

CL LEVEE
X = 749211.86
Y = 5895203.91
RL = 196

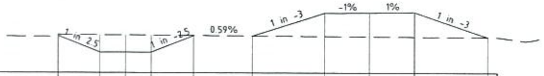


DATUM RL 194.000

DESIGN	195.36	194.56	194.55	194.55	195.19	195.22	195.98	196.00	196.02	195.26
EXISTING SURFACE	195.36	195.21	195.18	195.14	195.19	195.22	195.21	195.22	195.24	195.26
OFFSET	-12.51	-10.51	-9.50	-8.50	-6.92	-4.16	-1.75	0.00	1.75	3.90

CHAINAGE 800

CL LEVEE
X = 749195.17
Y = 5895105.31
RL = 196.37

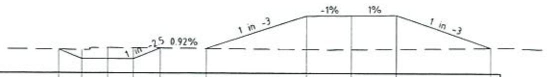


DATUM RL 194.000

DESIGN	195.45	194.80	194.80	194.80	195.46	195.45	196.35	196.37	196.39	195.40
EXISTING SURFACE	195.51	195.49	195.48	195.48	195.47	195.45	195.44	195.43	195.42	195.4
OFFSET	-12.12	-10.50	-9.50	-8.50	-6.85	-4.56	-1.75	0.00	1.75	4.61

CHAINAGE 700

CL LEVEE
X = 749178.49
Y = 5895006.71
RL = 196.74

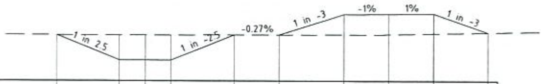


DATUM RL 194.500

DESIGN	195.41	195.05	195.05	195.05	195.47	195.46	196.73	196.74	196.76	195.50
EXISTING SURFACE	195.41	195.4	195.48	195.47	195.47	195.46	195.42	195.43	195.45	195.5
OFFSET	-11.40	-10.51	-9.50	-8.50	-7.45	-5.66	-1.75	0.00	1.75	5.43

CHAINAGE 600

CL LEVEE
X = 749161.8
Y = 5894908.11
RL = 197.11



DATUM RL 194.500

DESIGN	196.28	195.31	195.30	195.30	196.29	196.29	197.10	197.11	197.13	196.39
EXISTING SURFACE	196.28	196.27	196.28	196.28	196.29	196.29	196.3	196.31	196.34	196.39
OFFSET	-12.95	-10.52	-9.50	-8.50	-6.04	-4.27	-1.75	0.00	1.75	3.87

CHAINAGE 500

SCALE 1:100

ISSUED FOR TENDER

ENTURA IS A BUSINESS OF HYDRO-ELECTRIC CORPORATION ABN 48 072 377 158

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE

REFERENCES

DRAWN	BDS
CHECKED	
DESIGNED	
CHECKED	PS
APPROVED	TG
DATE	11-05-16
CLIENT APP'D	
DATE	

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Victoria, 3000, AUSTRALIA
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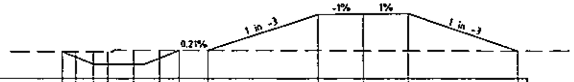
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No: E304639
TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WESTERN LEVEE
CROSS SECTIONS
SCALE 100
SIZE A1
DRG No. EHT-CA-DR-004A
SHT. 1/2
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509364\12D\CROSS SECTIONS.DWG

CL LEVEE
X = 749137.66
Y = 5895567.03
RL = 196

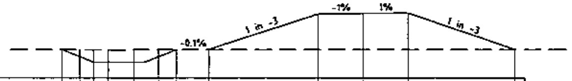


DATUM RL 193.500

DESIGN	194.56	194.33	194.06	194.06	194.06	194.29	194.59	194.59	195.98	196.00	196.02	194.56
EXISTING SURFACE	194.56	194.56	194.56	194.56	194.59	194.59	194.59	194.59	194.58	194.58	194.57	194.56
OFFSET	-11.71	-11.19	-10.50	-9.93	-8.93	-7.92	-7.16	-6.04	-1.75	0.00	1.75	5.01

CHAINAGE 1200

CL LEVEE
X = 749195.38
Y = 5895485.37
RL = 196

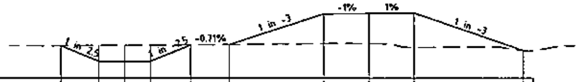


DATUM RL 193.500

DESIGN	194.60	194.32	194.11	194.11	194.11	194.32	194.60	194.60	195.98	196.00	196.02	194.60
EXISTING SURFACE	194.6	194.6	194.59	194.58	194.6	194.6	194.6	194.6	194.6	194.6	194.6	194.6
OFFSET	-11.73	-11.03	-10.50	-9.93	-8.93	-7.97	-7.27	-6.00	-1.75	0.00	1.75	5.90

CHAINAGE 1100

CL LEVEE
X = 749245.22
Y = 5895401.11
RL = 196

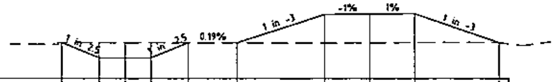


DATUM RL 193.500

DESIGN	194.75	194.16	194.15	194.15	194.78	194.79	195.98	196.00	196.02	194.57
EXISTING SURFACE	194.75	194.76	194.76	194.77	194.78	194.79	194.83	194.83	194.68	194.57
OFFSET	-11.98	-10.51	-9.50	-8.50	-6.93	-5.42	-1.75	0.00	1.75	6.00

CHAINAGE 1000

CL LEVEE
X = 749228.54
Y = 5895302.51
RL = 196

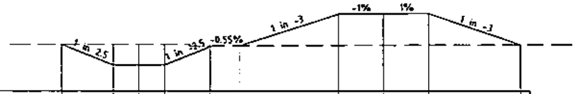


DATUM RL 193.500

DESIGN	194.89	194.31	194.30	194.30	194.89	194.88	195.98	196.00	196.02	194.89
EXISTING SURFACE	194.89	194.89	194.89	194.89	194.89	194.88	194.88	194.88	194.9	194.89
OFFSET	-11.97	-10.51	-9.50	-8.50	-7.05	-5.16	-1.75	0.00	1.75	5.03

CHAINAGE 900

CL LEVEE
X = 749095.32
Y = 5895842.38
RL = 196

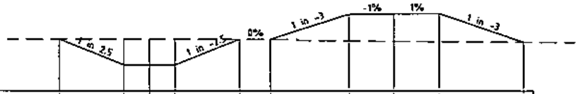


DATUM RL 193.000

DESIGN	194.80	194.00	194.00	194.00	194.71	194.74	195.98	196.00	196.02	194.80
EXISTING SURFACE	194.8	194.8	194.8	194.8	194.73	194.74	194.76	194.77	194.78	194.8
OFFSET	-12.50	-10.50	-9.50	-8.50	-6.73	-5.58	-1.75	0.00	1.75	5.31

CHAINAGE 1500

CL LEVEE
X = 749078.32
Y = 5895743.84
RL = 196

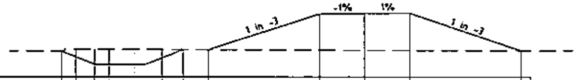


DATUM RL 193.000

DESIGN	195.00	194.00	194.00	194.00	195.00	195.00	195.98	196.00	196.02	194.89
EXISTING SURFACE	195	195	195	195	195	195	194.93	194.92	194.91	194.89
OFFSET	-13.00	-10.50	-9.50	-8.50	-6.00	-4.80	-1.75	0.00	1.75	5.02

CHAINAGE 1400

CL LEVEE
X = 749079.94
Y = 5895648.68
RL = 196



DATUM RL 193.500

DESIGN	194.52	194.30	194.00	194.00	194.00	194.25	194.58	194.58	195.98	196.00	196.02	194.54
EXISTING SURFACE	194.52	194.59	194.59	194.59	194.59	194.58	194.58	194.58	194.56	194.55	194.55	194.54
OFFSET	-11.79	-11.23	-10.50	-9.93	-8.93	-7.88	-7.06	-6.08	-1.75	0.00	1.75	6.08

CHAINAGE 1300

SCALE 1:100

ISSUED FOR TENDER

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE

REFERENCES

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CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No. E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

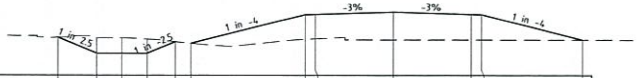
WESTERN LEVEE
CROSS SECTIONS

SCALE 100
SIZE A1
DWG No. EHT-CA-DR-004B
SHT. 2/2
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\12D\CROSS SECTIONS.DWG

ENTURA IS A BUSINESS OF HYDRO-ELECTRIC CORPORATION ABN 48 072 377 158

CL ROAD
X = 749157.88
Y = 5895963.63
RL = 195.51

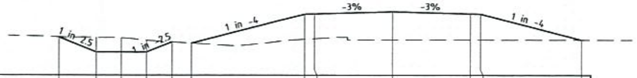


DATUM RL 193.000

DESIGN	194.49	193.87	193.87	193.87	194.32	194.27	195.41	195.42	195.51	195.42	195.41	194.40
EXISTING SURFACE	194.49	194.47	194.48	194.43	194.32	194.27	194.42	194.44	194.4	194.4	194.4	194.4
OFFSET	-13.34	-11.80	-10.80	-9.80	-8.67	-8.06	-3.50	-3.10	0.00	3.10	3.50	7.52

CHAINAGE 1630

CL ROAD
X = 749156.21
Y = 5895953.77
RL = 195.51

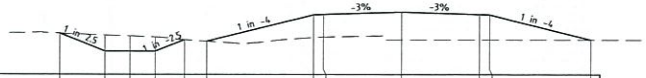


DATUM RL 193.000

DESIGN	194.51	193.92	193.92	193.92	194.33	194.28	195.41	195.42	195.51	195.42	195.41	194.40
EXISTING SURFACE	194.51	194.49	194.48	194.39	194.33	194.28	194.43	194.45	194.4	194.4	194.4	194.4
OFFSET	-13.29	-11.80	-10.80	-9.80	-8.78	-8.01	-3.50	-3.10	0.00	3.10	3.50	7.52

CHAINAGE 1620

CL ROAD
X = 749154.55
Y = 5895943.91
RL = 195.51

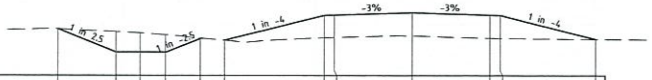


DATUM RL 193.000

DESIGN	194.66	193.94	193.94	193.94	194.40	194.34	195.41	195.42	195.51	195.42	195.41	194.40
EXISTING SURFACE	194.66	194.58	194.55	194.51	194.4	194.34	194.5	194.51	194.4	194.4	194.4	194.4
OFFSET	-13.60	-11.80	-10.80	-9.80	-8.64	-7.75	-3.50	-3.10	0.00	3.10	3.50	7.52

CHAINAGE 1610

CL ROAD
X = 749152.88
Y = 5895934.05
RL = 195.51

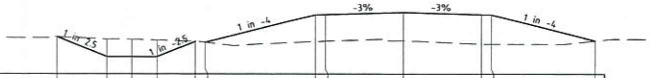


DATUM RL 193.000

DESIGN	194.87	193.94	193.94	193.94	194.48	194.41	195.41	195.42	195.51	195.42	195.41	194.45
EXISTING SURFACE	194.87	194.76	194.71	194.63	194.49	194.41	194.51	194.52	194.59	194.49	194.49	194.45
OFFSET	-14.13	-11.80	-10.84	-9.83	-8.45	-7.47	-3.50	-3.10	0.00	3.10	3.50	7.31

CHAINAGE 1600

CL ROAD
X = 749164.55
Y = 5896003.07
RL = 195.47

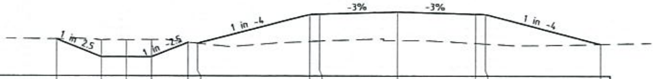


DATUM RL 193.000

DESIGN	194.49	193.70	193.70	193.70	194.31	194.27	195.37	195.38	195.47	195.38	195.37	194.33
EXISTING SURFACE	194.49	194.39	194.39	194.36	194.31	194.27	194.3	194.32	194.33	194.21	194.2	194.33
OFFSET	-13.78	-11.80	-10.80	-9.80	-8.28	-7.88	-3.50	-3.10	0.00	3.10	3.50	7.64

CHAINAGE 1670

CL ROAD
X = 749162.88
Y = 5895993.21
RL = 195.51

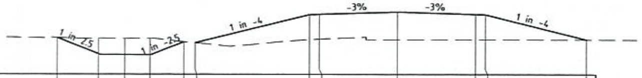


DATUM RL 193.000

DESIGN	194.45	193.74	193.74	193.74	194.33	194.29	195.40	195.42	195.51	195.42	195.40	194.26
EXISTING SURFACE	194.45	194.41	194.42	194.43	194.33	194.29	194.36	194.38	194.4	194.29	194.27	194.26
OFFSET	-13.57	-11.80	-10.80	-9.80	-8.34	-7.97	-3.50	-3.10	0.00	3.10	3.50	8.10

CHAINAGE 1660

CL ROAD
X = 749161.21
Y = 5895983.35
RL = 195.51



DATUM RL 193.000

DESIGN	194.48	193.82	193.79	193.79	194.32	194.27	195.41	195.42	195.51	195.42	195.41	194.40
EXISTING SURFACE	194.48	194.44	194.44	194.45	194.32	194.27	194.4	194.42	194.4	194.4	194.4	194.4
OFFSET	-13.52	-11.88	-10.84	-9.83	-8.48	-8.04	-3.50	-3.10	0.00	3.10	3.50	7.52

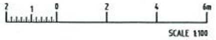
CHAINAGE 1650

CL ROAD
X = 749159.55
Y = 5895973.49
RL = 195.51

DATUM RL 193.000

DESIGN	194.46	193.83	193.83	193.83	194.32	194.26	195.41	195.42	195.51	195.42	195.41	194.40
EXISTING SURFACE	194.46	194.48	194.46	194.44	194.32	194.26	194.44	194.46	194.4	194.4	194.4	194.4
OFFSET	-13.36	-11.80	-10.80	-9.80	-8.59	-8.07	-3.50	-3.10	0.00	3.10	3.50	7.52

CHAINAGE 1640



SCALE 1:100

ISSUED FOR TENDER

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CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639

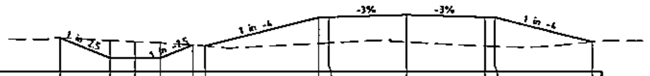
TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

WESTERN ROAD LEVEE
CROSS SECTIONS

SCALE 100
SIZE A1
DRG No. EHT-CA-DR-004C
SHT 1/13
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\12D\CROSS SECTIONS.DWG

CL ROAD
X = 749171.22
Y = 5896042.51
RL = 195.23

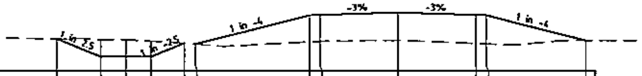


DATUM RL 193.000

DESIGN	194.32	193.52	193.52	193.52	194.04	194.00	195.13	195.14	195.23	195.14	195.13	194.16
EXISTING SURFACE	194.32	194.21	194.16	194.12	194.04	194	194.1	194.12	194.15	194	193.98	194.16
OFFSET	-13.79	-11.80	-10.80	-9.80	-8.50	-8.03	-3.50	-3.10	0.00	3.10	3.50	7.36

CHAINAGE 1710

CL ROAD
X = 749169.55
Y = 5896032.65
RL = 195.29

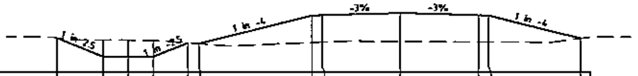


DATUM RL 193.000

DESIGN	194.26	193.57	193.57	193.57	194.09	194.06	195.19	195.20	195.29	195.20	195.19	194.20
EXISTING SURFACE	194.26	194.23	194.22	194.17	194.09	194.06	194.14	194.16	194.2	194.08	194.06	194.2
OFFSET	-13.54	-11.80	-10.80	-9.80	-8.48	-8.03	-3.50	-3.10	0.00	3.10	3.50	7.45

CHAINAGE 1700

CL ROAD
X = 749167.88
Y = 5896022.79
RL = 195.35

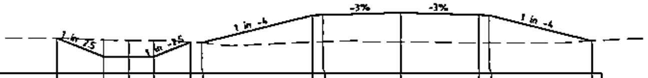


DATUM RL 193.000

DESIGN	194.34	193.61	193.61	193.61	194.16	194.12	195.25	195.26	195.35	195.26	195.25	194.34
EXISTING SURFACE	194.34	194.27	194.26	194.24	194.16	194.12	194.17	194.19	194.2	194.19	194.19	194.34
OFFSET	-13.63	-11.80	-10.80	-9.80	-8.44	-8.00	-3.50	-3.10	0.00	3.10	3.50	7.15

CHAINAGE 1690

CL ROAD
X = 749166.21
Y = 5896012.93
RL = 195.41

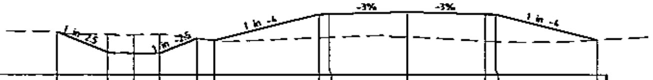


DATUM RL 193.000

DESIGN	194.40	193.65	193.65	193.65	194.24	194.20	195.31	195.32	195.41	195.32	195.31	194.29
EXISTING SURFACE	194.4	194.32	194.31	194.3	194.24	194.2	194.23	194.25	194.24	194.2	194.2	194.29
OFFSET	-13.66	-11.80	-10.80	-9.80	-8.34	-7.91	-3.50	-3.10	0.00	3.10	3.50	7.58

CHAINAGE 1680

CL ROAD
X = 749177.89
Y = 5896081.95
RL = 194.99

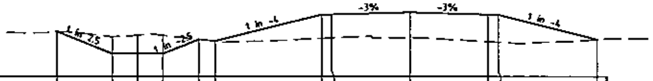


DATUM RL 192.500

DESIGN	194.18	193.38	193.34	193.34	193.92	193.85	194.89	194.90	194.99	194.90	194.89	193.88
EXISTING SURFACE	194.18	194.1	194.07	194.03	193.92	193.85	193.96	193.97	194	193.83	193.81	193.88
OFFSET	-13.89	-11.89	-10.84	-9.83	-8.35	-7.66	-3.50	-3.10	0.00	3.10	3.50	7.52

CHAINAGE 1750

CL ROAD
X = 749176.22
Y = 5896072.09
RL = 195.05

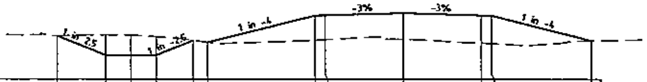


DATUM RL 192.500

DESIGN	194.27	193.39	193.39	193.39	193.96	193.89	194.95	194.96	195.05	194.96	194.95	193.97
EXISTING SURFACE	194.27	194.05	194.12	194.12	193.96	193.89	194	194.02	194.03	193.88	193.86	193.97
OFFSET	-13.99	-11.80	-10.80	-9.80	-8.37	-7.72	-3.50	-3.10	0.00	3.10	3.50	7.43

CHAINAGE 1740

CL ROAD
X = 749174.55
Y = 5896062.23
RL = 195.11

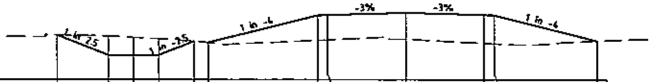


DATUM RL 192.500

DESIGN	194.20	193.43	193.43	193.43	194.02	193.94	195.01	195.02	195.11	195.02	195.01	194.02
EXISTING SURFACE	194.2	194.23	194.22	194.16	194.02	193.94	194.04	194.06	194.08	193.92	193.9	194.02
OFFSET	-13.73	-11.80	-10.80	-9.80	-8.33	-7.76	-3.50	-3.10	0.00	3.10	3.50	7.46

CHAINAGE 1730

CL ROAD
X = 749172.88
Y = 5896052.37
RL = 195.17



DATUM RL 192.500

DESIGN	194.29	193.48	193.48	193.48	194.04	193.98	195.07	195.08	195.17	195.08	195.07	194.05
EXISTING SURFACE	194.29	194.24	194.19	194.16	194.04	193.98	194.07	194.09	194.12	193.96	193.93	194.05
OFFSET	-13.82	-11.80	-10.80	-9.80	-8.40	-7.84	-3.50	-3.10	0.00	3.10	3.50	7.58

CHAINAGE 1720

SCALE 1:100

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ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE

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CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL DOCUMENT No. E304639
PROJECT CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
SCALE 100

WESTERN ROAD LEVEE
CROSS SECTIONS

SIZE A1
DWG No. EHT-CA-DR-004D
SHEET 2/13
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509344\120\CROSS SECTIONS.DWG

CL ROAD
X = 749184.55
Y = 5896121.39
RL = 194.75

DATUM RL 192.500

DESIGN	194.17	193.17	193.17	193.17	193.80	193.71	194.65	194.66	194.75	194.66	194.65	193.63
EXISTING SURFACE	194.17	194.02	193.97	193.93	193.8	193.71	193.86	193.88	193.8	193.62	193.6	193.63
OFFSET	-14.30	-11.80	-10.80	-9.80	-8.21	-7.24	-3.50	-3.10	0.00	3.10	3.50	7.59

CHAINAGE 1790

CL ROAD
X = 749182.89
Y = 5896111.53
RL = 194.81

DATUM RL 192.500

DESIGN	194.20	193.21	193.21	193.21	193.85	193.77	194.71	194.72	194.81	194.72	194.71	193.71
EXISTING SURFACE	194.2	194.03	194.01	193.96	193.85	193.77	193.89	193.9	193.8	193.65	193.62	193.71
OFFSET	-14.27	-11.80	-10.80	-9.80	-8.20	-7.28	-3.50	-3.10	0.00	3.10	3.50	7.49

CHAINAGE 1780

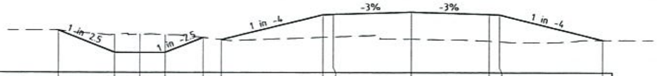
CL ROAD
X = 749181.22
Y = 5896101.67
RL = 194.87

DATUM RL 192.500

DESIGN	194.20	193.26	193.26	193.26	193.88	193.79	194.77	194.78	194.87	194.78	194.77	193.75
EXISTING SURFACE	194.2	194.03	194	194	193.88	193.79	193.9	193.91	193.83	193.71	193.69	193.75
OFFSET	-14.15	-11.80	-10.80	-9.80	-8.23	-7.40	-3.50	-3.10	0.00	3.10	3.50	7.57

CHAINAGE 1770

CL ROAD
X = 749179.55
Y = 5896091.81
RL = 194.93

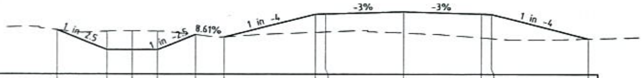


DATUM RL 192.500

DESIGN	194.20	193.30	193.30	193.30	193.91	193.82	194.83	194.84	194.93	194.84	194.83	193.80
EXISTING SURFACE	194.2	194.02	194.03	194.01	193.91	193.82	193.92	193.93	193.84	193.76	193.74	193.8
OFFSET	-14.05	-11.80	-10.80	-9.80	-8.29	-7.55	-3.50	-3.10	0.00	3.10	3.50	7.62

CHAINAGE 1760

CL ROAD
X = 749191.22
Y = 5896160.83
RL = 194.52



DATUM RL 192.000

DESIGN	193.79	192.99	192.99	192.99	193.60	193.50	194.41	194.42	194.52	194.42	194.41	193.45
EXISTING SURFACE	193.79	193.73	193.74	193.74	193.6	193.5	193.69	193.71	193.67	193.48	193.45	193.45
OFFSET	-13.79	-11.80	-10.80	-9.80	-8.28	-7.14	-3.50	-3.10	0.00	3.10	3.50	7.36

CHAINAGE 1830

CL ROAD
X = 749189.55
Y = 5896150.97
RL = 194.58

DATUM RL 192.500

DESIGN	193.82	193.04	193.04	193.04	193.66	193.56	194.47	194.48	194.58	194.48	194.47	193.47
EXISTING SURFACE	193.82	193.81	193.83	193.81	193.66	193.56	193.74	193.76	193.71	193.53	193.5	193.47
OFFSET	-13.75	-11.80	-10.80	-9.80	-8.24	-7.16	-3.50	-3.10	0.00	3.10	3.50	7.51

CHAINAGE 1820

CL ROAD
X = 749187.89
Y = 5896141.11
RL = 194.64

DATUM RL 192.500

DESIGN	193.88	193.08	193.08	193.08	193.72	193.61	194.53	194.54	194.64	194.54	194.53	193.60
EXISTING SURFACE	193.88	193.9	193.91	193.86	193.72	193.61	193.79	193.8	193.8	193.58	193.55	193.6
OFFSET	-13.79	-11.80	-10.80	-9.80	-8.20	-7.18	-3.50	-3.10	0.00	3.10	3.50	7.22

CHAINAGE 1810

CL ROAD
X = 749186.22
Y = 5896131.25
RL = 194.69

DATUM RL 192.500

DESIGN	194.02	193.16	193.12	193.12	193.77	193.66	194.59	194.60	194.69	194.60	194.59	193.61
EXISTING SURFACE	194.02	194.02	193.94	193.93	193.77	193.66	193.83	193.85	193.8	193.6	193.57	193.61
OFFSET	-14.04	-11.90	-10.84	-9.83	-8.18	-7.21	-3.50	-3.10	0.00	3.10	3.50	7.41

CHAINAGE 1800

SCALE 1:100

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ALTERATIONS	PROJ. No. 501436	ORIGINAL ISSUE

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CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639

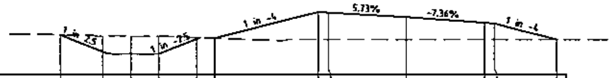
TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

WESTERN ROAD LEVEE
CROSS SECTIONS

SCALE 100
SIZE A1
DRG No. EHT-CA-DR-004E
SHT 3/13
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\120\CROSS SECTIONS.DWG

CL ROAD
X = 749198.35
Y = 5896200.17
RL = 194.28



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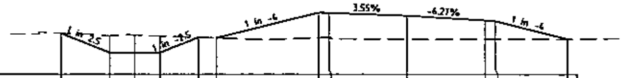
DESIGN	193.58	192.91	192.82	192.82	193.42	193.45	194.48	194.45	194.28	194.05	194.02	193.40
EXISTING SURFACE	193.58	193.53	193.51	193.53	193.48	193.45	193.4	193.4	193.4	193.4	193.4	193.4
OFFSET	-13.75	-12.07	-10.95	-9.84	-8.32	-7.62	-3.50	-3.10	0.00	3.10	3.50	5.97

CHAINAGE 1870

CL ROAD
X = 749196.22
Y = 5896190.41
RL = 194.34



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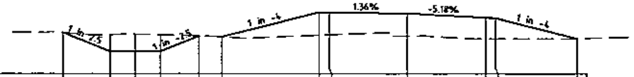
DESIGN	193.63	192.86	192.86	192.86	193.47	193.45	194.46	194.45	194.34	194.14	194.12	193.40
EXISTING SURFACE	193.63	193.54	193.56	193.52	193.47	193.45	193.45	193.47	193.4	193.4	193.4	193.4
OFFSET	-13.73	-11.80	-10.80	-9.80	-8.20	-7.56	-3.50	-3.10	0.00	3.10	3.50	6.37

CHAINAGE 1860

CL ROAD
X = 749194.55
Y = 5896180.55
RL = 194.4

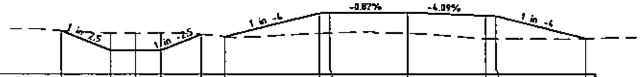


DATUM RL 192.000

DESIGN	193.65	192.90	192.90	192.90	193.52	193.48	194.44	194.44	194.40	194.24	194.21	193.41
EXISTING SURFACE	193.65	193.57	193.58	193.57	193.52	193.48	193.54	193.56	193.5	193.4	193.4	193.41
OFFSET	-13.47	-11.80	-10.80	-9.83	-8.27	-7.35	-3.50	-3.10	0.00	3.10	3.50	6.74

CHAINAGE 1850

CL ROAD
X = 749192.89
Y = 5896170.69
RL = 194.46

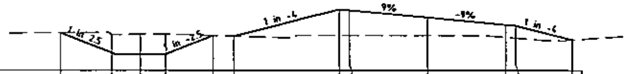


DATUM RL 192.000

DESIGN	193.73	192.95	192.95	192.95	193.59	193.49	194.43	194.43	194.46	194.33	194.31	193.42
EXISTING SURFACE	193.73	193.64	193.63	193.65	193.59	193.49	193.62	193.64	193.62	193.4	193.4	193.42
OFFSET	-13.76	-11.80	-10.80	-9.80	-8.20	-7.26	-3.50	-3.10	0.00	3.10	3.50	7.07

CHAINAGE 1840

CL ROAD
X = 749217.1
Y = 5896235.13
RL = 194.1

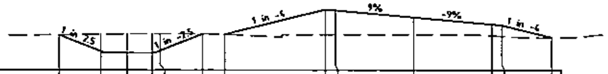


DATUM RL 192.000

DESIGN	193.51	192.69	192.64	192.64	193.39	193.37	194.41	194.38	194.10	193.82	193.79	193.22
EXISTING SURFACE	193.51	193.43	193.45	193.44	193.39	193.37	193.4	193.4	193.4	193.33	193.3	193.22
OFFSET	-14.56	-12.53	-11.31	-10.39	-8.51	-7.69	-3.50	-3.10	0.00	3.10	3.50	5.74

CHAINAGE 1910

CL ROAD
X = 749210.98
Y = 5896227.23
RL = 194.11

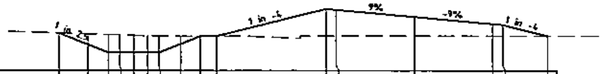


DATUM RL 192.000

DESIGN	193.40	192.74	192.68	192.68	192.77	193.44	193.42	194.42	194.38	194.11	193.83	193.79	193.30
EXISTING SURFACE	193.4	193.42	193.43	193.44	193.44	193.44	193.42	193.4	193.4	193.4	193.36	193.34	193.3
OFFSET	-14.06	-12.40	-11.36	-10.37	-10.05	-8.37	-7.50	-3.50	-3.10	0.00	3.10	3.50	5.48

CHAINAGE 1900

CL ROAD
X = 749205.78
Y = 5896218.7
RL = 194.36

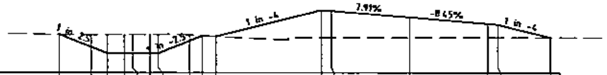


DATUM RL 192.000

DESIGN	193.51	193.05	192.73	192.73	192.73	192.73	192.73	193.07	193.38	193.39	194.47	194.44	194.16	193.88	193.84	193.40
EXISTING SURFACE	193.51	193.48	193.45	193.43	193.42	193.41	193.4	193.39	193.38	193.39	193.4	193.4	193.4	193.4	193.4	193.4
OFFSET	-14.09	-12.94	-12.12	-11.68	-11.12	-10.58	-10.12	-9.26	-8.49	-7.84	-3.50	-3.10	0.00	3.10	3.50	5.27

CHAINAGE 1890

CL ROAD
X = 749201.55
Y = 5896209.64
RL = 194.22



DATUM RL 192.000

DESIGN	193.54	193.03	192.77	192.77	192.77	192.77	192.77	193.27	193.48	193.45	194.49	194.46	194.22	193.95	193.92	193.40
EXISTING SURFACE	193.54	193.51	193.52	193.52	193.52	193.52	193.52	193.5	193.48	193.45	193.4	193.4	193.4	193.4	193.4	193.4
OFFSET	-13.90	-12.62	-11.98	-11.30	-10.98	-10.29	-9.98	-8.73	-8.22	-7.68	-3.50	-3.10	0.00	3.10	3.50	5.58

CHAINAGE 1880

SCALE 1:100

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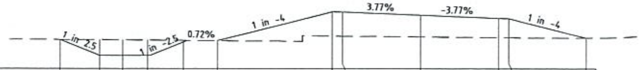
FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTOM\E304XXX\E3046XX\E304639\PS09364\120\CROSS SECTIONS.DWG

CL ROAD
X = 749240.14
Y = 5896254.13
RL = 194.1

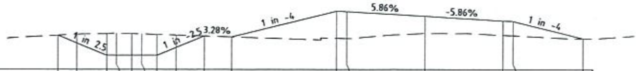


DATUM RL 192.000

DESIGN	193.13	192.51	192.51	192.51	193.03	193.09	194.23	194.22	194.10	193.98	193.97	193.20
EXISTING SURFACE	193.13	193.12	193.12	193.11	193.1	193.09	193.28	193.27	193.24	193.22	193.21	193.2
OFFSET	-14.31	-12.74	-11.82	-10.83	-9.42	-8.06	-3.50	-3.10	0.00	3.10	3.50	6.57

CHAINAGE 1940

CL ROAD
X = 749231.77
Y = 5896248.67
RL = 194.1

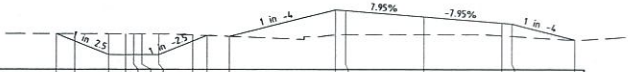


DATUM RL 192.000

DESIGN	193.32	193.02	192.55	192.55	192.55	192.55	192.55	192.86	193.30	193.26	194.31	194.28	194.10	193.92	193.89	193.20
EXISTING SURFACE	193.32	193.37	193.39	193.4	193.39	193.38	193.36	193.34	193.3	193.26	193.21	193.2	193.4	193.33	193.31	193.2
OFFSET	-14.57	-13.81	-12.63	-12.25	-11.63	-11.24	-10.63	-9.87	-8.76	-7.67	-3.50	-3.10	0.00	3.10	3.50	6.28

CHAINAGE 1930

CL ROAD
X = 749224.06
Y = 5896242.31
RL = 194.1



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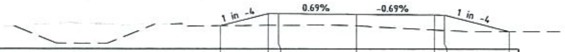
DESIGN	193.43	193.13	192.59	192.59	192.59	192.59	192.59	193.13	193.36	193.33	194.38	194.35	194.10	193.85	193.82	193.20
EXISTING SURFACE	193.43	193.42	193.42	193.41	193.41	193.41	193.41	193.38	193.36	193.33	193.39	193.4	193.4	193.36	193.33	193.2
OFFSET	-14.59	-13.85	-12.52	-11.84	-11.52	-11.19	-10.52	-9.18	-8.61	-7.71	-3.50	-3.10	0.00	3.10	3.50	5.99

CHAINAGE 1920

CL ROAD
X = 749255.91
Y = 5896271.25
RL = 193.87

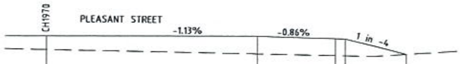


DATUM RL 192.500

DESIGN	193.41	193.89	193.89	193.87	193.84	193.84	193.20
EXISTING SURFACE	193.41	193.42	193.43	193.42	193.26	193.24	193.2
OFFSET	-5.40	-3.50	-3.10	0.00	3.10	3.50	6.06

CHAINAGE 1970

CL ROAD
X = 749258.07
Y = 5896262.98
RL = 193.98

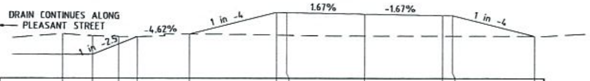


DATUM RL 192.500

DESIGN	193.88	193.98	193.89	193.87	193.27
EXISTING SURFACE	193.44	193.28	193.22	193.21	193.27
OFFSET	-8.39	0.00	3.10	3.50	5.91

CHAINAGE 1960

CL ROAD
X = 749249.04
Y = 5896258.68
RL = 194.07



DATUM RL 191.500

DESIGN	192.46	192.46	192.88	193.17	193.26	194.13	194.12	194.07	194.02	194.01	193.20
EXISTING SURFACE	193.28	193.2	193.17	193.17	193.26	193.23	193.23	193.2	193.2	193.2	193.2
OFFSET	-12.00	-10.80	-9.76	-9.03	-6.96	-3.50	-3.10	0.00	3.10	3.50	6.75

CHAINAGE 1950

SCALE 1:100

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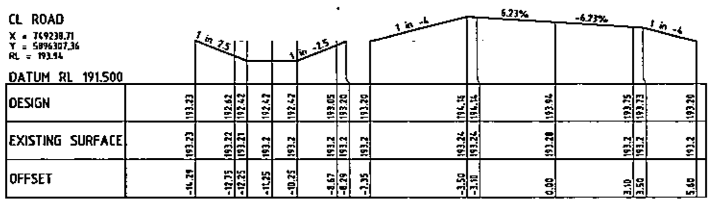

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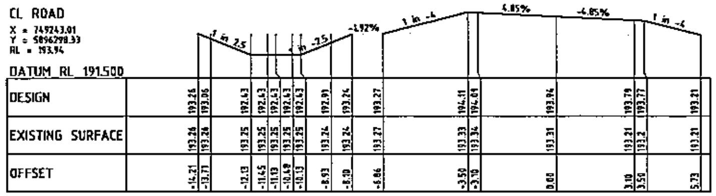

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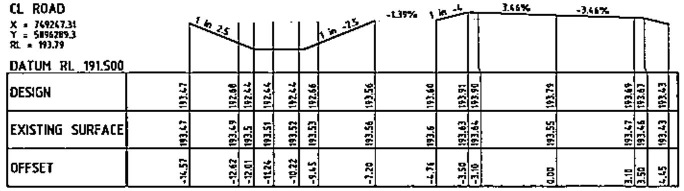
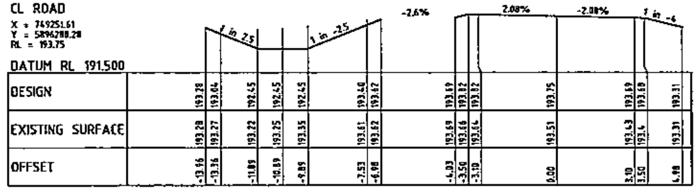
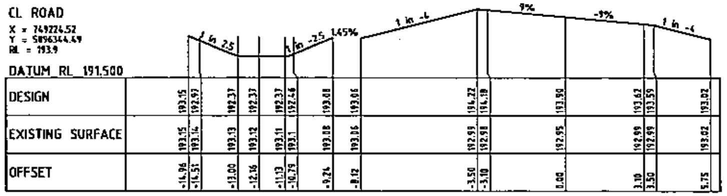


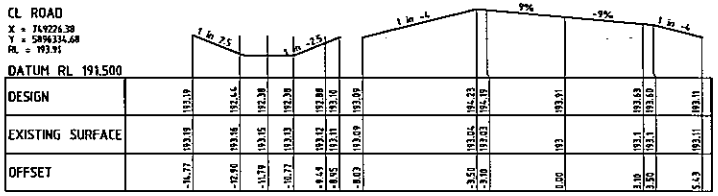
CHAINAGE 1990



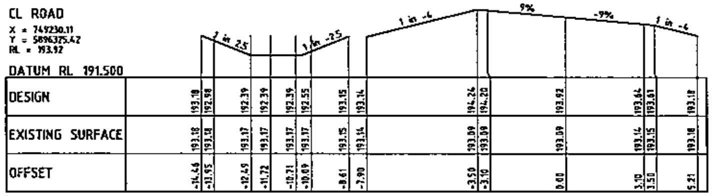
CHAINAGE 1980



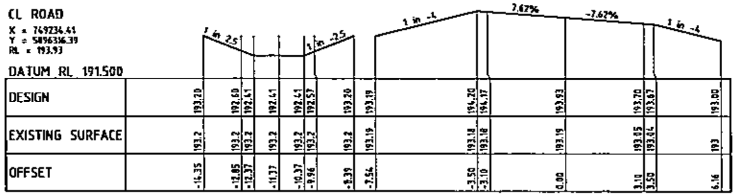
CHAINAGE 2050



CHAINAGE 2040



CHAINAGE 2030



CHAINAGE 2020

SCALE 1:100

ISSUED FOR TENDER

ALTERATIONS	PROJ. No.	501436	ORIGINAL ISSUE

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REFERENCES

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CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL DRAWING No. E304639

TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

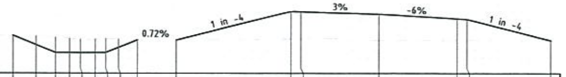
WESTERN ROAD LEVEE
CROSS SECTIONS

SCALE 1:100
SIZE A1
DWG No. EHT-CA-DR-004H SHT 6/13 REV. 0

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTING\E304XXX\E3046XX\E304639\PS01364\120\CROSS SECTIONS.DWG

CL ROAD
X = 749229.65
Y = 5896384.85
RL = 193.86

DATUM RL 191.500

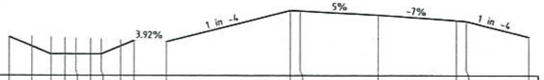


DESIGN	193.00	192.63	192.32	192.32	192.32	192.32	192.32	192.53	192.83	192.82	193.96	193.95	193.86	193.67	193.65	192.81
EXISTING SURFACE	193	192.98	192.93	192.89	192.87	192.86	192.88	192.86	192.83	192.82	192.87	192.87	192.83	192.82	192.82	192.81
OFFSET	-14.57	-13.65	-12.88	-12.31	-11.88	-11.30	-10.88	-10.37	-9.62	-8.07	-3.50	-3.10	0.00	3.10	3.50	6.84

CHAINAGE 2090

CL ROAD
X = 749227.95
Y = 5896374.19
RL = 193.87

DATUM RL 191.500

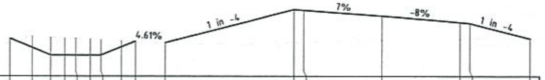


DESIGN	193.00	192.64	192.34	192.34	192.34	192.34	192.34	192.65	192.86	192.81	194.04	194.02	193.87	193.65	193.62	193.00
EXISTING SURFACE	193	193.04	193	192.98	192.96	192.93	192.92	192.88	192.86	192.81	192.85	192.86	192.94	193	193	193
OFFSET	-14.69	-13.79	-13.03	-12.47	-12.03	-11.45	-11.03	-10.25	-9.72	-8.44	-3.50	-3.10	0.00	3.10	3.50	5.99

CHAINAGE 2080

CL ROAD
X = 749226.25
Y = 5896364.34
RL = 193.88

DATUM RL 191.500

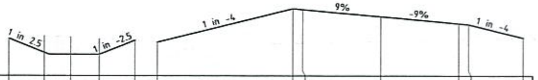


DESIGN	193.00	192.64	192.35	192.35	192.35	192.35	192.35	192.68	192.90	192.84	194.12	194.10	193.88	193.63	193.60	193.00
EXISTING SURFACE	193	193.08	193.05	193.02	193	192.98	192.96	192.92	192.9	192.84	192.85	192.85	192.94	192.99	193	193
OFFSET	-14.81	-13.92	-13.19	-12.62	-12.19	-11.61	-11.19	-10.37	-9.81	-8.63	-3.50	-3.10	0.00	3.10	3.50	5.90

CHAINAGE 2070

CL ROAD
X = 749224.64
Y = 5896354.47
RL = 193.89

DATUM RL 191.500

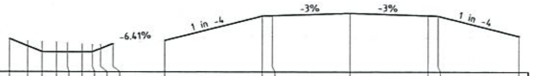


DESIGN	193.00	192.44	192.36	192.36	192.93	192.85	194.20	194.17	193.89	193.61	193.57	193.03
EXISTING SURFACE	193	193.11	193.05	192.99	192.93	192.85	192.81	192.82	192.9	192.97	192.98	193.03
OFFSET	-14.82	-13.41	-12.36	-11.22	-9.79	-8.90	-3.50	-3.10	0.00	3.10	3.50	5.68

CHAINAGE 2060

CL ROAD
X = 749236.44
Y = 5896423.47
RL = 193.81

DATUM RL 191.500



DESIGN	192.80	192.51	192.28	192.28	192.28	192.28	192.28	192.41	192.60	192.74	193.71	193.72	193.81	193.72	193.71	192.90
EXISTING SURFACE	192.8	192.72	192.68	192.66	192.63	192.59	192.56	192.57	192.6	192.74	192.9	192.9	192.75	192.84	192.85	192.9
OFFSET	-13.57	-12.84	-12.27	-11.70	-11.27	-10.68	-10.27	-9.94	-9.45	-7.39	-3.50	-3.10	0.00	3.10	3.50	6.72

CHAINAGE 2130

CL ROAD
X = 749234.75
Y = 5896413.61
RL = 193.82

DATUM RL 191.500

DESIGN	192.89	192.61	192.29	192.29	192.29	192.29	192.29	192.50	192.64	192.69	193.04	193.72	193.73	193.82	193.73	193.72	192.80
EXISTING SURFACE	192.89	192.85	192.8	192.76	192.74	192.7	192.68	192.65	192.64	192.69	192.75	192.88	192.79	192.8	192.8	192.8	192.8
OFFSET	-13.92	-13.23	-12.42	-11.85	-11.42	-10.84	-10.42	-9.90	-9.54	-7.61	-6.21	-3.50	-3.10	0.00	3.10	3.50	7.18

CHAINAGE 2120

CL ROAD
X = 749233.05
Y = 5896403.76
RL = 193.84

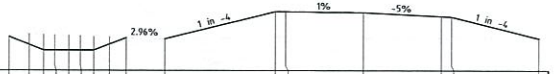
DATUM RL 191.500

DESIGN	192.91	192.57	192.30	192.30	192.30	192.30	192.30	192.58	192.77	192.80	193.80	193.80	193.84	193.71	193.70	192.80
EXISTING SURFACE	192.98	192.95	192.92	192.9	192.86	192.82	192.81	192.79	192.77	192.8	192.86	192.87	192.8	192.8	192.8	192.8
OFFSET	-14.09	-13.25	-12.58	-12.01	-11.58	-10.99	-10.58	-9.87	-9.40	-7.51	-3.50	-3.10	0.00	3.10	3.50	7.08

CHAINAGE 2110

CL ROAD
X = 749231.35
Y = 5896393.9
RL = 193.85

DATUM RL 191.500



DESIGN	192.86	192.54	192.31	192.31	192.31	192.31	192.31	192.56	192.83	192.78	193.88	193.88	193.85	193.69	193.67	192.80
EXISTING SURFACE	192.86	192.97	192.95	192.93	192.92	192.9	192.88	192.85	192.83	192.78	192.86	192.87	192.8	192.8	192.8	192.8
OFFSET	-14.10	-13.30	-12.73	-12.29	-11.73	-11.27	-10.73	-10.11	-9.45	-7.91	-3.50	-3.10	0.00	3.10	3.50	6.99

CHAINAGE 2100

SCALE 1:100

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ALTERATIONS

PROJ. No.	
501436	ORIGINAL ISSUE

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REFERENCES

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DATE	11-05-16
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CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No: E304639

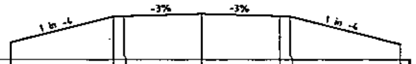
TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

WESTERN ROAD LEVEE
CROSS SECTIONS

SCALE 100
SIZE A1
DWG No. EHT-CA-DR-0041
SHT 7/13
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509364\12D\CROSS SECTIONS.DWG

CL ROAD
X = 749243.24
Y = 5896462.89
RL = 193.8

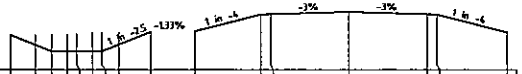


DATUM RL 192.000

DESIGN	192.67	193.69	193.71	193.80	193.71	193.69	192.60
EXISTING SURFACE	192.67	192.82	192.83	192.88	192.87	192.87	192.6
OFFSET	-7.59	-3.50	-3.10	0.00	3.10	3.50	7.88

CHAINAGE 2170

CL ROAD
X = 749241.54
Y = 5896453.03
RL = 193.8

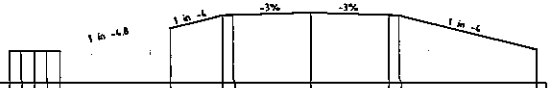


DATUM RL 191.500

DESIGN	192.90	192.50	192.24	192.24	192.24	192.24	192.24	192.51	193.02	193.04	193.69	193.71	193.80	193.71	193.69	193.00
EXISTING SURFACE	192.9	192.9	192.9	192.9	192.95	192.99	192.99	193	193.02	193.04	193.07	193.07	193.08	193	193	193
OFFSET	-13.44	-12.46	-11.81	-11.19	-10.81	-10.18	-9.81	-9.14	-7.87	-6.10	-3.50	-3.10	0.00	3.10	3.50	6.28

CHAINAGE 2160

CL ROAD
X = 749239.84
Y = 5896443.18
RL = 193.8

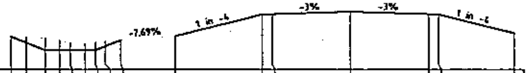


DATUM RL 191.000

DESIGN	192.26	192.26	192.26	192.26	192.26	193.17	193.69	193.71	193.80	193.71	193.69	192.33
EXISTING SURFACE	192.11	192.12	192.13	192.14	192.15	193.17	192.87	192.81	192.34	192.18	192.21	192.33
OFFSET	-11.96	-11.51	-10.96	-10.49	-9.96	-5.58	-3.50	-3.10	0.00	3.10	3.50	8.96

CHAINAGE 2150

CL ROAD
X = 749238.14
Y = 5896433.32
RL = 193.8

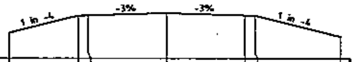


DATUM RL 191.500

DESIGN	192.81	192.56	192.27	192.27	192.27	192.27	192.27	192.42	192.67	192.84	193.70	193.71	193.80	193.71	193.70	192.95
EXISTING SURFACE	192.81	192.79	192.74	192.67	192.56	192.54	192.58	192.62	192.67	192.84	192.86	192.81	192.73	192.82	192.77	192.95
OFFSET	-13.46	-12.86	-12.12	-11.54	-11.12	-10.53	-10.12	-9.72	-9.11	-6.95	-3.50	-3.10	0.00	3.10	3.50	6.49

CHAINAGE 2140

CL ROAD
X = 749251.72
Y = 5896512.16
RL = 193.32

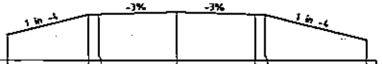


DATUM RL 191.500

DESIGN	192.53	193.21	193.22	193.32	193.22	193.21	192.36
EXISTING SURFACE	192.53	192.39	192.4	192.61	192.4	192.4	192.36
OFFSET	-6.23	-3.50	-3.10	0.00	3.10	3.50	6.89

CHAINAGE 2220

CL ROAD
X = 749250.02
Y = 5896502.31
RL = 193.43

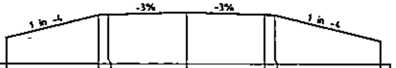


DATUM RL 191.500

DESIGN	192.52	193.33	193.34	193.43	193.34	193.33	192.32
EXISTING SURFACE	192.52	192.39	192.42	192.58	192.4	192.4	192.32
OFFSET	-6.72	-3.50	-3.10	0.00	3.10	3.50	7.52

CHAINAGE 2210

CL ROAD
X = 749248.32
Y = 5896492.45
RL = 193.55



DATUM RL 191.500

DESIGN	192.54	193.45	193.46	193.55	193.46	193.45	192.40
EXISTING SURFACE	192.54	192.43	192.45	192.6	192.4	192.4	192.4
OFFSET	-7.15	-3.50	-3.10	0.00	3.10	3.50	7.70

CHAINAGE 2200

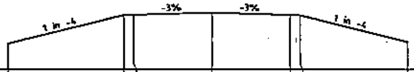
CL ROAD
X = 749246.63
Y = 5896482.6
RL = 193.67

DATUM RL 191.500

DESIGN	192.59	193.57	193.58	193.67	193.58	193.57	192.46
EXISTING SURFACE	192.59	192.46	192.48	192.66	192.4	192.4	192.46
OFFSET	-7.42	-3.50	-3.10	0.00	3.10	3.50	7.92

CHAINAGE 2190

CL ROAD
X = 749244.93
Y = 5896472.74
RL = 193.77



DATUM RL 191.500

DESIGN	192.52	193.67	193.68	193.77	193.68	193.67	192.60
EXISTING SURFACE	192.52	192.63	192.65	192.72	192.77	192.56	192.6
OFFSET	-8.10	-3.50	-3.10	0.00	3.10	3.50	7.76

CHAINAGE 2180

SCALE 1:100

ISSUED FOR TENDER

ALTERATIONS

PROJ. No.	501435
	ORIGINAL ISSUE

REFERENCES

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CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL
DRAWING No. E304639

PROJECT CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

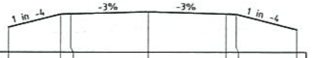
WESTERN ROAD LEVEE
CROSS SECTIONS

SIZE A1

DWG No. EHT-CA-DR-004J
8/13
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTOM\E304XXXX\E3044XXX\E304639\P509364\12D\CROSS SECTIONS.DWG

CL ROAD
X = 749260.2
Y = 5896561.44
RL = 193.11

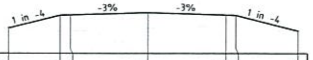


DATUM RL 191.500

DESIGN	192.49	193.01	193.02	193.11	193.02	193.01	192.40
EXISTING SURFACE	192.49	192.28	192.29	192.46	192.43	192.43	192.4
OFFSET	-5.58	-3.50	-3.10	0.00	3.10	3.50	5.92

CHAINAGE 2270

CL ROAD
X = 749258.5
Y = 5896551.58
RL = 193.12

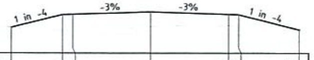


DATUM RL 191.500

DESIGN	192.51	193.02	193.03	193.12	193.03	193.02	192.40
EXISTING SURFACE	192.51	192.37	192.39	192.51	192.54	192.52	192.4
OFFSET	-5.55	-3.50	-3.10	0.00	3.10	3.50	5.98

CHAINAGE 2260

CL ROAD
X = 749256.8
Y = 5896541.73
RL = 193.14

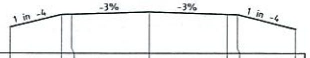


DATUM RL 191.500

DESIGN	192.52	193.03	193.04	193.14	193.04	193.03	192.43
EXISTING SURFACE	192.52	192.39	192.4	192.54	192.6	192.58	192.43
OFFSET	-5.55	-3.50	-3.10	0.00	3.10	3.50	5.92

CHAINAGE 2250

CL ROAD
X = 749255.11
Y = 5896531.87
RL = 193.15

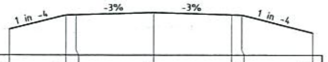


DATUM RL 191.500

DESIGN	192.53	193.05	193.06	193.15	193.06	193.05	192.46
EXISTING SURFACE	192.53	192.4	192.4	192.58	192.6	192.6	192.46
OFFSET	-5.55	-3.50	-3.10	0.00	3.10	3.50	5.82

CHAINAGE 2240

CL ROAD
X = 749253.41
Y = 5896522.02
RL = 193.2

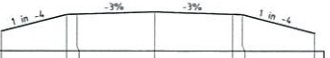


DATUM RL 191.500

DESIGN	192.53	193.10	193.11	193.20	193.11	193.10	192.39
EXISTING SURFACE	192.53	192.4	192.4	192.61	192.43	192.43	192.39
OFFSET	-5.76	-3.50	-3.10	0.00	3.10	3.50	6.33

CHAINAGE 2230

CL ROAD
X = 749268.68
Y = 5896610.71
RL = 193.05

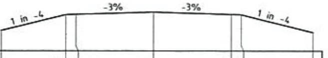


DATUM RL 191.500

DESIGN	192.29	192.94	192.95	193.05	192.95	192.94	192.22
EXISTING SURFACE	192.29	192.16	192.19	192.38	192.38	192.36	192.22
OFFSET	-6.10	-3.50	-3.10	0.00	3.10	3.50	6.38

CHAINAGE 2320

CL ROAD
X = 749266.98
Y = 5896600.86
RL = 193.06

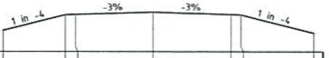


DATUM RL 191.500

DESIGN	192.31	192.95	192.97	193.06	192.97	192.95	192.24
EXISTING SURFACE	192.31	192.17	192.2	192.39	192.4	192.38	192.24
OFFSET	-6.08	-3.50	-3.10	0.00	3.10	3.50	6.35

CHAINAGE 2310

CL ROAD
X = 749265.28
Y = 5896591
RL = 193.07

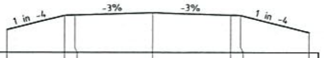


DATUM RL 191.500

DESIGN	192.35	192.97	192.98	193.07	192.98	192.97	192.24
EXISTING SURFACE	192.35	192.17	192.2	192.39	192.4	192.4	192.24
OFFSET	-5.97	-3.50	-3.10	0.00	3.10	3.50	6.39

CHAINAGE 2300

CL ROAD
X = 749263.59
Y = 5896581.15
RL = 193.09

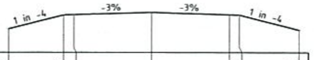


DATUM RL 191.500

DESIGN	192.41	192.98	192.99	193.09	192.99	192.98	192.30
EXISTING SURFACE	192.41	192.17	192.2	192.41	192.41	192.41	192.3
OFFSET	-5.79	-3.50	-3.10	0.00	3.10	3.50	6.22

CHAINAGE 2290

CL ROAD
X = 749261.89
Y = 5896571.29
RL = 193.1

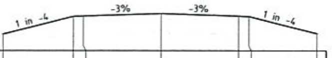


DATUM RL 191.500

DESIGN	192.45	192.99	193.01	193.10	193.01	192.99	192.40
EXISTING SURFACE	192.45	192.21	192.21	192.42	192.42	192.41	192.4
OFFSET	-5.69	-3.50	-3.10	0.00	3.10	3.50	5.87

CHAINAGE 2280

CL ROAD
X = 749277.16
Y = 5896659.99
RL = 192.98

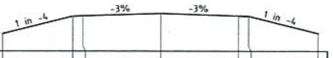


DATUM RL 191.500

DESIGN	192.18	192.88	192.89	192.98	192.89	192.88	192.20
EXISTING SURFACE	192.18	192.08	192.1	192.28	192.2	192.2	192.2
OFFSET	-6.30	-3.50	-3.10	0.00	3.10	3.50	6.21

CHAINAGE 2370

CL ROAD
X = 749275.46
Y = 5896650.13
RL = 193

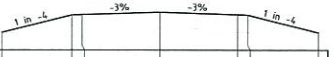


DATUM RL 191.500

DESIGN	192.19	192.89	192.90	193.00	192.90	192.89	192.20
EXISTING SURFACE	192.19	192.1	192.13	192.28	192.2	192.2	192.2
OFFSET	-6.30	-3.50	-3.10	0.00	3.10	3.50	6.26

CHAINAGE 2360

CL ROAD
X = 749273.77
Y = 5896640.28
RL = 193.01

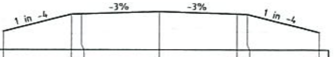


DATUM RL 191.500

DESIGN	192.21	192.90	192.91	193.01	192.91	192.90	192.20
EXISTING SURFACE	192.21	192.12	192.14	192.29	192.2	192.2	192.2
OFFSET	-6.28	-3.50	-3.10	0.00	3.10	3.50	6.31

CHAINAGE 2350

CL ROAD
X = 749272.07
Y = 5896630.42
RL = 193.02

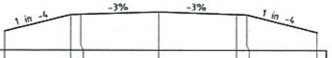


DATUM RL 191.500

DESIGN	192.24	192.92	192.93	193.02	192.93	192.92	192.20
EXISTING SURFACE	192.24	192.14	192.16	192.33	192.22	192.22	192.2
OFFSET	-6.21	-3.50	-3.10	0.00	3.10	3.50	6.36

CHAINAGE 2340

CL ROAD
X = 749270.37
Y = 5896620.57
RL = 193.03



DATUM RL 191.500

DESIGN	192.27	192.93	192.94	193.03	192.94	192.93	192.23
EXISTING SURFACE	192.27	192.15	192.17	192.36	192.32	192.32	192.23
OFFSET	-6.13	-3.50	-3.10	0.00	3.10	3.50	6.29

CHAINAGE 2330

2 1 0 2 4 6m
SCALE 1:100

ISSUED FOR TENDER

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ALTERATIONS	PROJ. No. 501436	ORIGINAL ISSUE

REFERENCES

DRAWN	BOS
CHECKED	
DESIGNED	
CHECKED	PS
APPROVED	TG
DATE	11-05-16
CLIENT APP'D	
DATE	

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CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639

TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

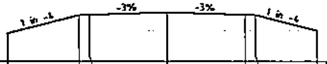
WESTERN ROAD LEVEE
CROSS SECTIONS

SCALE 100
SIZE A1
DRG No. EHT-CA-DR-004K
SHT 9/13
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509364\120\CROSS SECTIONS.DWG

CL ROAD
X = 749285.64
Y = 5896709.26
RL = 192.92

DATUM RL 191.000

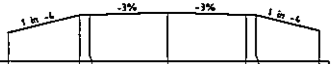


DESIGN	192.10	192.81	192.82	192.92	192.82	192.81	192.20
EXISTING SURFACE	192.1	192.03	192.06	192.24	192.2	192.2	192.2
OFFSET	-6.35	-3.50	-3.10	0.00	3.10	3.50	5.95

CHAINAGE 2420

CL ROAD
X = 749283.94
Y = 5896699.41
RL = 192.93

DATUM RL 191.000

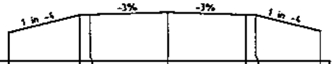


DESIGN	192.12	192.83	192.84	192.93	192.84	192.83	192.20
EXISTING SURFACE	192.12	192.05	192.08	192.24	192.2	192.2	192.2
OFFSET	-6.33	-3.50	-3.10	0.00	3.10	3.50	6.00

CHAINAGE 2410

CL ROAD
X = 749282.25
Y = 5896689.55
RL = 192.94

DATUM RL 191.000

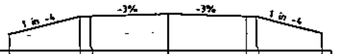


DESIGN	192.13	192.84	192.85	192.94	192.85	192.84	192.20
EXISTING SURFACE	192.13	192.06	192.09	192.25	192.2	192.2	192.2
OFFSET	-6.32	-3.50	-3.10	0.00	3.10	3.50	6.05

CHAINAGE 2400

CL ROAD
X = 749280.55
Y = 5896679.7
RL = 192.96

DATUM RL 191.500

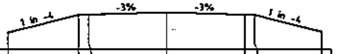


DESIGN	192.15	192.85	192.86	192.96	192.86	192.85	192.20
EXISTING SURFACE	192.15	192.06	192.09	192.26	192.2	192.2	192.2
OFFSET	-6.32	-3.50	-3.10	0.00	3.10	3.50	6.11

CHAINAGE 2390

CL ROAD
X = 749278.85
Y = 5896669.84
RL = 192.97

DATUM RL 191.500

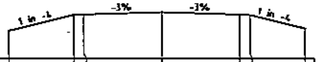


DESIGN	192.16	192.86	192.88	192.97	192.88	192.86	192.20
EXISTING SURFACE	192.16	192.06	192.09	192.27	192.2	192.2	192.2
OFFSET	-6.31	-3.50	-3.10	0.00	3.10	3.50	6.16

CHAINAGE 2380

CL ROAD
X = 749294.12
Y = 5896758.54
RL = 192.85

DATUM RL 191.000

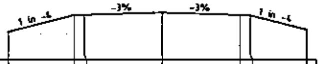


DESIGN	192.10	192.75	192.76	192.85	192.76	192.75	192.20
EXISTING SURFACE	192.1	192.05	192.07	192.26	192.2	192.2	192.2
OFFSET	-6.08	-3.50	-3.10	0.00	3.10	3.50	5.69

CHAINAGE 2470

CL ROAD
X = 749292.42
Y = 5896748.68
RL = 192.87

DATUM RL 191.000

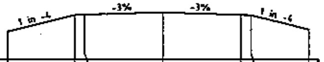


DESIGN	192.11	192.76	192.77	192.87	192.77	192.76	192.20
EXISTING SURFACE	192.11	192.04	192.08	192.25	192.2	192.2	192.2
OFFSET	-6.12	-3.50	-3.10	0.00	3.10	3.50	5.74

CHAINAGE 2460

CL ROAD
X = 749290.73
Y = 5896738.83
RL = 192.88

DATUM RL 191.000

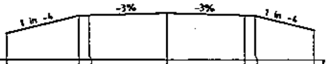


DESIGN	192.11	192.77	192.79	192.88	192.79	192.77	192.20
EXISTING SURFACE	192.11	192.01	192.04	192.23	192.2	192.2	192.2
OFFSET	-6.16	-3.50	-3.10	0.00	3.10	3.50	5.80

CHAINAGE 2450

CL ROAD
X = 749289.03
Y = 5896728.97
RL = 192.89

DATUM RL 191.000

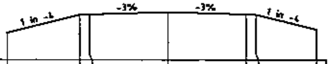


DESIGN	192.07	192.79	192.80	192.89	192.80	192.79	192.20
EXISTING SURFACE	192.07	192.01	192.04	192.23	192.2	192.2	192.2
OFFSET	-6.37	-3.50	-3.10	0.00	3.10	3.50	5.85

CHAINAGE 2440

CL ROAD
X = 749287.33
Y = 5896719.12
RL = 192.9

DATUM RL 191.000

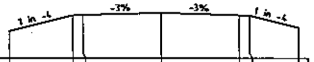


DESIGN	192.09	192.80	192.81	192.90	192.81	192.80	192.20
EXISTING SURFACE	192.09	192.02	192.05	192.23	192.2	192.2	192.2
OFFSET	-6.36	-3.50	-3.10	0.00	3.10	3.50	5.90

CHAINAGE 2430

CL ROAD
X = 749302.6
Y = 5896807.82
RL = 192.79

DATUM RL 191.000

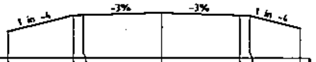


DESIGN	192.06	192.68	192.70	192.79	192.70	192.68	192.20
EXISTING SURFACE	192.06	192	192.03	192.22	192.2	192.2	192.2
OFFSET	-6.00	-3.50	-3.10	0.00	3.10	3.50	5.43

CHAINAGE 2520

CL ROAD
X = 749300.9
Y = 5896797.96
RL = 192.8

DATUM RL 191.000

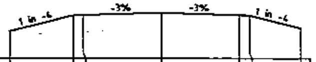


DESIGN	192.05	192.70	192.71	192.80	192.71	192.70	192.20
EXISTING SURFACE	192.05	192	192.03	192.22	192.2	192.2	192.2
OFFSET	-6.09	-3.50	-3.10	0.00	3.10	3.50	5.49

CHAINAGE 2510

CL ROAD
X = 749299.21
Y = 5896788.11
RL = 192.81

DATUM RL 191.000

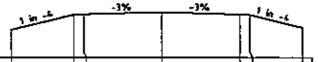


DESIGN	192.08	192.71	192.72	192.81	192.72	192.71	192.20
EXISTING SURFACE	192.08	192.02	192.05	192.2	192.2	192.2	192.2
OFFSET	-6.02	-3.50	-3.10	0.00	3.10	3.50	5.54

CHAINAGE 2500

CL ROAD
X = 749297.51
Y = 5896778.25
RL = 192.83

DATUM RL 191.000

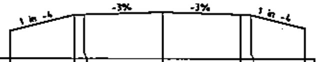


DESIGN	192.10	192.72	192.73	192.83	192.73	192.72	192.20
EXISTING SURFACE	192.1	192.04	192.06	192.23	192.2	192.2	192.2
OFFSET	-5.97	-3.50	-3.10	0.00	3.10	3.50	5.59

CHAINAGE 2490

CL ROAD
X = 749295.81
Y = 5896768.4
RL = 192.84

DATUM RL 191.000



DESIGN	192.10	192.74	192.75	192.84	192.75	192.74	192.20
EXISTING SURFACE	192.1	192.05	192.07	192.24	192.2	192.2	192.2
OFFSET	-6.04	-3.50	-3.10	0.00	3.10	3.50	5.64

CHAINAGE 2480

SCALE 1:100

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ALTERATIONS
PROJ. No. 501436 ORIGINAL ISSUE

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REFERENCES

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CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL
ENTURA REF No. E304639

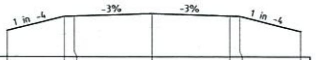
PROJECT CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

WESTERN ROAD LEVEE
CROSS SECTIONS

SCALE 100
SIZE A1
DWG No. EHT-CA-DR-004L
10/13
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTING\E304XXX\E3046XX\E304639\P509364\120\CROSS SECTIONS.DWG

CL ROAD
X = 749311.08
Y = 5896857.09
RL = 192.71

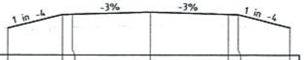


DATUM RL 191.000

DESIGN	192.04	192.61	192.62	192.71	192.62	192.61	192.00
EXISTING SURFACE	192.04	191.9	191.94	192.16	192.16	192.13	192
OFFSET	-5.77	-3.50	-3.10	0.00	3.10	3.50	5.93

CHAINAGE 2570

CL ROAD
X = 749309.38
Y = 5896847.24
RL = 192.73

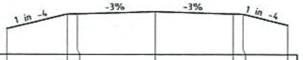


DATUM RL 191.000

DESIGN	192.08	192.63	192.64	192.73	192.64	192.63	192.11
EXISTING SURFACE	192.08	192.11	192.12	192.2	192.17	192.15	192.11
OFFSET	-5.67	-3.50	-3.10	0.00	3.10	3.50	5.56

CHAINAGE 2560

CL ROAD
X = 749307.69
Y = 5896837.38
RL = 192.75

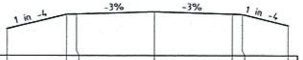


DATUM RL 191.000

DESIGN	192.04	192.65	192.66	192.75	192.66	192.65	192.20
EXISTING SURFACE	192.04	191.96	192	192.2	192.2	192.2	192.2
OFFSET	-5.91	-3.50	-3.10	0.00	3.10	3.50	5.28

CHAINAGE 2550

CL ROAD
X = 749305.99
Y = 5896827.53
RL = 192.76

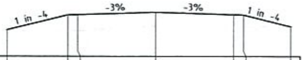


DATUM RL 191.000

DESIGN	192.07	192.66	192.67	192.76	192.67	192.66	192.20
EXISTING SURFACE	192.07	192.01	192.04	192.23	192.2	192.2	192.2
OFFSET	-5.87	-3.50	-3.10	0.00	3.10	3.50	5.33

CHAINAGE 2540

CL ROAD
X = 749304.29
Y = 5896817.67
RL = 192.78

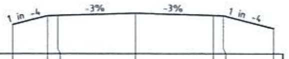


DATUM RL 191.000

DESIGN	192.07	192.67	192.68	192.78	192.68	192.67	192.20
EXISTING SURFACE	192.07	192	192.03	192.22	192.2	192.2	192.2
OFFSET	-5.92	-3.50	-3.10	0.00	3.10	3.50	5.38

CHAINAGE 2530

CL ROAD
X = 749319.56
Y = 5896906.37
RL = 192.62

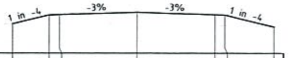


DATUM RL 191.000

DESIGN	192.17	192.52	192.53	192.62	192.53	192.52	192.02
EXISTING SURFACE	192.17	192.18	192.18	192.19	192.11	192.1	192.02
OFFSET	-4.88	-3.50	-3.10	0.00	3.10	3.50	5.50

CHAINAGE 2620

CL ROAD
X = 749317.86
Y = 5896896.51
RL = 192.64

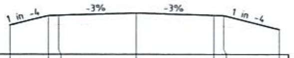


DATUM RL 191.000

DESIGN	192.17	192.53	192.55	192.64	192.55	192.53	192.04
EXISTING SURFACE	192.17	192.18	192.18	192.2	192.12	192.1	192.04
OFFSET	-4.96	-3.50	-3.10	0.00	3.10	3.50	5.47

CHAINAGE 2610

CL ROAD
X = 749316.17
Y = 5896886.66
RL = 192.66

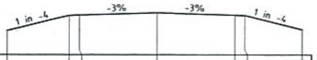


DATUM RL 191.000

DESIGN	192.17	192.55	192.56	192.66	192.56	192.55	192.00
EXISTING SURFACE	192.17	192.18	192.18	192.19	192.11	192.1	192
OFFSET	-5.03	-3.50	-3.10	0.00	3.10	3.50	5.71

CHAINAGE 2600

CL ROAD
X = 749314.47
Y = 5896876.8
RL = 192.68

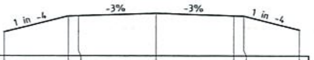


DATUM RL 191.000

DESIGN	191.95	192.57	192.58	192.68	192.58	192.57	192.00
EXISTING SURFACE	191.95	191.95	191.99	192.16	192.11	192.09	192
OFFSET	-5.97	-3.50	-3.10	0.00	3.10	3.50	5.78

CHAINAGE 2590

CL ROAD
X = 749312.78
Y = 5896866.95
RL = 192.69

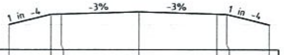


DATUM RL 191.000

DESIGN	191.95	192.59	192.60	192.69	192.60	192.59	192.03
EXISTING SURFACE	191.95	191.92	191.96	192.16	192.15	192.13	192.03
OFFSET	-6.06	-3.50	-3.10	0.00	3.10	3.50	5.72

CHAINAGE 2580

CL ROAD
X = 749328.04
Y = 5896955.64
RL = 192.53

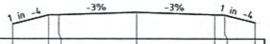


DATUM RL 191.000

DESIGN	192.01	192.42	192.43	192.53	192.43	192.42	192.00
EXISTING SURFACE	192.01	192.01	192	192	192	192	192
OFFSET	-5.16	-3.50	-3.10	0.00	3.10	3.50	5.19

CHAINAGE 2670

CL ROAD
X = 749326.34
Y = 5896945.79
RL = 192.55

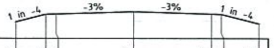


DATUM RL 191.500

DESIGN	192.09	192.44	192.45	192.55	192.45	192.44	192.14
EXISTING SURFACE	192.09	192.09	192.09	192.11	192.15	192.15	192.14
OFFSET	-4.92	-3.50	-3.10	0.00	3.10	3.50	4.71

CHAINAGE 2660

CL ROAD
X = 749324.65
Y = 5896935.93
RL = 192.56

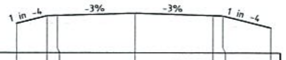


DATUM RL 191.500

DESIGN	192.16	192.46	192.47	192.56	192.47	192.46	192.08
EXISTING SURFACE	192.16	192.16	192.16	192.17	192.19	192.17	192.08
OFFSET	-4.70	-3.50	-3.10	0.00	3.10	3.50	5.00

CHAINAGE 2650

CL ROAD
X = 749322.95
Y = 5896926.08
RL = 192.58

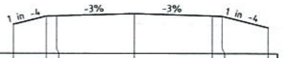


DATUM RL 191.000

DESIGN	192.17	192.48	192.49	192.58	192.49	192.48	192.00
EXISTING SURFACE	192.17	192.18	192.18	192.2	192.09	192.07	192
OFFSET	-4.72	-3.50	-3.10	0.00	3.10	3.50	5.41

CHAINAGE 2640

CL ROAD
X = 749321.26
Y = 5896916.22
RL = 192.6



DATUM RL 191.000

DESIGN	192.17	192.50	192.51	192.60	192.51	192.50	192.04
EXISTING SURFACE	192.17	192.18	192.18	192.19	192.12	192.11	192.04
OFFSET	-4.81	-3.50	-3.10	0.00	3.10	3.50	5.33

CHAINAGE 2630

2 1 0 2 4 6m
SCALE 1:100

ISSUED FOR TENDER

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ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE

REFERENCES

DRAWN	BDS
CHECKED	
DESIGNED	
CHECKED	PS
APPROVED	TG
DATE	11-05-16
CLIENT APP'D	
DATE	

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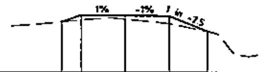
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No. E304639

TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WESTERN ROAD LEVEE
CROSS SECTIONS

SCALE 100
SIZE A1
DWG No. EHT-CA-DR-004M
SHT 11/13
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\120\CROSS SECTIONS.DWG

CL LEVEE
X = 749943.3
Y = 5894066.97
RL = 196.75

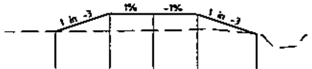


DATUM RL 194.500

DESIGN	196.51	196.77	196.75	196.73	196.12
EXISTING SURFACE	196.51	196.58	196.62	196.43	196.12
OFFSET	-2.53	-1.75	0.00	1.75	3.27

CHAINAGE 700

CL LEVEE
X = 749844.75
Y = 5894083.94
RL = 196.75



DATUM RL 194.500

DESIGN	196.05	196.77	196.75	196.73	195.95
EXISTING SURFACE	196.05	196.08	196.09	196.16	195.95
OFFSET	-3.89	-1.75	0.00	1.75	4.10

CHAINAGE 600

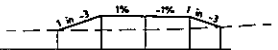
CL LEVEE
X = 749746.21
Y = 5894100.95
RL = 196.75

DATUM RL 195.000

DESIGN	196.25	196.77	196.75	196.73	196.30
EXISTING SURFACE	196.25	196.26	196.28	196.31	196.3
OFFSET	-3.39	-1.75	0.00	1.75	3.03

CHAINAGE 500

CL LEVEE
X = 749647.66
Y = 5894117.96
RL = 196.82

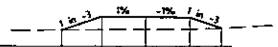


DATUM RL 195.500

DESIGN	196.26	196.84	196.82	196.80	196.39
EXISTING SURFACE	196.26	196.27	196.29	196.34	196.39
OFFSET	-3.49	-1.75	0.00	1.75	2.98

CHAINAGE 400

CL LEVEE
X = 749549.12
Y = 5894134.97
RL = 197.16



DATUM RL 196.000

DESIGN	196.64	197.18	197.16	197.14	196.72
EXISTING SURFACE	196.64	196.65	196.66	196.68	196.72
OFFSET	-3.34	-1.75	0.00	1.75	3.01

CHAINAGE 300

SCALE 1:100

ISSUED FOR TENDER

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ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE

NO PART OF THIS DRAWING MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM IN ANY FORM, OR TRANSMITTED BY ANY MEANS, WITHOUT THE PRIOR PERMISSION OF ENTURA.

REFERENCES

DRAWN	BDS
CHECKED	
DESIGNED	
CHECKED	PS
APPROVED	TG
DATE	11-05-16
CLIENT APP'D	
DATE	

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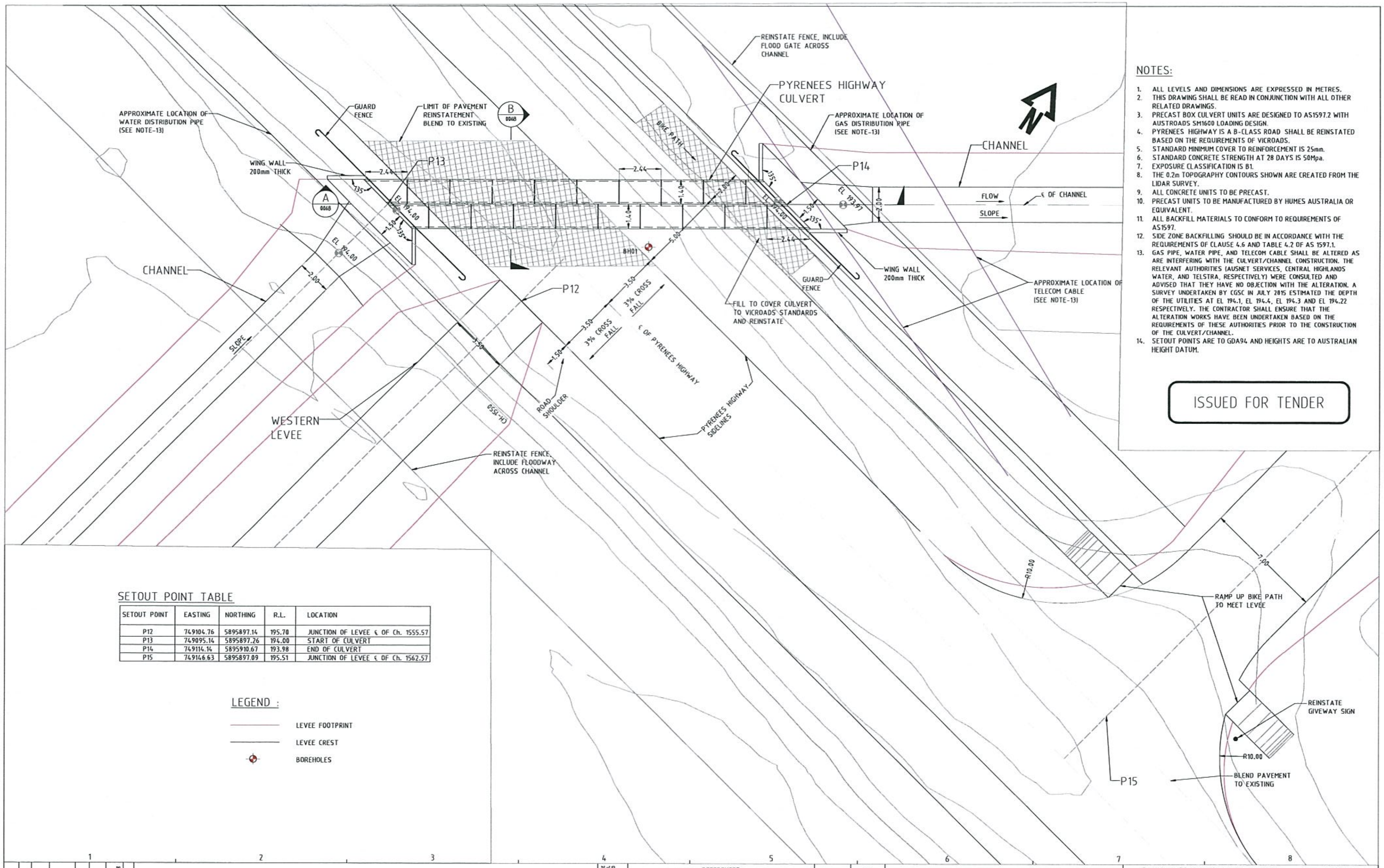
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No. E304639
PROJECT CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WILLIAMS ROAD LEVEE LEVEE
CROSS SECTIONS
SCALE 100
SIZE A1
DWG No. EHT-CA-DR-005C
SHT. 1/1
REV. 0

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTON\E304XXX\E3046XX\E304639\P509364\120\CROSS SECTIONS.DWG



NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS.
3. PRECAST BOX CULVERT UNITS ARE DESIGNED TO AS1597.2 WITH AUSTROADS SM1600 LOADING DESIGN.
4. PYRENEES HIGHWAY IS A B-CLASS ROAD SHALL BE REINSTATED BASED ON THE REQUIREMENTS OF VICROADS.
5. STANDARD MINIMUM COVER TO REINFORCEMENT IS 25mm.
6. STANDARD CONCRETE STRENGTH AT 28 DAYS IS 50Mpa.
7. EXPOSURE CLASSIFICATION IS B1.
8. THE 0.2m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY.
9. ALL CONCRETE UNITS TO BE PRECAST.
10. PRECAST UNITS TO BE MANUFACTURED BY HUMES AUSTRALIA OR EQUIVALENT.
11. ALL BACKFILL MATERIALS TO CONFORM TO REQUIREMENTS OF AS1597.
12. SIDE ZONE BACKFILLING SHOULD BE IN ACCORDANCE WITH THE REQUIREMENTS OF CLAUSE 4.6 AND TABLE 4.2 OF AS 1597.1.
13. GAS PIPE, WATER PIPE, AND TELECOM CABLE SHALL BE ALTERED AS ARE INTERFERING WITH THE CULVERT/CHANNEL CONSTRUCTION. THE RELEVANT AUTHORITIES (AUSNET SERVICES, CENTRAL HIGHLANDS WATER, AND TELSTRA, RESPECTIVELY) WERE CONSULTED AND ADVISED THAT THEY HAVE NO OBJECTION WITH THE ALTERATION. A SURVEY UNDERTAKEN BY CGSC IN JULY 2015 ESTIMATED THE DEPTH OF THE UTILITIES AT EL 194.1, EL 194.4, EL 194.3 AND EL 194.22 RESPECTIVELY. THE CONTRACTOR SHALL ENSURE THAT THE ALTERATION WORKS HAVE BEEN UNDERTAKEN BASED ON THE REQUIREMENTS OF THESE AUTHORITIES PRIOR TO THE CONSTRUCTION OF THE CULVERT/CHANNEL.
14. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P12	749104.76	5895897.14	195.70	JUNCTION OF LEVEE ℄ OF Ch. 1555.57
P13	749095.14	5895897.26	194.00	START OF CULVERT
P14	749114.14	5895910.67	193.98	END OF CULVERT
P15	749146.63	5895897.09	195.51	JUNCTION OF LEVEE ℄ OF Ch. 1562.57

LEGEND :

─	LEVEE FOOTPRINT
─	LEVEE CREST
⊕	BOREHOLES

ALTERATIONS
PROJ. No. 501436 ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
PROJ. No. 501436 ENGAGEMENT No. 304639 REV. 1 DRN. BDS APPD. PS DATE 13/05/16
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CLIENT APPD. DATE

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REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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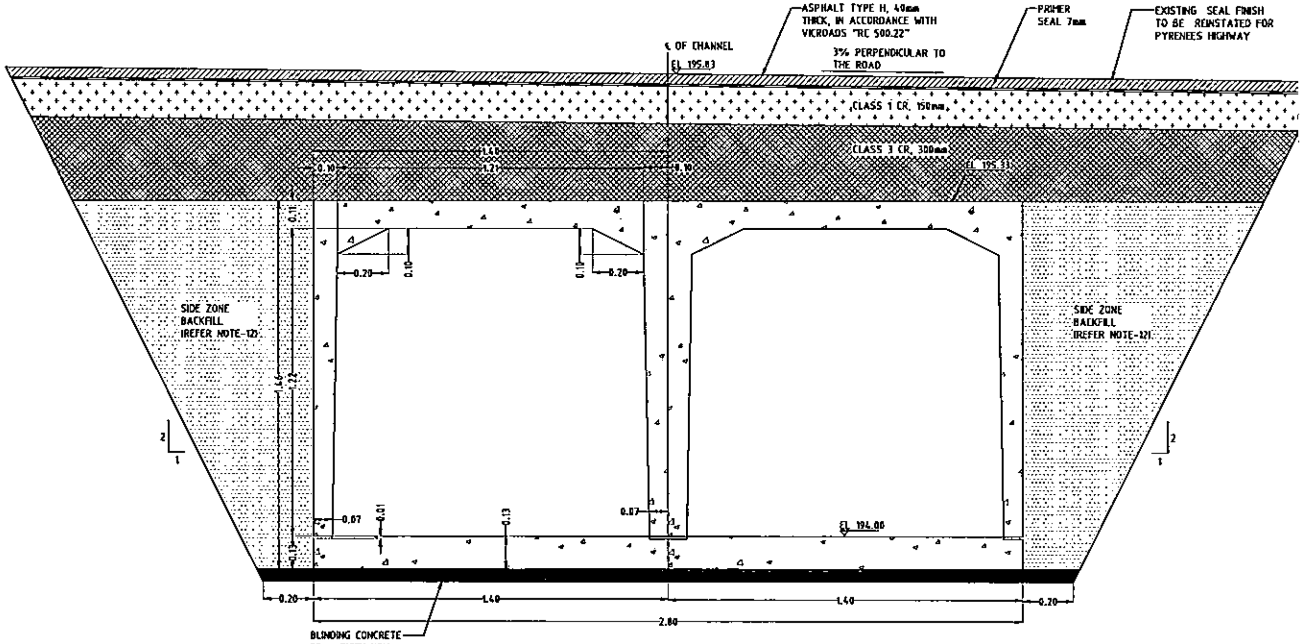
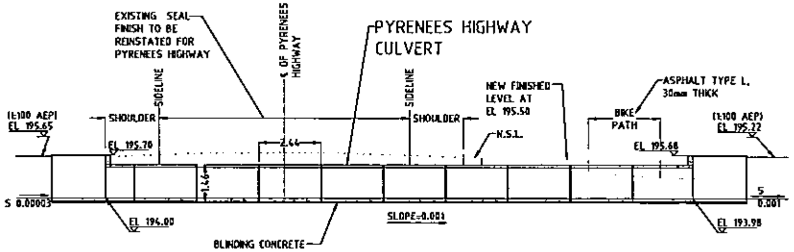
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
PYRENEES HIGHWAY CULVERT
PLAN AND SECTIONS
SCALE AS SHOWN
SIZE A3
DRG No. EHT-CA-DR-006A
SHT. 1/2
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010(TENDER).DWG



SECTION (B)
SCALE 1:20
006A



SECTION (A)
SCALE 1:200
006A

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS.
3. FOR OTHERS NOTES, REFER DRG. NO. EHT-CA-DR-006A
4. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

1 2 3 4 5 6 7 8

ALTERATIONS
PROJ. No. 5014:36
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
ENGAGEMENT No. 304639
APP'D PS
DATE 13/05/16
PROJ. No. 5014:36
REV. 1
DRN. BDS
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DATE
CLIENT APP'D

2.0 1.0 0 2.0 4.0 6.0m
SCALE 1:200
0.2 0.1 0 0.2 0.4 0.6m
SCALE 1:20

REFERENCES

DRAWN	S.B.
CHECKED	H.H.
DESIGNED	H.H.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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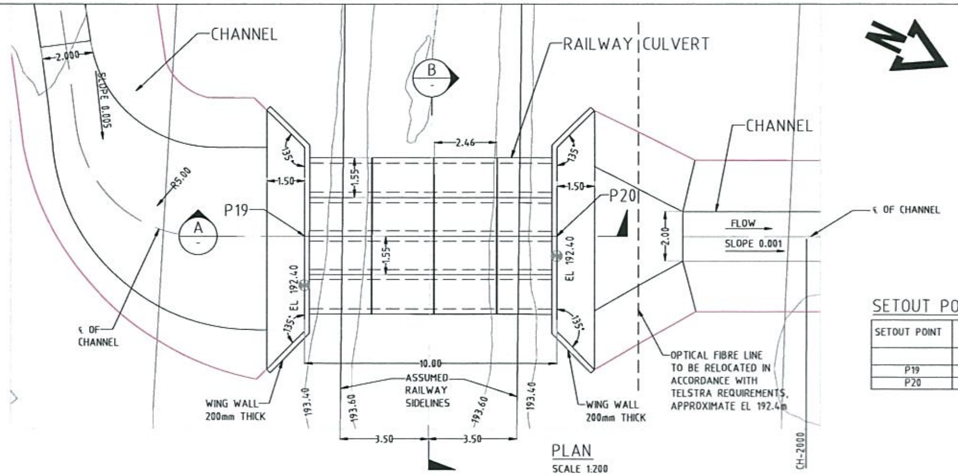
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
PYRENEES HIGHWAY CULVERT
SECTIONS
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-006B
SHT. 2/2
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509344\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-00(1)TENDER.DWG



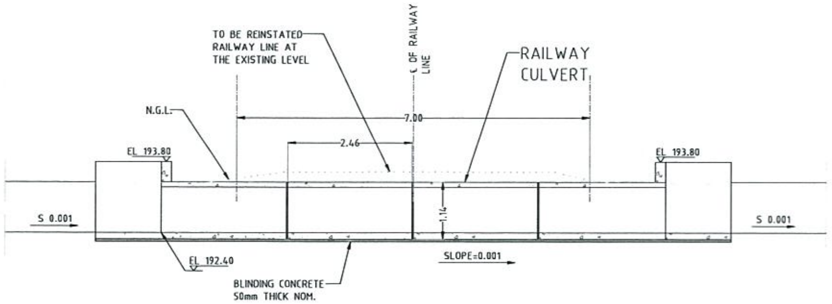
PLAN
SCALE 1:200

SETOUT POINT TABLE

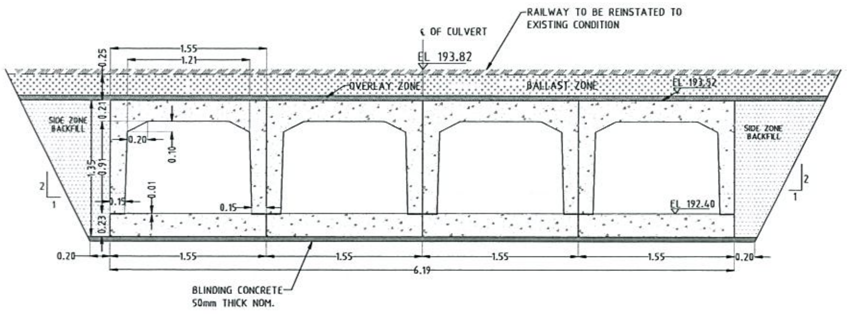
SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P19	749232.75	5896271.42	192.40	START OF CULVERT
P20	749228.45	5896280.45	192.39	END OF CULVERT

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS.
3. THE RAILWAY LINE SHALL BE REINSTATED TO EXISTING CONDITIONS.
4. THESE UNITS ARE DESIGNED TO AS1597.2 WITH R300LA LOADING DESIGN.
5. STANDARD MINIMUM COVER TO REINFORCEMENT IS 25mm.
6. STANDARD CONCRETE STRENGTH AT 28 DAYS IS 50Mpa.
7. EXPOSURE CLASSIFICATION IS B1.
8. MASS IS CALCULATED ON NOMINAL BULK DENSITY BEING 2600kg/m³.
9. THE 0.2m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY.
10. ALL CONCRETE UNITS ARE TO BE PRECAST UNITS MANUFACTURED BY HUMES AUSTRALIA OR EQUIVALENT.
11. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.



SECTION A
SCALE 1:100



SECTION B
SCALE 1:50

LEGEND :

LEVEE FOOTPRINT & CHANNEL TOP
LEVEE CREST & CHANNEL BASE
CONTOURS

ISSUED FOR TENDER

ALTERATIONS	PROJ. No.	
	501436	ORIGINAL ISSUE
	501436	CLIENT COMMENTS ADDRESSED

ENGAGEMENT № 304639
APP'D PS
DATE 13/05/16
REV. 1
DRN. BDS

0.50 0.25 0 0.5 1.0 1.50m
VERTICAL SCALE 1:50

2.0 1.0 0 2.0 4.0 6.0m
SCALE 1:200

1.0 0.5 0 1.0 2.0 3.0m
VERTICAL SCALE 1:100

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REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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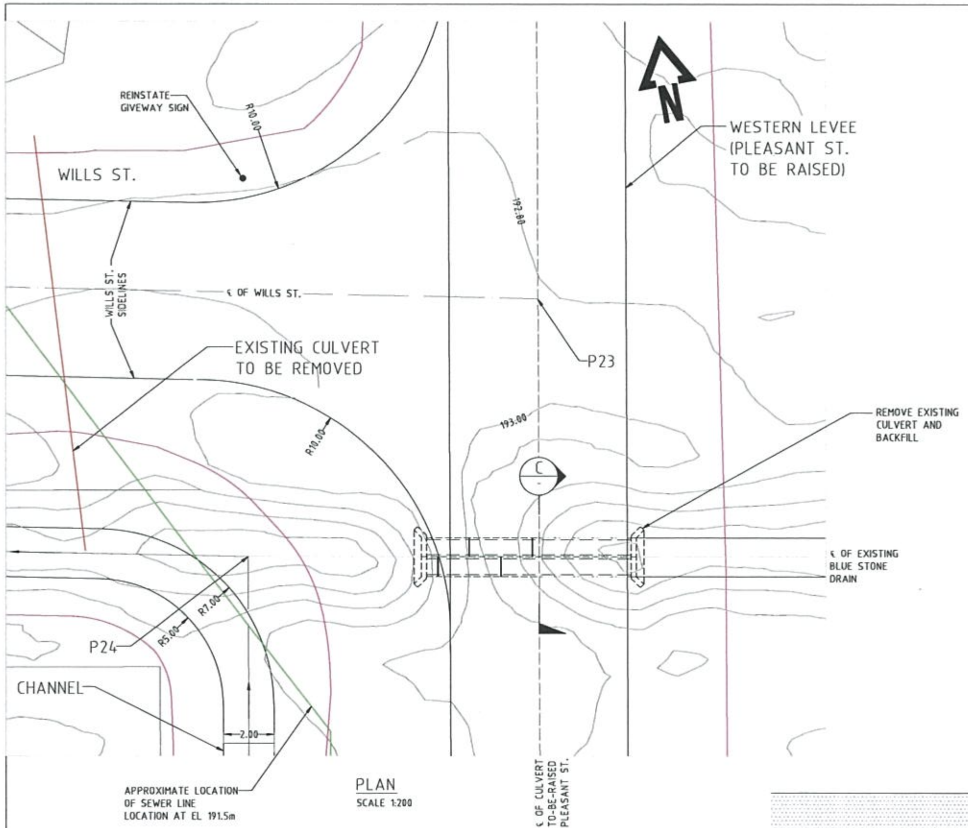
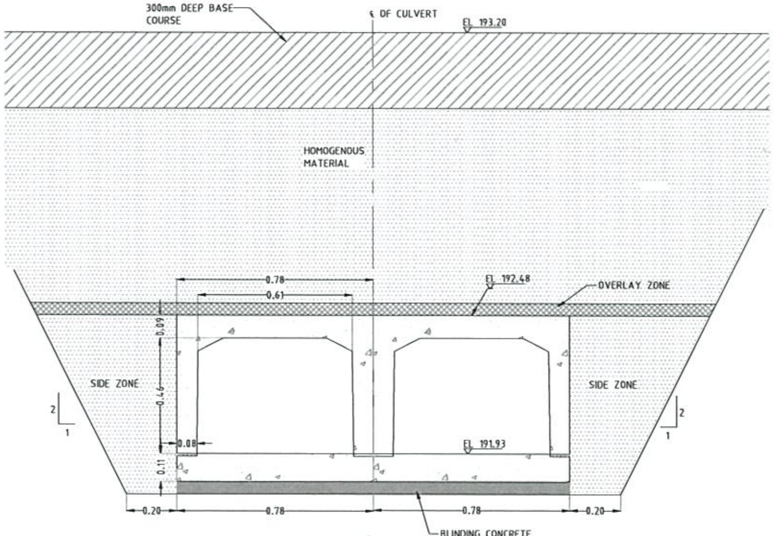
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT №: E304639
TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
RAILWAY CULVERT
PLAN AND SECTIONS
SCALE: AS SHOWN
SIZE: A3
DRG No.: EHT-CA-DR-007
SHT.: -
REV.: 1

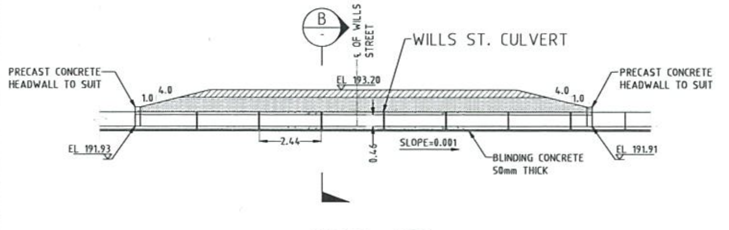
FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010(TENDER).DWG



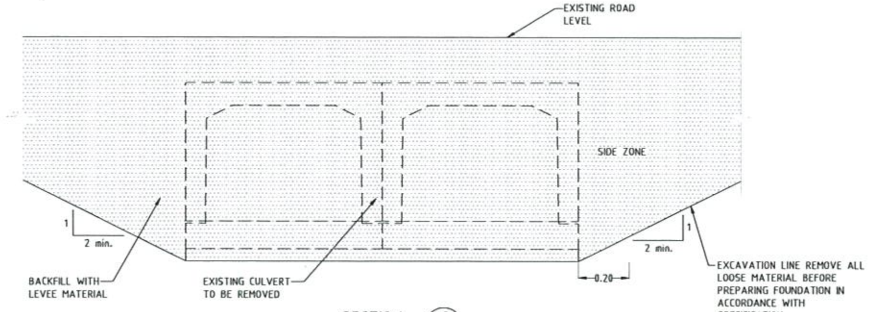
PLAN
SCALE 1:200



SECTION B
SCALE 1:20



SECTION A
SCALE 1:200
0020



SECTION C
SCALE 1:20

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION .
3. THESE UNITS ARE DESIGNED TO AS1597.2 WITH AUSTRAROADS SM1600 LOADING DESIGN.
4. FOR TOP OF THE LEVEE AND CHANNEL INVERT LEVELS REFER TO EHT-CA-DR-002A TO EHT-CA-DR-002E.
5. PLEASANT ST. IS TO BE RAISED & REINSTATED BASED ON SECTION 12 OF THE INFRASTRUCTURE DESIGN MANUAL, AUSTROADS GUIDE TO ROAD DESIGN, VICROADS GUIDELINES & SPECIFICATION.
6. FOR PROPERTIES OF HOMOGENOUS MATERIAL & BASE COURSE TYPE A & B REFER TO THE SPECIFICATION.
7. WILLS ST. NEEDS TO BE RAISED FOR 30m BASED ON A SIMILAR SECTION TO PLEASANT ST.
8. STANDARD MINIMUM COVER TO REINFORCEMENT IS 25mm.
9. STANDARD CONCRETE STRENGTH AT 28 DAYS IS 50Mpa.
10. EXPOSURE CLASSIFICATION IS B1.
11. MASS IS CALCULATED ON NOMINAL BULK DENSITY BEING 2600kg/m^3.
12. THE 0.2m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM THE LIDAR SURVEY.
13. ALL CONCRETE UNITS ARE TO BE PRECAST UNITS MANUFACTURED BY HUMES AUSTRALIA OR EQUIVALENT. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	R.L.	LOCATION
P23	749241.66	5896453.73	193.80	INTERSECTION OF PLEASANT ST. AND WILLS ST.
P24	749228.58	5896445.63	192.20	START OF WILLS ST. DRAIN

LEGEND :

- LEVEE FOOTPRINT & CHANNEL TOP
- LEVEE CREST & CHANNEL BASE
- CONTOURS

ALTERATIONS						
PROJ. No.	501436	ORIGINAL ISSUE				
		CLIENT COMMENTS ADDRESSED	PROJ. NO. 501436 REV. 1	ENGAGEMENT No 304639 DRN. BOS DESIGN APP'D PS DATE 13/05/16	entura Hydro Tasmania | The power of natural thinking	CLIENT APP'D DATE

2.0 1.0 0 2.0 4.0 6.0m
SCALE 1:200

0.2 0.1 0 0.2 0.4 0.6m
SCALE 1:20

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REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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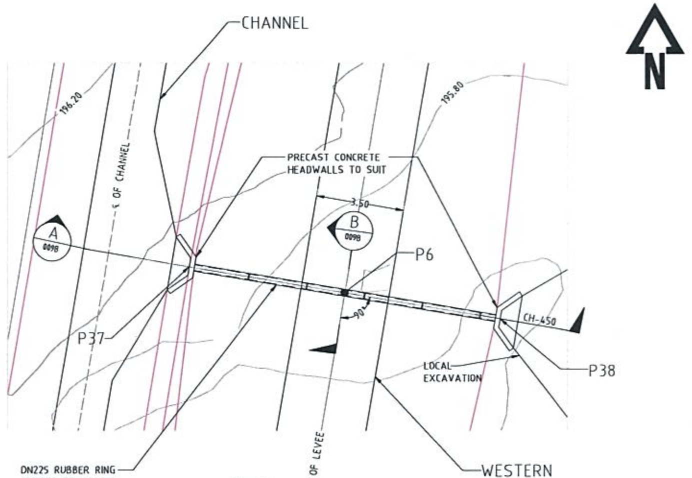
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
OTHERS CULVERT
PLAN AND SECTIONS
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-008
SHT. -
REV. 1

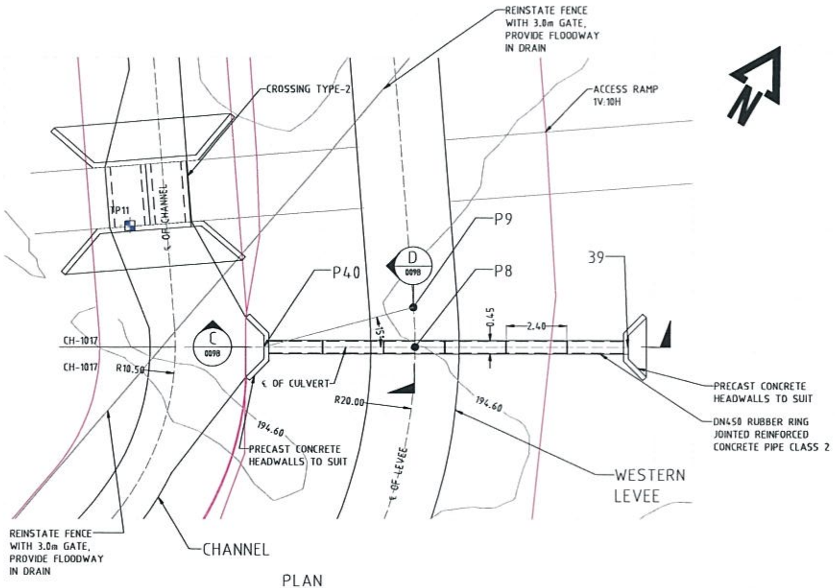
FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\P509364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010(TENDER).DWG



PLAN
SCALE 1:200
AT CH. 450

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	LOCATION
P37	749146.55	5894855.42	START OF CULVERT Ch. 445.50
P38	749158.88	5894853.34	END OF CULVERT Ch. 445.50
P39	749238.04	5895414.56	START OF CULVERT Ch. 1017.00
P40	749250.48	5895421.95	END OF CULVERT Ch. 1017.00



PLAN
SCALE 1:200
AT CH. 1017

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION .
3. THESE UNITS ARE DESIGNED TO AS1597.2 WITH AUSTROADS SM1600 LOADING DESIGN.
4. FOR TOP OF THE LEVEE AND CHANNEL INVERT LEVELS REFER TO EHT-CA-DR-002A TO EHT-CA-DR-002G.
5. FOR PROPERTIES OF HOMOGENOUS MATERIAL & BASE COURSE REFER TO THE SPECIFICATION.
6. STANDARD MINIMUM COVER TO REINFORCEMENT IS 25mm.
7. STANDARD CONCRETE STRENGTH AT 28 DAYS IS 50Mpa.
8. EXPOSURE CLASSIFICATION IS B1.
9. MASS IS CALCULATED ON NOMINAL BULK DENSITY BEING 2600kg/m^3.
10. THE 0.2m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM ENTURA FEATURE SURVEY.
11. ALL CONCRETE UNITS ARE TO BE PRECAST UNITS MANUFACTURED BY HUMES AUSTRALIA OR EQUIVALENT.
12. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

LEGEND :

—	LEVEE FOOTPRINT
—	LEVEE CREST
—	CULVERTS
▣	TEST PITS

ISSUED FOR TENDER

1 2 3 4 5 6 7 8

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
PROJ. No. 501436
REV. 1
DRN. BOS
DESIGN.
ENGAGEMENT No 304639
APPD. PS
DATE 13/05/16
entura Hydro Tasmania | The power of natural thinking
CLIENT APPD.
DATE

2.0 1.0 0 2.0 4.0 6.0m
SCALE 1:200

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REFERENCES

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DESIGNED	M.M.
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APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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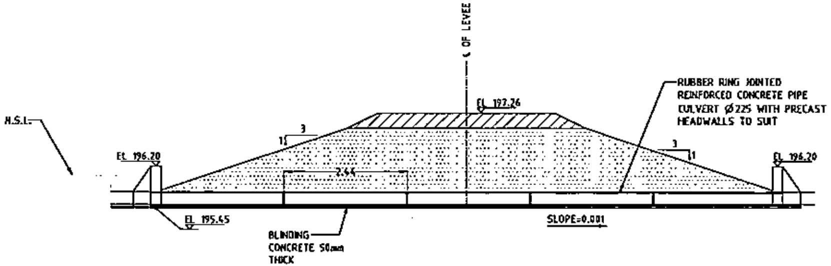
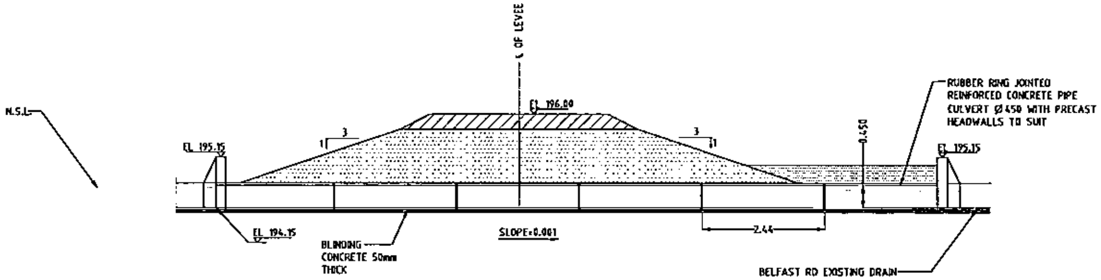
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No: E304639
TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
OTHER CULVERT
PLAN
SCALE AS SHOWN
SIZE A3
DRG No. EHT-CA-DR-009A
SHT. 1/2
REV. 1

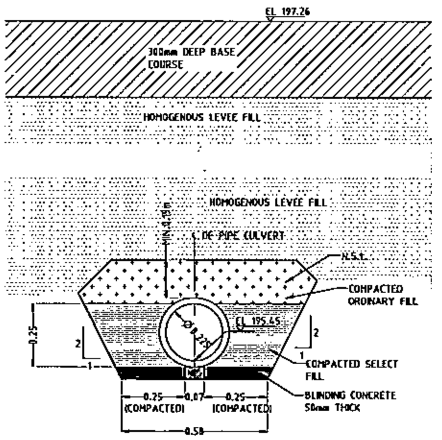
FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010(TENDER).DWG



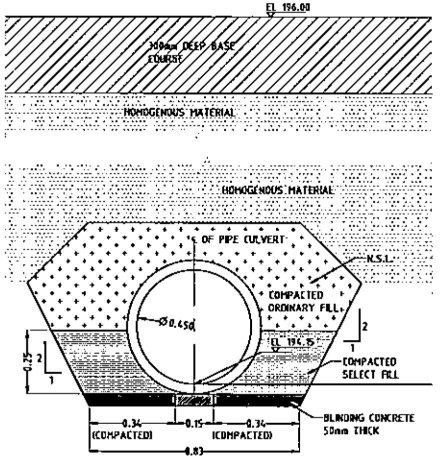
SECTION A
SCALE 1:100
009A



SECTION C
SCALE 1:100
009A



SECTION B
SCALE 1:20
009A



SECTION D
SCALE 1:20
009A

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE EXPRESSED IN METRES.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION.
3. THESE UNITS ARE DESIGNED TO AS1597.2 WITH AUSTRAROADS SM1600 LOADING DESIGN.
4. FOR TOP OF THE LEVEE AND CHANNEL INVERT LEVELS REFER TO EHT-CA-DR-002A TO EHT-CA-DR-002E.
5. FOR PROPERTIES OF HOMOGENOUS MATERIAL & BASE COURSE REFER TO THE SPECIFICATION.
6. STANDARD MINIMUM COVER TO REINFORCEMENT IS 25mm.
7. STANDARD CONCRETE STRENGTH AT 28 DAYS IS 50Mpa.
8. EXPOSURE CLASSIFICATION IS B1.
9. MASS IS CALCULATED ON NOMINAL BULK DENSITY BEING 2600kg/m^3.
10. THE 0.2m TOPOGRAPHY CONTOURS SHOWN ARE CREATED FROM ENTURA FEATURE SURVEY.
11. ALL CONCRETE UNITS ARE TO BE PRECAST UNITS MANUFACTURED BY HUMES AUSTRALIA OR EQUIVALENT.
12. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

ISSUED FOR TENDER

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
ENGAGEMENT No. 304639
APP'D PS
DATE 13/05/16
501436
REV. 1
DRN. BDS

SCALE 1:100
SCALE 1:20

REFERENCES

DRAWN	S.B.
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DESIGNED	M.H.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
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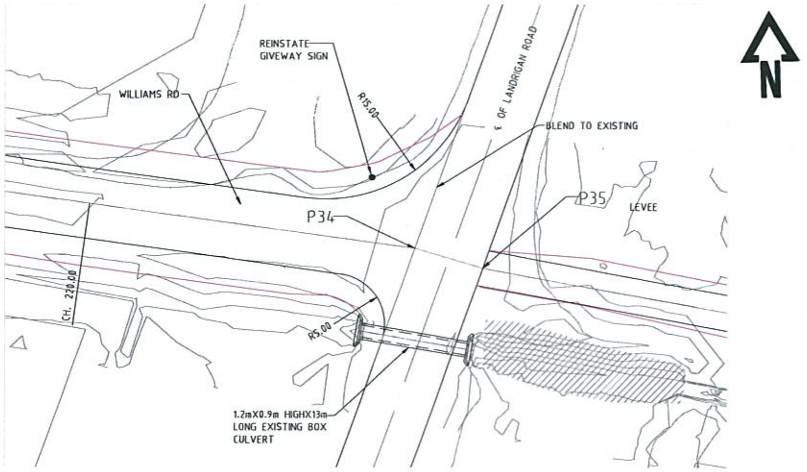
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL
ENGAGEMENT No. E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
OTHER CULVERT
SECTIONS
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-009B
SHT. 2/2
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTON\E304XXX\E3044XX\E304639\P509346\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-008(TENDER).DWG



CLEAR DEBRIS AND
SEDIMENT, GRADE FROM
CULVERT INVERT LEVEL TO
BLUE STORE DRAIN LEVEL

PLAN WILLIAMS ROAD LEVEE AND LANDRIGAN ROAD INTERSECTION
SCALE 1:500

NOTES:

1. ALL LEVELS AND DIMENSION ARE IN METRES.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION .
3. FOR TOP OF THE LEVEE LEVELS REFER TO EHT-CA-DR-003.
4. FOR PROPERTIES OF HOMOGENOUS MATERIAL & BASE COURSE TYPE A & B REFER TO THE SPECIFICATION.
5. WILLIAM ROAD IS TO BE RAISED & REINSTATED BASED ON SECTION 12 OF THE INFRASTRUCTURE DESIGN MANUAL, AUSTROADS GUIDE TO ROAD DESIGN, VICROADS GUIDELINES & SPECIFICATION.
11. SETOUT POINTS ARE TO GDA94 AND HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM.

LEGEND :

〰	CONTOURS

ISSUED FOR TENDER

1 2 3 4 5 6 7 8

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
PROJ. NO. 501436 ENGAGEMENT № 304639
REV. 1 DRN. BOS DESGN. APP'D PS DATE 13/05/16
entura Hydro Tasmania The power of natural thinking
CLIENT APP'D. DATE

5.0 2.5 0 5.0 10.0 15.0m
SCALE 1:500

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REFERENCES

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DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
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DATE	

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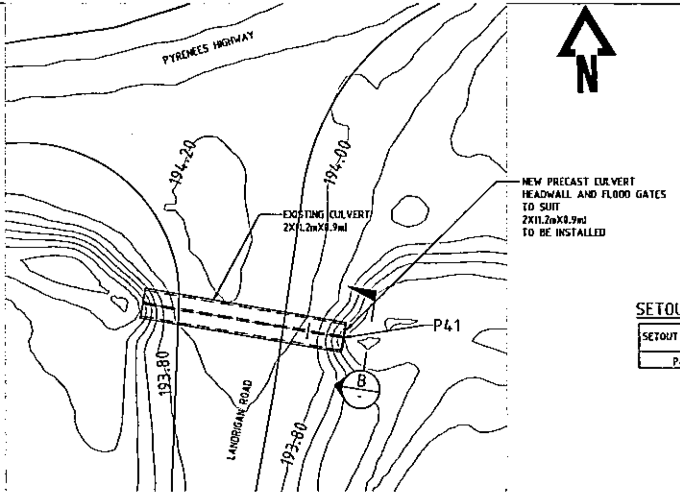
CLIENT: CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT №: E304639

TITLE: CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
WILLIAMS ROAD LEVEE AND
LANDRIGAN ROAD INTERECTION
PLAN

SCALE AS SHOWN
SIZE A3
DRG No. EHT-CA-DR-010
SHT. -
REV. 1

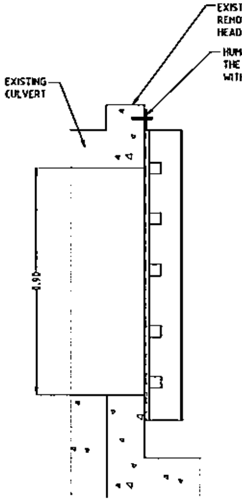
FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTDM\E304XXX\E3046XX\E304639\PS09364\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-0010(TENDER).DWG



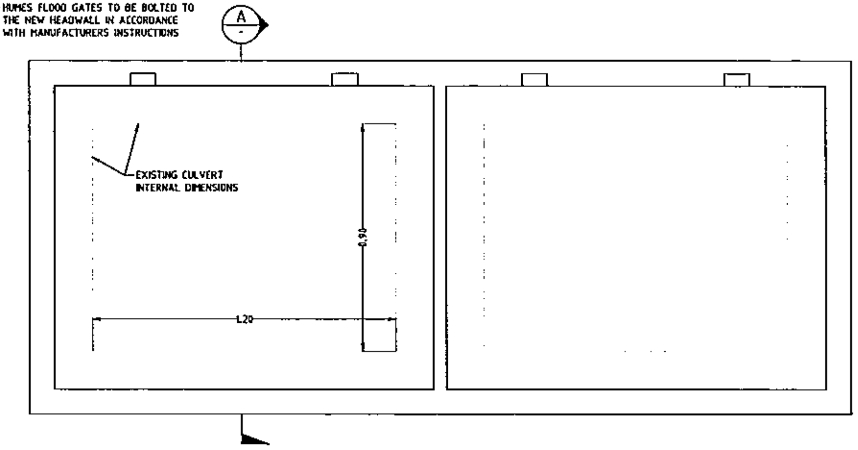
PLAN LANDRIGAN ROAD CULVERT AT PYRENEES HIGHWAY INTERSECTION
SCALE 1:500

SETOUT POINT TABLE

SETOUT POINT	EASTING	NORTHING	LOCATION
P41	750059.09	5895723.91	START POINT OF EXISTING CULVERT



SECTION (A -)
SCALE 1:20



SECTION (B -)
SCALE 1:20

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE IN METRES.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION .
3. CONTRACTOR SHALL CONFIRM DIMENSIONS PRIOR TO ORDERING NEW HEADWALL AND FLOODGATES.

ISSUED FOR TENDER

ALTERATIONS
PROJ. No. 501436
ORIGINAL ISSUE
CLIENT COMMENTS ADDRESSED
304639
1 BOS
13/15/16

0.2 0.1 0 0.2 0.4 0.6m
SCALE 1:20

REFERENCES

DRAWN	S.B.
CHECKED	M.M.
DESIGNED	M.M.
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APPROVED	T.G.
DATE	15-03-16
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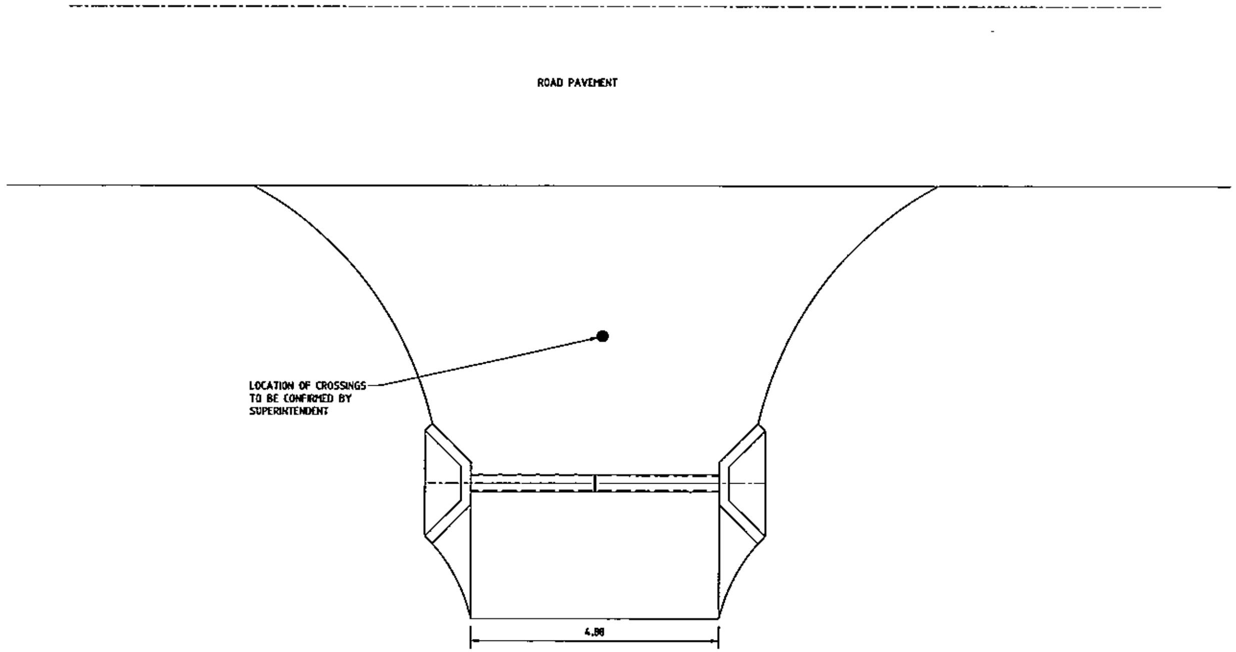
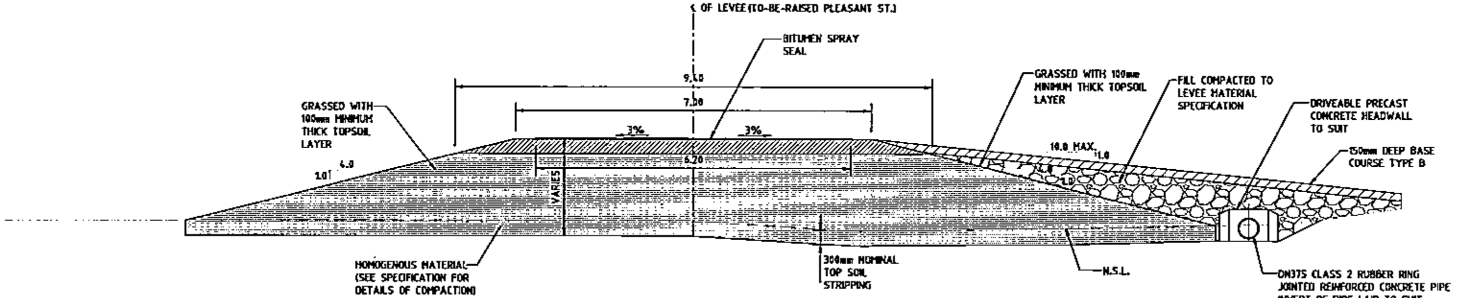
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639
TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
FLOOD GATES & PARAPET WALLS
SECTION & DETAILS
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-011
SHEET -
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULT$\MELBOURNE\CONSULTON\E304XXX\E3046XX\E304639\P509346\DRAWINGS\FINAL DRAWINGS-13-05-2016\EHT-CA-DR-001_003_006-008(TENDER).DWG



TYPICAL PLAN FOR DRIVEWAY CROSSINGS

SCALE 1:100



TYPICAL SECTION FOR DRIVEWAY CROSSINGS

SCALE 1:100
(FROM CH. 1562.57 TO CH. 2563.18)

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE IN METRES.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION.
3. FOR TOP OF THE LEVEE AND CHANNEL INVERT LEVELS REFER TO EHT-CA-DR-002A TO EHT-CA-DR-002G.
4. FOR PROPERTIES OF HOMOGENOUS MATERIAL & BASE COURSE REFER TO THE SPECIFICATION.
5. PLEASANT ST. IS TO BE RAISED & REINSTATED BASED ON SECTION 12 OF THE INFRASTRUCTURE DESIGN MANUAL, AUTROADS GUIDE TO ROAD DESIGN, VICROADS GUIDELINES & SPECIFICATION.

ISSUED FOR TENDER

ALTERATIONS

PROJ. No.	
501436	ORIGINAL ISSUE
	CLIENT COMMENTS ADDRESSED

PROJ. No. 501436 | REV. 1 | DRN. BDS | INCIDENT No. 304639 | APPD. PS | DATE 13/05/16 | CLIENT APPD. | DATE

1.0 0.5 0 1.0 2.0 3.0m
SCALE 1:100

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REFERENCES

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DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APPD	
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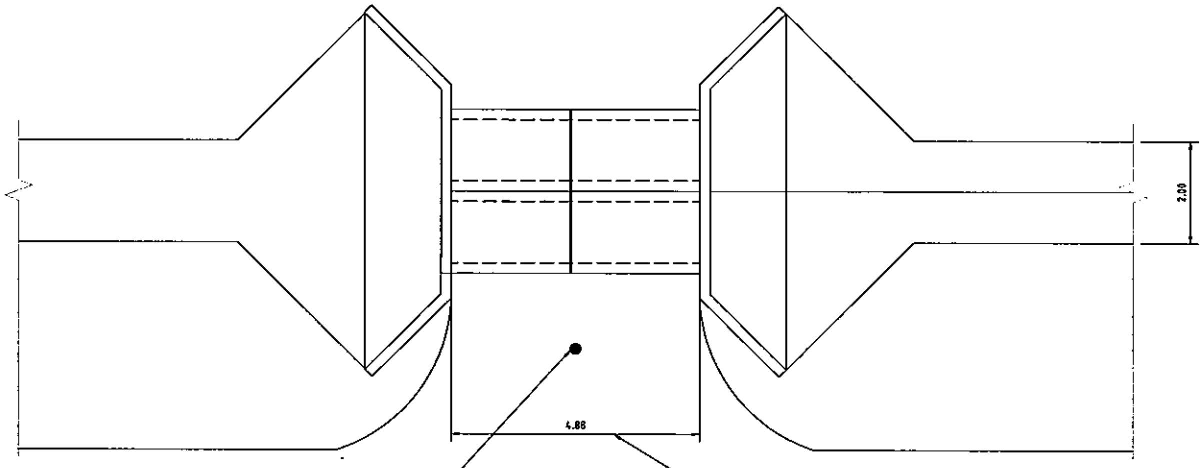
CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL
INCIDENT No. E304639

TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT
DRIVEWAY CROSSING
TYPICAL DETAILS
TYPE-1

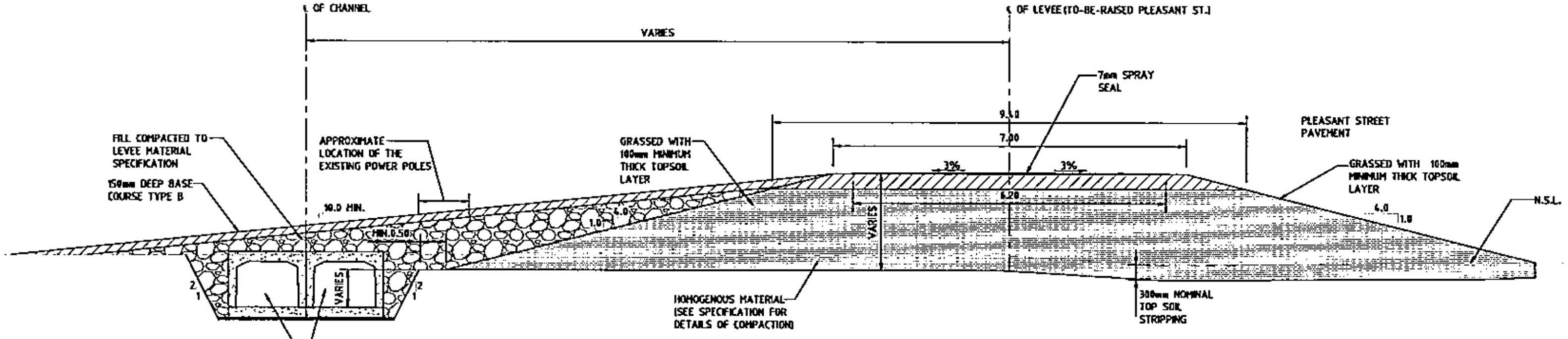
SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-012
SHT. –
REV. 1

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTOM\E304XXX\E3046XX\E304639\P509364\DRAWINGS\FINAL DRAWING-06-05-2016\EHT-CA-DR-012.DWG



TYPICAL PLAN FOR DRIVEWAY CROSSINGS

SCALE 1:100



TYPICAL SECTION FOR DRIVEWAY CROSSINGS

SCALE 1:100
(FROM CH. 1562.57 TO CH. 2563.18)

NOTES:

1. ALL LEVELS AND DIMENSIONS ARE IN METRES.
2. THIS DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATION .
3. FOR TOP OF THE LEVEE AND CHANNEL INVERT LEVELS REFER TO EHT-CA-DR-002A TO EHT-CA-DR-002E.
4. FOR PROPERTIES OF HOMOGENOUS MATERIAL & BASE COURSE REFER TO THE SPECIFICATION.
5. PLEASANT ST. IS TO BE RAISED & REINSTATED BASED ON SECTION 12 OF THE INFRASTRUCTURE DESIGN MANUAL, AUTROADS GUIDE TO ROAD DESIGN, VICROADS GUIDELINES & SPECIFICATION.

ISSUED FOR TENDER

ALTERATIONS	PROJ. No.	REV.
ORIGINAL ISSUE	501436	
CLIENT COMMENTS ADDRESSED	501436	1

ENGINEER No. 304639 APP'D PS DATE 13/11/16 DRN. BDS

0 0.5 1 1.0 2.0 3.0m
SCALE 1:100

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REFERENCES

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DESIGNED	M.M.
CHECKED	P.S.
APPROVED	T.G.
DATE	15-03-16
CLIENT APP'D	
DATE	

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CLIENT CENTRAL GOLDFIELDS SHIRE COUNCIL ENGAGEMENT No. E304639

TITLE CARISBROOK FLOOD AND DRAINAGE MITIGATION PROJECT

DRIVEWAY CROSSING
TYPICAL DETAILS
TYPE-2

SCALE AS SHOWN
SIZE A3
DWG No. EHT-CA-DR-013 SHT. - REV. 1

FILENAME: \\HYDROTASMANIA\CONSULTS\MELBOURNE\CONSULTON\E304XXX\E3046XX\E304639\P509344\DRAWINGS\FINAL DRAWING-06-05-2016\EHT-CA-DR-013.DWG

F Safety in design risk assessment

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Project Delivery Form

ISO 9001
BUREAU VERITAS
Certification

Project risk register

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Engagement name: Carisbrook Flood Levees

Engagement manager: Mohsen Moeini

Engagement number: 304639

Prepared for submission approval by: Paul Southcott

Date: 06/06/2016

				Prior to implementing mitigating actions				*After mitigating actions implemented*					
ID	**Discipline**	**Category**	**Risk description**	**Likelihood**	**Consequence**	**Risk ranking**	**Mitigation**	**Likelihood**	**Consequence**	**Risk Ranking**	**Risk Status**	**Risk Trend**	**Review Date**
1	Engineering	Civil	Levee fails by piping due to poor stripping, compaction, dessication cracking or tree growth	5. Possible	4. Major	20	Design: specify stripping, compaction and gravel capping on crest. Vegetation control covered in design report. Construction: comply with design requirements. Operations: Control vegetation.	2. Extremely Rare	4. Major	8	✓	→	Ongoing
2	Engineering	Civil	Levee fails by overtopping	5. Possible	4. Major	20	Design: design for 1:100 AEP levels with freeboard for uncertainty. Operations: Control vegetation and clear debris from channels and culverts. Monitor operation during flood.	2. Extremely Rare	4. Major	8	✓	→	Ongoing
3	Engineering	Civil	Vehicle drives off top of levee resulting in accident	5. Possible	4. Major	20	Design: minimum crest width 3.5m, batter slopes no steeper than 1V:3H. Construction: prepare safe work method statement, limit speed. Operations: limit speed.	2. Extremely Rare	4. Major	8	✓	→	Ongoing
4	Engineering	Civil	People fall off levee and injure themselves	3. Rare	2. Minor	6	Design: as above. Construction & Operations: consider safe work method	2. Extremely Rare	2. Minor	4	✓	→	Ongoing
5	Engineering	Civil	Construction works intersect concealed/buried services and cause serious accident	7. Almost Certain	5. Extreme	35	Design: dial before you dig, show services on drawings, require contractor to confirm.Construction:safe work method statement, confirm location of services before ground breaking, record location of services. Operations: confirm location of service before undertaking ground breaking maintenance.	2. Extremely Rare	4. Major	8	✓	→	Ongoing
6	Engineering	Civil	Construction works make contact with overhead services	7. Almost Certain	5. Extreme	35	Design: show location of poles on drawings, locate works to avoid poles. Construction: safe work method statement, use height limiters and spotter. Operations: safe work method statement for maintenance	2. Extremely Rare	4. Major	8	✓	→	Ongoing
7	Engineering	Civil	Traffic accident during construction causes injury or death	6. Likely	5. Extreme	30	Design: require contractor to prepare traffic management plan, restrict access to local traffic where possible. Contractor: prepare traffic management plan, safe work method statement and maintain works as required.	3. Rare	3. Moderate	9	✓	→	Ongoing
8	Engineering	Civil	Traffic accident on road levees cause injury or death	6. Likely	5. Extreme	30	Design: design in accordance with safe road design requirements including width, batters, surface finish, signage and markings. Operations: maintain in accordance with safe road design requirements including width, batters, surface finish, signage and markings	2. Extremely Rare	4. Major	8	✓	→	Ongoing
9	Engineering	Civil	Property owner has accident while accessing road from road levee	5. Possible	3. Moderate	15	Design: provde safe crossing with grade limited to 1V:10H and sufficient width. Construction: comply with design requirements.	2. Extremely Rare	2. Minor	4	✓	→	Ongoing
10	Engineering	Civil	Road user looses control and drives into floodwater.	4. Unlikely	5. Extreme	20	Design: provide flood protection up to 1:100AEP level plus freeboard, batters limited to 1V:4H to allow drivers to regain control. Operations: Maintain road in good condition, close road during flood conditions.	2. Extremely Rare	4. Major	8	✓	→	Ongoing
11	Engineering	Civil	Collision between train and vehicle at Pleasant St causes death or injury	2. Extremely Rare	5. Extreme	10	Design: railway currently disused. Crossing should be reviewed and possibly closed if railway reopened. Operations: Monitor use of railway and change crossing if required.	2. Extremely Rare	4. Major	8	✓	→	Ongoing
12	Engineering	Civil	Member of public drowns in drainage channel	3. Rare	5. Extreme	15	Design: fence off channels as far as practical, provide gentle slopes on batters, limit depth. Operations: monitor during floods to keep public away. Close road levees where possible	2. Extremely Rare	4. Major	8	✓	→	Ongoing
13	Engineering	Civil	Tree removal causes injury or death	4. Unlikely	6. Catastrophic	24	Design: minimise removal of trees. Construction: prepare safe work method	2. Extremely Rare	4. Major	8	✓	→	Ongoing
14													

KEY

Risk status (column L)

Symbol	**Definition**
✓	Satisfactory - everything necessary and possible is being done
☯	Some concerns - actions are in place but are not fully implemented or effective - close monitoring required
✗	Unsatisfactory - current actions are not sufficient, or actions still to be commenced - immediate attention required

KEY

Risk trend (column M)

Symbol	**Definition**
↓	Risk is likely to reduce
→	Risk is likelty to remain the same
↑	Risk is likely to become moderately worse
↑	Risk is likely to become significantly worse

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G Cost estimate

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Estimate summary sheet +/- 30%

CLIENT: Central Goldfields Central Council

PROJECT: Investigation & design of Carisbrook flood & drainage mitigation treatments

DETAIL DESIGN WESTERN & WILLIAMS ROAD LEVEES + CULVERTS

MOBILISATION / DEMOBILISATION	80,000
WESTERN LEVEE (SOUTH OF PYRENEES)	957,000
WESTERN LEVEE (NORTH OF PYRENEES)	1,666,000
WILLIAMS ROAD LEVEE	287,000
LANDRIGAN ROAD FLOOD GATES	24,000
PERMITS AND APPROVALS	60,000
Sub Total	**3,074,000**
PROJECT MANAGEMENT (10%)	308,000
Sub Total	**3,382,000**
CONTINGENCY (10%)	339,000
Total Estimated Cost	**$3,721,000**

ESTIMATED BY: M. Moeini
REVIEWED: P. Southcott
DATE: 08-Jun-16

Key exclusions from cost estimate:

Design and investigation costs
Easement acquisition costs
Insurances

Excl. GST

Unit rates sourced from Mikany Dam Upgrade works, Tasmania
Rawlinsons, 2012. Rawlinsons Publishing, Perth, Western Australia
Hume, Quotation for culvert and floodgates
Telstra & Ausnet quotes for services alterations

Project	**Carisbrook flood levees**
Description	**Construction only**

Item	**Description**	**Quantity**	**Unit**	**Rate ($/unit)**	**Cost ($AUD)**	**Comments**
1	**Preliminaries**				**$80,000.00**	
1.1	Deliver heavy equipment to site & from site	1	Item	$30,000.00	$30,000.00	
1.2	Hire of site hut	14	Week	$100.00	$1,400.00	
1.3	Hire of Portaloo toilet	14	Week	$40.00	$560.00	
1.4	Contractor site survey work (including labour)	1	Item	$10,000.00	$10,000.00	
1.5	Spread & compact gravel for Site Huts & maintenance areas	20	m^3	$50.00	$1,000.00	
1.6	Hire of diesel Generator to service site, temporary power boards etc.	98	Day	$250.00	$24,500.00	
1.7	Provision of PPE equipment as required on site	1	Item	$400.00	$400.00	
1.8	Contractor preparation & presentation of Safety, Traffic Management, Environmental, Quality & Construction plans	1	Item	$11,160.00	$11,160.00	
2	**Western Levee and Channel - South of Pyrenees Highway (ch 0 to 1555)**				**$957,000.00**	
2.1	Clear vegetation, fences and/or other	23445	m^2	$1.50	$35,166.75	
2.2	Remove and reinstate fences and gates as required	1500	m	$20.00	$30,000.00	
2.3	Strip topsoil (300 mm deep) and stockpile - levee	4640	m^3	$20.00	$92,796.87	
2.4	Strip topsoil (300 mm deep) and stockpile - drainage channel	2394	m^3	$20.00	$47,870.14	
2.5	Excavate the drainage channel	1212	m^3	$30.00	$36,348.49	
2.6	Place embankment fill for levee and compact	11496	m^3	$35.00	$402,359.76	Assume borrowed locally
2.7	Place and compact levee's basecourse	2053	m^3	$65.00	$133,419.00	
2.8	Topsoil and regrass levee, channel and road batters	18811	m^2	$8.00	$150,489.80	
2.10	Driveway crossings type 2 (incl. culverts)	1	item	$6,385.70	$6,385.70	
2.11	Culverts					
2.11.1	Supply & installation of Φ225 Culvert at ch 450	1	item	$6,293.30	$6,293.30	includes excavation and backfilling
2.11.2	Supply & installation of Φ450 Culvert at ch 1000	1	item	$15,207.40	$15,207.40	includes excavation and backfilling
3	**Western Levee and Channel - North of Pyrenees Highway (ch1562 to 2900)**				**$1,666,000.00**	
3.1	Clear vegetation, fences and/or other	24979	m^2	$1.50	$37,468.86	
3.2	Remove and reinstate fences and gates as required	1500	m	$20.00	$30,000.00	
3.3	Strip topsoil (300 mm deep) and stockpile - Levee	5071	m^3	$20.00	$101,411.18	
3.4	Strip topsoil (300 mm deep) and stockpile - drainage channel ch1562 to P24	986	m^3	$20.00	$19,724.24	
3.5	Strip topsoil (300 mm deep) and stockpile - drainage channel P24 to P29 (Wills St)	1437	m^3	$20.00	$28,740.00	
3.6	Excavate drainage channel ch 1562 to P24	661	m^3	$30.00	$19,835.57	
3.7	Excavate drainage channel P24 to P29 (Wills St)	1710	m^3	$30.00	$51,300.00	
3.8	Place embankment fill for levee and compact (ch2703 to 2900)	259	m^3	$35.00	$9,066.23	Assume borrowed locally
3.9	Place embankment fill for road raising and compact (ch1562 to 2703)	10893	m^3	$35.00	$381,260.76	Assume borrowed locally
3.10	Place and compact levee's basecourse (ch2703 to 2900)	260	m^3	$65.00	$16,902.60	
3.11	Place and compact road raising pavements (ch1562 to 2703)	3050	m^3	$90.00	$274,536.00	
3.12	Topsoil and regrass levee, channel and road batters	16933	m^2	$8.00	$135,461.48	
3.13	Traffic management	1	item	$20,000.00	$20,000.00	
3.14	Driveway crossings type 1 (incl. culverts)	8	item	$2,435.97	$19,487.80	
3.15	Driveway crossings type 1 12.2m long (incl. culverts)	1	item	$5,079.94	$5,079.94	
3.16	Driveway crossings type 2 (incl. culverts)	2	item	$6,385.70	$12,771.39	
3.17	Spray seal for all the road levees and transitions	8680	m^2	$11.00	$95,480.00	Rawlinson's with escalation
3.18	Relocation of Telstra services	1	item	$68,909.25	$68,909.25	quote + 10% pass throughs
3.19	Relocation of gas main	1	item	$102,205.40	$102,205.40	quote + 10% pass throughs
3.20	Relocation of water main	1	item	$35,000.00	$35,000.00	JH estimate
3.21	Relocation of private power supply	1	item	$1,000.00	$1,000.00	
3.22	Line marking and signage	1	item	$10,000.00	$10,000.00	
	Culverts					
3.23.1	Supply & installation of two 1200x1200 culvert under Pyrenees Highway ch 1550	1	item	$85,585.46	$85,585.46	includes excavation and backfilling
3.23.2	Supply & installation of four 1200x900 culverts at Railway ch1950	1	item	$75,209.08	$75,209.08	includes excavation and backfilling
3.23.3	Supply & installation of two 600x450 culverts at Wills St	1	item	$25,387.46	$25,387.46	includes excavation and backfilling
3.23.4	Remove and backfill existing culverts at Pleasant Street ch 2150m & Wills Street	1	item	$3,640.00	$3,640.00	
4	**Williams Road Levee**				**$287,000.00**	
4.1	Clear vegetation, fences and/or other	5618	m^2	$1.50	$8,426.71	
4.2	Remove and reinstate fences and gates as required	1000	m	$20.00	$20,000.00	
4.3	Strip topsoil (300 mm deep) and stockpile	1685	m^3	$20.00	$33,706.84	
4.4	Place embankment fill for ~0.5km levee and compact	1519	m^3	$35.00	$53,161.81	
4.5	Place embankment fill for ~0.2km road raising and compact	1017	m^3	$35.00	$35,586.02	
4.6	Place and compact ~0.5km levee's basecourse	668	m^3	$65.00	$43,414.80	
4.7	Place and compact ~0.2km road raisng pavements	571	m^3	$90.00	$51,364.80	
4.8	Topsoil and regrass levee and road batters	796	m^2	$8.00	$6,368.28	
4.10	Driveway crossings type 2 (incl. culverts)	1	item	$6,385.70	$6,385.70	
4.11	Spray seal for all the road levees and transitions	1624	m^2	$11.00	$17,864.00	
4.13	Traffic management	1	item	$10,000.00	$10,000.00	
4.12	Line marking and signage	1	item	$2,000.00	$2,000.00	
5	**Landrigan Road Flood Gates**				**$24,000.00**	
5.1	Supply and installation of two 1200x900 flood gates & headwall	1	item	$23,629.06	$23,629.06	
	TOTAL (Excluding GST)				**3,014,000**	