CONTENTS

APPENDIX 1: MCU COURT APPROVAL CONDITIONS

Duplicate

In the Planning and Environment Court
Held at: Brisbane

No. 2606 of 2010

Between:	**WESTLINK PTY LTD AS TRUSTEE FOR WESTLINK INDUSTRIAL TRUST**	Appellant
And:	**LOCKYER VALLEY REGIONAL COUNCIL**	Respondent
And:	**CHIEF EXECUTIVE, DEPARTMENT OF ENVIRONMENT AND RESOURCE MANAGEMENT**	First Co-Respondent by Election
And:	**MICHAEL WILLIAM ASHLEY**	Second Co-Respondent by Election
And:	**GERALD SCOTT**	Third Co-Respondent by Election
And:	**KEEP LOCKYER RURAL INC.**	Fourth Co-Respondent by Election
And:	**LYNNE HALL**	Fifth Co-Respondent by Election
And:	**GEOFFREY KING**	Sixth Co-Respondent by Election

FINAL ORDER

Before: His Honour Judge Robin QC
Date of Hearing: 3 – 7 June 2013 and 28 February 2014
Date of Judgment:

THIS MATTER having on 3 – 7 June 2013 and this day come on for hearing by way of appeal against the Respondent's decision to refuse a development application (**Application**) made in respect of land located at Ranger Road, Adare, which has a real property description of Lot 191 on Crown Plan CSH2361 (**Land**), which seeks:

1. a development permit for a material change of use of the Land for electricity generation infrastructure comprising a staged development of a gas-fired peaking power generation plant consisting of up to six open cycle gas turbines with a total generating capacity of up to 1,000 MW;

THE PLANNING AND ENVIRONMENT COURT BRISBANE

FINAL ORDER

McInnes Wilson Lawyers
Level 14, Central Plaza One
345 Queen Street BRISBANE QLD 4000
Phone: 07 3231 0600
Facsimile: 07 3221 2921
Email: tgallienne@mcw.com.au
Our ref: TWG:NMC:97064

2. a development permit for environmentally relevant activity no.14 – electricity generation threshold 1 – generating electricity by using gas at a rated capacity of 10 MW electrical or more; and

3. a development permit for operational work for clearing vegetation made assessable under Schedule 8 of the *Integrated Planning Act* 1997 (Qld).

IT IS ORDERED THAT:

1. The appeal be allowed.

2. The Application be approved subject to the approval package attached and marked 'Annexure A', which is comprised of:

   (a) conditions required to be imposed by the Respondent and the approved plan, which appear at pages 1 to 10 of Annexure A;

   (b) conditions required to be imposed by the First Co-Respondent by Election, which appear at pages 11 to 33 of Annexure A; and

   (c) conditions recommended by Energex, which appear at pages 34 to 36 of Annexure A, and are imposed through condition 49 required to be imposed by the Respondent.

Filed on:
Filed by: McInnes Wilson Lawyers
Trevor Gallienne
Service Address: Level 14, Central Plaza One
345 Queen Street, BRISBANE QLD 4000
Phone: 07 3231 0600
Fax: 07 3221 2921
Email tgallienne@mcw.com.au

THE PLANNING AND ENVIRONMENT COURT BRISBANE

Registrar

THE PLANNING AND ENVIRONMENT COURT BRISBANE

Annexure A

CONDITIONS OF APPROVAL		
NO.	**CONDITION**	**TIMEFRAME**
Scope of Approval		
1.	Deleted	**N/A**
2.	Whilst the facility may be staffed (e.g. security, maintenance and operational staff) 24 hours a day, every day, electricity generation is limited to satisfy peak electricity demand.	**Ongoing**
Approved Plans and Documents		
3.	The development shall be undertaken generally in accordance with the following plans and documents: A. Plan 41-21379-SK004 Rev E (Plant Layout Option 1 Plan View) prepared by GHD and dated 3 December 2009. B. Westlink Power Project Site Based Management Plan Rev 0 prepared by GHD and dated 3 September 2009. C. Westlink Power Project Landscape Management and Revegetation Plan Rev 0 prepared by GHD and dated 23 February 2010. D. Westlink Power Project Draft Landscape Specification Rev 0 prepared by GHD and dated 23 February 2010. E. Westlink Power Project Erosion Management Plan Rev 0 prepared by GHD and dated 23 February 2010. F. Westlink Power Project Stormwater Management Plan Rev 0 prepared by GHD and dated 23 February 2010. G. Westlink Power Project Waste Management Plan Rev 0 prepared by GHD and dated 23 February 2010. H. Westlink Power Project Visual Impact Rev 0 and Landscape Assessment prepared by GHD and dated 31 August 2009. I. Westlink Power Project Visual Impact and Landscape Assessment Addendum prepared by GHD and dated February 2010.	**Ongoing**

<table>
<tr><td></td><td>J. Vegetation Clearing Plan 41-22282-L007 prepared by GHD and dated 28 May 2010.</td><td></td></tr>
<tr><td colspan="3">Relevant Period of Approval and Staging</td></tr>
<tr><td>4.</td><td>(a) The relevant period is stated in Section 341(1)(a) of the Sustainable Planning Act 2009 (i.e. ‘four years starting the day the approval takes effect’). To avoid doubt, this condition does not effect the operation of section 341(4) of the Sustainable Planning Act 2009.

(b) The proposed development may be constructed in stages, to reflect market demand for peak electricity generation.

(c) If the proposed development is constructed in stages, the staged development shall not exceed the following:

<table><tr><th>Stage</th><th>Max. Generation Capacity (Total)</th><th>Max. No. of Turbines (Total)</th></tr><tr><td>1</td><td>350MW</td><td>2</td></tr><tr><td>2</td><td>700MW</td><td>4</td></tr><tr><td>3</td><td>1,000MW</td><td>6</td></tr><tr><td>Total</td><td>1,000MW</td><td>6</td></tr></table></td><td>Ongoing</td></tr>
<tr><td colspan="3">Internal Road Works and Vehicle Parking</td></tr>
<tr><td>5.</td><td>All internal roads, driveways, vehicle parking spaces and manoeuvring areas shall be sealed or of concrete construction.</td><td>To be included in Operational Works application</td></tr>
<tr><td>6.</td><td>The construction width of internal roads shall be sufficient to accommodate the turning movements of operational vehicles, maintenance vehicles and fire trucks.</td><td>To be included in Operational Works application</td></tr>
<tr><td>7.</td><td>A total of 27 car parking spaces are to be provided generally in accordance with Drawing 41-21379-SK004 Rev E</td><td>To be included in Operational Works application</td></tr>
<tr><td>8.</td><td>The minimum dimensions of car parking spaces and heavy vehicle loading and manoeuvring areas shall be in accordance with the requirements of AS/NZS2890.1 and AS 2890.2.</td><td>To be included in Operational Works application</td></tr>
<tr><td>9.</td><td>All internal roads, driveways, vehicle parking spaces and manoeuvring areas shall be maintained and kept available for their intended purposes.</td><td>Ongoing</td></tr>
<tr><td colspan="3">Vegetation Clearing and Rehabilitation</td></tr>
<tr><td>10.</td><td>Clearing of vegetation shall only occur within areas identified on Vegetation Clearing Plan 41-22282-L007 prepared by GHD and dated 28 May 2010</td><td>Prior to the commencement of any site works and</td></tr>
</table>

	and in accordance with the requirements of the Department of Environmental Resource Management as a referral agency.	**ongoing**
11.	All vegetation that is cleared on the site or external to the site to provide access shall be mulched on-site and used for onsite landscaping works	**During and after any clearing works**
12.	Where vegetation that is cleared on the site or external to the site to provide access cannot be used for onsite landscaping works it shall be removed and disposed of in an approved facility.	**During and after any clearing works**
13.	A Koala spotter must be present on-site during all vegetation clearance works of trees greater than 15cm diameter at breast height (DBH).	**During clearing works**
14.	Within Area B as defined by the Department of Environmental Resource Management approval map RARP2009/009249 the 50m boundary fire trail/break shall be reduced to 1.5 times the height of the tallest vegetation or 20m whichever is the greater. The difference between this and the 50m firebreak is to be rehabilitated to reflect the pre-cleared Regional Ecosystem. The Applicant is to submit and secure Council approval of an amended Landscaping and Rehabilitation Plan to reflect this condition.	**Prior to the commencement of any site works and ongoing**
15.	Within Area B as defined by the Department of Environmental Resource Management approval map RARP2009/009249, the developer shall provide wildlife friendly fencing that allows the movement of macropods, koalas and gliders. This fencing must also be designed to reduce possible injury to native wildlife. Within the balance of the lot, the applicant must utilise wildlife friendly fencing that is designed to minimise possible injury native wildlife.	**Prior to the commencement of any site works and ongoing**
16.	Except where amended by conditions of this approval all rehabilitation and landscaping works are to be undertaken in accordance with: A. Westlink Power Project Landscape Management and Revegetation Plan Rev 0 prepared by GHD and dated 23 February 2010. B. Westlink Power Project Draft Landscape Specification Rev 0 prepared by GHD and dated 23 February 2010. C. Westlink Power Project Visual Impact Rev 0 and Landscape Assessment prepared by GHD and dated 31 August 2009. D. Westlink Power Project Visual Impact and	**Prior to commencement of the use and included in Operational Works application.**

	Landscape Assessment Addendum prepared by GHD and dated February 2010. E. Vegetation Clearing Plan 41-22282-L007 prepared by GHD and dated 28 May 2010.	
17.	All areas of vegetation that are not cleared in accordance with the approval and all rehabilitation areas shall be protected in perpetuity in the form of a statutory covenant placed on the land title in accordance with the *Land Title Act 1994*.	**Prior to commencement of the use**
18.	All Revegetated Earth Bunds identified on Vegetation Clearing Plan 41-22282-L007 prepared by GHD and dated 28 May 2010 shall be protected in perpetuity in the form of a statutory covenant placed on the land title in accordance with the *Land Title Act 1994*.	**Prior to commencement of the use**
Mitigation of Bushfire Risk		
19.	A Bushfire Management Plan shall be prepared by a suitably qualified person in consultation with the local rural fire brigade which provides: A. An evaluation of bushfire hazard on Lot 191 CSH2361. B. Mitigation measures during construction and operational phases of the development. C. Details of the responsibilities and obligations of the operator of the facility for the ongoing management of bushfire hazard on the Land.	**Prior to commencement of the use**
Lighting		
20.	Lighting shall only be provided on-site for security and safety purposes and shall be designed, constructed, located and maintained in accordance with Australian Standard 4282 – 1997 (Control of the obtrusive effects of outdoor lighting) so as not to cause nuisance to the occupants of nearby properties or passing traffic. In addition on-site lighting must be wildlife friendly and so shall not include flood lighting, bare bulbs and any lighting pointing upward and shall comply with the mitigation measures outlined in Table 5.1 of Detailed Ecological Assessment Prepared by Conics, dated 21 April 2009.	**Ongoing**
20A.	Notification of the structure shall be given in accordance with Civil Aviation Safety Authority publication AC139-08(0) Reporting of Tall Structures.	**Prior to the commencement of any works**
20B.	The advice of the Civil Aviation Safety Authority shall be sought regarding the requirements to	**Prior to the commencement of**

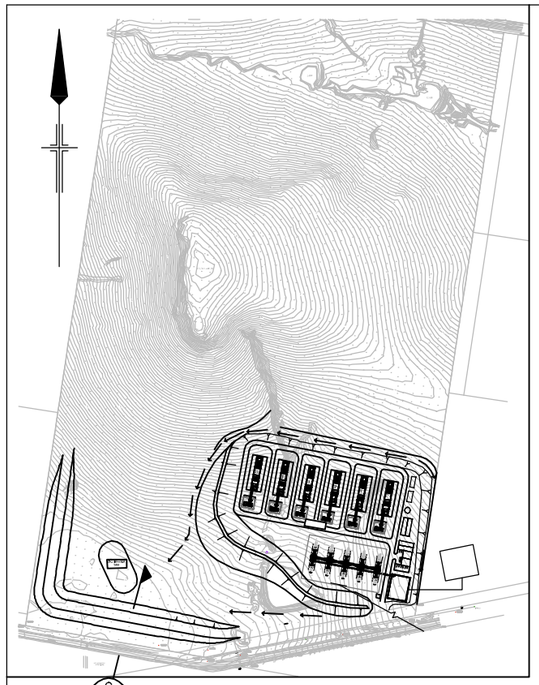
	provide obstacle lighting on the structure.	**any works**
Environmental Health		
21.	All waste storage and management shall be undertaken in accordance with Westlink Power Project Waste Management Plan Rev 0 prepared by GHD and dated 23 February 2010 subject to the following: A. An adequate number of an appropriate type of commercial and bulk waste containers shall be provided at a central location to accommodate all waste produced on the site; B. Arrangements shall be made for all waste collected on the site to be removed not less than once per week; C. The waste collection area shall be provided with an imperviously paved area on which to stand all waste containers and a suitable form of enclosure to conceal and secure the waste disposal area; and D. The waste collection area must be located such that the waste collection vehicle can collect the waste without obstruction and leave the property in a forward gear.	**To be included in Operational Works application**
Access and External Road Works		
22.	Access to the site from the Warrego Highway for construction traffic (other than Heavy Oversized Vehicles and Heavy Haulage Road Trains) during all stages of construction is to be via Gatton-Esk Road, Redbank Creek Road and Fords Road.	**During all construction activities**
23.	Subject to the requirements of the Department of Transport and Main Roads access to the site for from the Warrego Highway for Heavy Oversized Vehicles and Heavy Haulage Road Trains during all stages of construction is to be via a direct temporary connection between the Warrego Highway and Fords Road.	**During all construction activities**
24.	Where temporary access is provided for Heavy Oversized Vehicles and Heavy Haulage Road Trains in accordance with Condition 21, the developer shall be responsible for the design and construction of all works on Fords Road necessary to provide temporary access and shall be responsible for removal of temporary works upon completion of all stages of the development.	**To be included in Operational Works application and ongoing**
25.	The applicant shall enter into an infrastructure agreement with the Lockyer Valley Regional Council to address the mitigation of the impacts of	**To be completed prior to the commencement of**

	construction traffic generated by the development on the local road network. The agreement shall include but not be limited to: A. The identification of works required to be undertaken on Redbank Creek Road and Fords Road and the intersections of Gatton-Esk Road /Redbank Creek Road and Redbank Creek Road/Fords Road/Adare Road to accommodate construction traffic generated by the development; B. The requirement for the developer to design and construct the required works identified in Point A prior to the commencement of construction of the first stage of the development; C. The extent to which the works identified in Point A which are not temporary works and which are required to be constructed by Point B constitute trunk infrastructure that can be offset against the infrastructure contributions required to be paid to Council pursuant to Condition 46. D. The basis for the calculation of the amount of the reduction in infrastructure contributions payable pursuant to Condition 46 as a result of the offset identified in Point C.	**any works on the land**
26.	Access to the development from Fords Road shall be designed by an RPEQ to an industrial access standard and be configured to accommodate the turning movements of all construction traffic to Austroad Standards. To this end drawings provided with the Operational Works application shall indicate proposed width, turning movements, drainage provision and detail all required road or shoulder widening.	**To be included in Operational Works application**
27.	The minimum sealed width of the main entrance from Fords Road shall be 6m.	**To be included in Operational Works application**
Operational Works		
28.	Approval of Operational Works for all site works, internal roads, parking and manoeuvring areas, drainage and landscaping and all external works for each applicable stage shall be obtained prior to the undertaking of any works or clearing on the land or external to the land.	**Prior to the commencement of any works**
29.	An application for Operational Works shall be supported by detailed plans, drawings and calculations that includes but is not limited to:	**To be included in Operational Works application**

	A. Three full sets plans and drawings in A3 size showing full construction details, layout dimensions and finished surface levels; B. All relevant calculations supporting all proposed stormwater and drainage infrastructure; C. Evidence that all plans, drawings and calculations have been checked, approved and signed by a current RPEQ with their registration number; and D. Any other detail or documentation required to be included in the Operational Works application by conditions of this approval.	
30.	All batters resulting from earthworks (cut and fill) associated with the development must be located within the subject land.	**To be included in Operational Works application**
31.	With regard to the construction of infrastructure to become Council owned, all works must be supervised by a RPEQ competent in civil works and must be undertaken by a nominated Principal Contractor experienced in the construction of Municipal Works. Council reserves the right to request evidence of the Principal Contractor's competency.	**At all times during construction**
32.	With regard to the construction of infrastructure to become Council owned, works must be accepted "On Maintenance" prior to commencement of use. A maintenance bond equal to 10% of the construction cost (minimum of $1,000.00) must be retained by Council for a minimum period of twelve months, or until such time as the works are accepted "Off Maintenance" by Council.	**To be included in Operational Works application**
33.	On completion of the works a certificate must be submitted to Council by an RPEQ certifying that the works have been constructed in accordance with Council's construction standards and in compliance with the approved plans and specification. It is expected that the RPEQ will undertake the necessary inspections to make this certification.	**To be included in Operational Works application**
Stormwater Management and Drainage		
34.	All stormwater management and drainage infrastructure shall be designed by an RPEQ generally in accordance with: A. Westlink Power Project Stormwater Management Plan Rev 0 prepared by GHD and dated 23 February 2010;	**To be included in Operational Works application**

	B. Gatton Shire Council Planning Scheme; C. Queensland Urban Drainage Manual; and D. Any other detail or documentation required to be included in the Operational Works application by conditions of this approval.	
35.	Stormwater drainage structures shall be designed so that there is 'no worsening' of runoff beyond that which occurs on the existing undeveloped site.	**To be included in Operational Works application**
36.	Detailed design plans submitted with the Operational Works Application shall show the location and details of the stormwater treatment devices identified in Section 4.4 of Westlink Power Project Stormwater Management Plan Rev 0 prepared by GHD and dated 23 February 2010.	**To be included in Operational Works application**
37.	All devices shall be installed on the development site and responsibility for maintenance shall rest with the relevant site manager. Details of required operation and maintenance procedures shall be supplied for future Council reference if required.	**To be included in Operational Works application and ongoing**
38.	The Fords Road table drain on the outlet for the culverts through the landscape bund shall be reshaped and stabilised as necessary to carry the ARI 100 year design outlet flow from the detention basin. Such works shall be continued as necessary to an agreed point of discharge.	**To be included in Operational Works application**
39.	Ponding of stormwater must not occur on the subject land, adjoining allotments or road reserve unless specifically conditioned as part of this development approval or the subsequent approval for Operational Works.	**Ongoing**
Erosion, Sediment and Pollutant Management		
40.	Erosion and sediment control measures shall be provided generally in accordance with Westlink Power Project Erosion Management Plan Rev 0 prepared by GHD and dated 23 February 2010.	**To be included in Operational Works application**
41.	Detailed design plans shall show the location and dimensions of the relevant erosion and sediment control devices.	**To be included in Operational Works application**
42.	All unlined open drains on the site and along Fords Road adjacent to the site shall be stabilised with vegetation upon completion in accordance with Table 9.05.3 of QUDM.	**Prior to the commencement of any site works and ongoing**
Impact of Works on Assets, Services and Infrastructure		
43.	Any alterations which are necessary or damage which is incurred as a result of the proposed development, to any public infrastructure, must be	**During any works and ongoing**

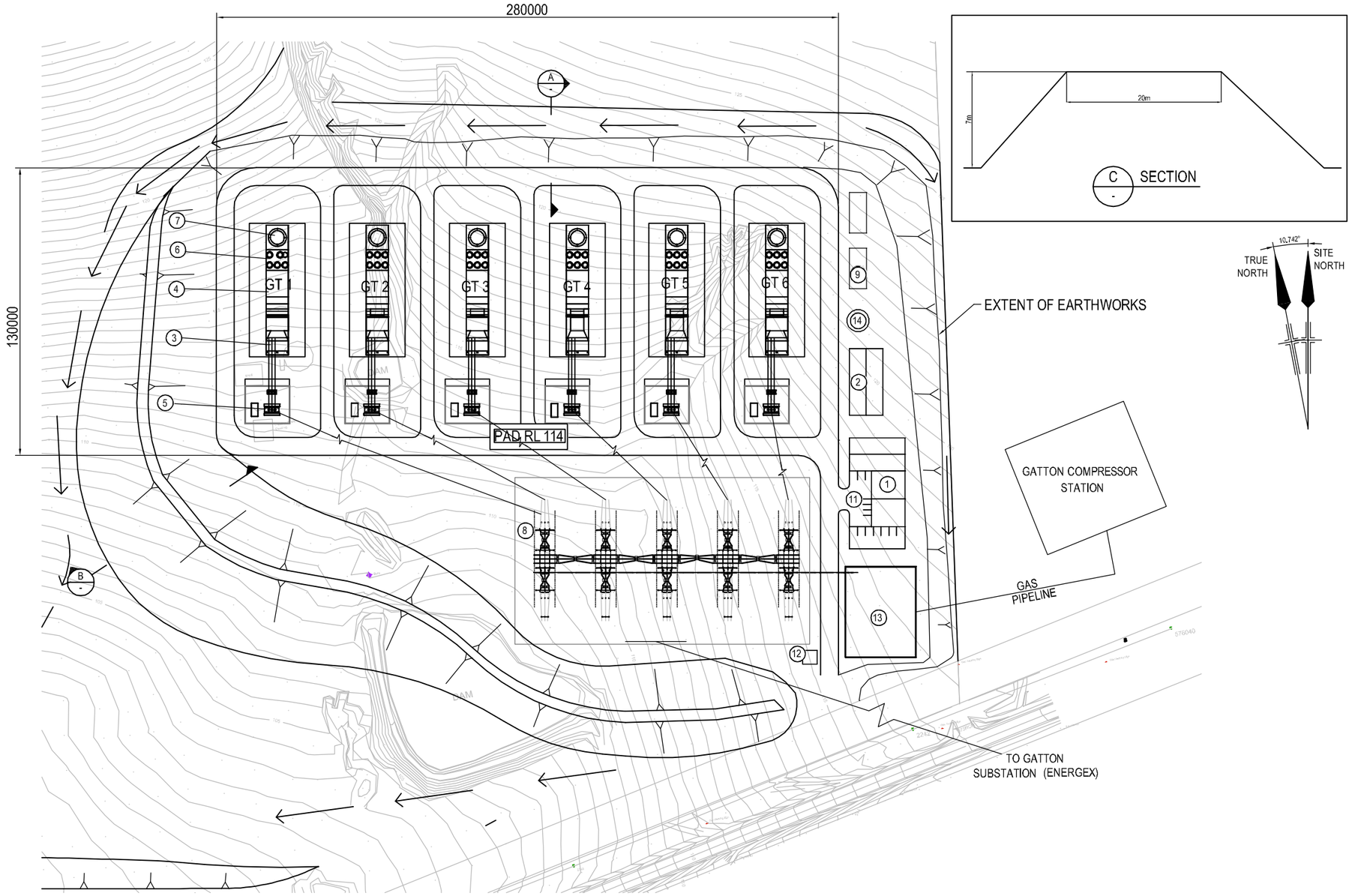
	carried out or repaired at the applicant's expense and with the approval of the relevant asset owner.	
44.	Where existing features or services are required to be removed or relocated to suit the development the terms and conditions of the relevant controlling authority are required to be met. The developer is required to contact controlling authorities for determination of conditions prior to any works being undertaken.	**During any works and ongoing**
45.	Any costs from repairs due to damage caused to Council assets as a result of proposed works undertaken shall be met by the applicant. Where pedestrian and vehicular traffic safety is exposed to hazards created from damage, the damage shall be repaired immediately.	**During any works and ongoing**
Infrastructure Contributions		
46.	Infrastructure contributions shall be payable to the Lockyer Valley Regional Council in accordance with an Adopted Infrastructure Charges Notice issued pursuant to the Council's Adopted Infrastructure Charges Resolution.	**To be paid prior to commencement of the use**
47.	Should the development be connected to the reticulated water supply an infrastructure contribution shall be payable to Queensland Urban Utilities in accordance with an Adopted Infrastructure Charges Notice issued pursuant to the Council's Adopted Infrastructure Charges Resolution.	**To be paid prior to commencement of the use and connect to the reticulated water supply**
Plumbing And Wastewater Disposal		
48.	No plumbing or drainage works are to be undertaken until plumbing approval has been granted.	**Prior to plumbing and drainage work**
Concurrence and Advice Agency Conditions		
49.	This approval is subject to the requirements and conditions of the following referral agencies which are provided in Schedule 1: A. Department of Environment and Resource Management; and B. Energex	**As set out in the requirements and conditions of the relevant agencies**



C
-

SITE LOCATION

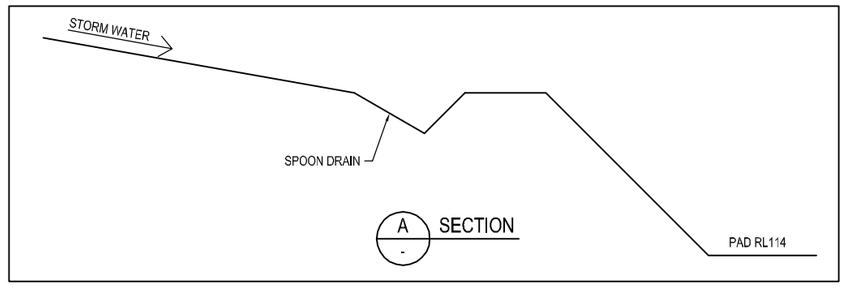
SCALE 1:5000



	DESCRIPTION	HEIGHT (m)
1	CONTROL AND ADMIN BUILDING	7.0
2	WAREHOUSE AND WORKSHOP	14.0
3	GAS TURBINE AIR INTAKE	26.0
4	GAS TURBINE ENCLOUSRE	8.5
5	TRANSFORMER	5.0
6	COOLING FANS	13.0
7	EXHAUST STACK	30.0
8	SWITCHYARD	11.0
9	OTHER TANKS & PUMPS	7.0
10	FIRE SYSTEM	4.0
11	CAR PARK	-
12	SECURITY HOUSE	4.0
13	GAS SKID (IF REQUIRED)	6.0
14	FIRE TANK	9.0

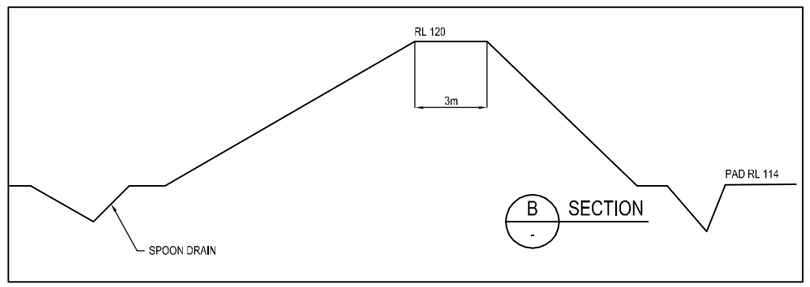
NOTES:

1. SITE LOCATION, SIZING AND LAYOUT INDICITIVE ONLY.
2. EXISTING DAM TO BE FILLED IN.
3. ARROWS INDICATE STORMWATER FLOW



SITE LAYOUT

SCALE 1:1000



PRELIMINARY

No	Revision	Drawn	Checked	Approved	Date
E	BUND MODIFIED	GHD			03/12/09
D	BUND & STORMWATER ADDED	GHD			24/11/09
C	EXTERNAL INFRASTRUCTURE INCLUDED	GHD			25/08/09
B	CLIENT COMMENTS INCORPORATED	GHD			17/07/09
A	ISSUED FOR CLIENT REVIEW	GHD			

Notes " Indicates signatures on original issue of drawing or last revision of drawing

GHD CLIENTS | PEOPLE | PERFORMANCE

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E brsmail@ghd.com W www.ghd.com

Drawn	GHD	Designed	
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: **WESTLINK PTY. LTD.**

Project: **WESTLINK POWERSTATION DEVELOPMENT ASSISTANCE**

Title: **PLANT LAYOUT OPTION 1**
PLAN VIEW

Original Size **A1**

Drawing No: **41-21379-SK004**

Rev: **E**

Plot Date: 3 December 2009 - 2:55 PM Plotted by: Cameron Cassar

Cad File No: G:\41\21379\CADD\Drawings\41-21379-SK004_ALT_E.dwg

1. **Application information**

1.1. **Applicant's name:** Westlink Pty Ltd as trustee for Westlink Industrial Trust

1.2. **Property description:** 191 CSH2361 - Lockyer Valley Regional Council

1.3. **Assessment Manager/Reference:** DA6538

1.4. **Date application was referred to Department:**24 September 2009

1.5. **Departmental Reference**: eLVAS Case No: 2009/009249, File Ref. No: SER/017011, Trackjob No: IC0909BEE0028

1.6. **Type/s of development sought by the application:**

- Material Change of Use

2. **Concurrence Agency response:**

The Chief Executive of the Department of Environment and Resource Management directs that the following conditions must be imposed on any approval given by the Assessment Manager:

2.1 Clearing of assessable native vegetation is limited to Area A as shown on the attached Referral Agency Response (Vegetation) Plan that has the reference RARP2009/009249;

2.2 Clearing within Area A is limited to the extent necessary to establish the Westlink Powerstation as shown on siteplan titled 'Plan Layout Option 1' prepared by GHD, drawing number 41-2139-SK004 Rev E, dated 3 December 2009; and

2.3 No clearing as a result of the Material Change of Use is to occur within the area shown as Area B on the attached *Referral Agency Response (Vegetation) Plan* that has the reference RARP2009/009249, unless the clearing is—

- By fire under the *Fire and Service Rescue Service Act 1990* to reduce hazardous fuel loads or an activity under the *Fire Service and Rescue Act 1990,* section 53, 68 or 69; or
- Where it is necessary to remove or reduce the imminent risk that the vegetation poses to serious personal injury or damage to property; or
- To establish a firebreak to protect the Westlink Powerstation as shown on siteplan titled 'Plan Layout Option 1' prepared by GHD, drawing number 41-2139-SK004 Rev E, dated 3 December 2009 for a maximum width not exceeding 1.5 times the height of the tallest vegetation adjacent to the infrastructure, or 20 metres, whichever is the greater; and
- To give effect to any subsequent development approvals for operational works that is the clearing of native vegetation.

2.4 Prior to, during and post clearing of assessable native vegetation, sediment and erosion controls must be implemented in accordance with the site management plan titled 'Westlink Power Project Erosion Management Plan' prepared by GHD, dated February 2010; and

2.5 Clearing of assessable native vegetation must be staged in accordance with operational needs; and

2.6 Any clearing or activities associated with clearing within Permit Area A on the attached Referral Agency Response (Vegetation) Plan that has the reference RARP2009/009249 must not adversely impact on assessable native vegetation outside Permit Area A; and

2.7 Within Permit Area A as shown on the attached Referral Agency Response (Vegetation) Plan that has the reference RARP2009/009249 clearing must only commence once the clearing area has been clearly defined; and

2.8 Land clearing debris must not be pushed into gullies, watercourses, other drainage line or waterlogged areas; and

2.9 Site briefings for all construction staff must occur prior to any major works and before commencement of works daily to discuss approved clearing processes and provide clear understanding of areas to be protected from construction; and

2.10 No clearing as a result of the Material Change of Use shall occur in any High Value Regrowth vegetation unless clearing is exempt under schedule 24 of the *Sustainable Planning Regulation 2009* or done in accordance with *the Regrowth Vegetation Code – Version 1*, October 2009.

THIRD PARTY ADVICE MATTERS

Aboriginal Cultural Heritage Act 2003

The Department of Environment and Resource Management (DERM) also takes this opportunity to advise the Assessment Manager of the responsibilities of applicants under the *Aboriginal Cultural Heritage Act 2003*. The Assessment Manager may wish to include this information as an Advisory Note on the Decision Notice issued for the application.

Under section 23 of the *Aboriginal Cultural Heritage Act 2003* a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the "cultural heritage duty of care"). Maximum penalties for breaching the duty of care are $750,000 for a corporation and $75,000 for an individual.

Applicants will comply with the duty of care in relation to Aboriginal cultural heritage if they are acting in accordance with cultural heritage duty of care guidelines gazetted under the *Aboriginal Cultural Heritage Act 2003*, available on the DERM website, or in accordance with an agreement with the Aboriginal party for the area or a cultural heritage management plan approved under Part 7 of the *Aboriginal Cultural Heritage Act 2003.*

Applicants are also encouraged to undertake a search of the Aboriginal Cultural Heritage Database and the Aboriginal Cultural Heritage Register, administered by the Cultural Heritage Coordination Unit, Department of Environment and Resource Management. Application forms to undertake a free search of the Cultural Heritage Register and the Database may be obtained by contacting the Cultural Heritage Coordination Unit on (07) 3239 3647 or on the DERM website http://www.derm.qld.gov.au/cultural_heritage/index.html.

Water Act 2000

- There is no watercourse on or adjacent to this land.
- There are no water authorities attached to this parcel of land.
- Property falls within the Moreton Water Resource Plan area and **is** in a Groundwater Management area

- No new bores permitted unless for stock or domestic purposes or to replace an existing bore.
- Construction of any dams or other interference with overland flow of water is to be in accordance with the requirements of the codes developed under Schedule 8, Part 1, table 4 of *Integrated Planning Act 1997*(IPA).
- Property falls within the Great Artesian Basin Water Resource Plan area
- No new bores tapping aquifers of the Great Artesian Basin are permitted unless for stock or domestic purposes or to replace an existing bore

3. Reasons:

A Statement of Reasons is attached at Schedule 1.

4. Additional comments or information:

South East Queensland Planning unit to provide on departmental response.

5. Authorised Officer Signature:

Shannon Cooper
Vegetation Management Officer
South East Region

Date of Response: 23 March 2010

Att. Schedule 1 – Statement of Reasons

eLVAS Case No:	2009/009249
File Ref. No:	SER/017011
Trackjob No:	IC0909BEE0028

Schedule 1

Statement of Reasons
Referral Agency Response
Application for Material Change of Use
Westlink Pty Ltd as trustee for Westlink Industrial Trust

The following Statement of Reasons is provided pursuant to s. 3.3.18(8) of the *Integrated Planning Act 1997*

Introduction

1. The Department of Environment and Resource Management (DERM) received an application from Westlink Pty Ltd on 24 September 2009.
2. The application is for a MCU for Electricity Generation and Infrastructure (Concurrence-Multiple Issue) on 191 CSH2361 - Lockyer Valley Regional Council.
3. A departmental Information Request was sent to the applicant on the 23 October 2009.
4. The applicant responded to the Information Request on 26 February 2010.
5. An Assessment Report was approved by the delegated officer on 17 March 2010.
6. The Delegate determined the Referral Agency Response on 23 March 2010.

Evidence

1. Application dated 23 September 2009.
    a) Completed IDAS Form 1 Parts "A, D & J".
    b) Property Vegetation Management Plan.
2. Smartmap
3. Regional ecosystem mapping, version 6.0
4. *Integrated Planning Act 1997& Integrated Planning Regulation 1998 (Schedule 2)*
5. *Vegetation Management Act 1999*
6. *Department of Environment and Resource Managements Concurrence Agency Policy for Material Change of Use dated* 23 August 2007
7. *State Planning Policy (SPP) 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire, and Landslide.*
8. Information Request to applicant dated 23 October 2009.
9. Response to Information Request from applicant received 26 February 2010.
10. Assessment Report dated 17 March 2010.

Findings of fact

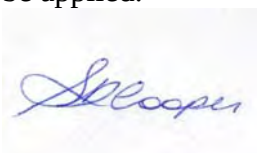
1. The application received by DERM on 24 September is for a Material Change of Use (MCU) for Electricity Generation and Infrastructure on lot 191 CSH2361.
2. Smartmap identifies the land tenure as freehold.
3. Regional ecosystem mapping identifies lot 191 on CSH2361 contains Least Concern (12.9-10.2 & 12.9-10.5a) regional ecosystem and non-remnant vegetation.
4. A rectified image of the proposed development area and regional ecosystem mapping identifies clearing of a Least Concern regional ecosystem will occur.
5. The application was assessed against Criteria Table H-2 of the Concurrence Agency Policy for Material Change of Use – Clearing as a result of the MCU involves clearing of a Least Concern regional ecosystem.
6. The assessment report concluded the application satisfied all the performance requirements of the concurrence agency policy with the following conditions applied to any development approval.
    - Clearing of assessable native vegetation is limited to Area A as shown on the attached *Referral Agency Response (Vegetation) Plan* that has the reference RARP2009/009249;
    - Clearing within Area A is limited to the extent necessary to establish the Westlink Powerstation as shown on site plan titled 'Plan Layout Option 1' prepared by GHD, drawing number 41-2139-SK004 Rev E, dated 3 December 2009; and
    - No clearing as a result of the Material Change of Use is to occur within the area shown as Area B on the attached Referral Agency Response (Vegetation) Plan that has the reference RARP2009/009249, unless the clearing is—
        - By fire under the *Fire and Service Rescue Service Act 1990* to reduce hazardous fuel loads or an activity under the *Fire Service and Rescue Act 1990*, section 53, 68 or 69; or
        - Where it is necessary to remove or reduce the imminent risk that the vegetation poses to serious personal injury or damage to property; or
        - To establish a firebreak to protect the Westlink Powerstation as shown on site plan titled 'Plan Layout Option 1' prepared by GHD, drawing number 41-2139-SK004 Rev E, dated 3 December 2009 for a maximum width not exceeding 1.5 times the height of the tallest vegetation adjacent to the infrastructure, or 20 metres, whichever is the greater; and
        - To give effect to any subsequent development approvals for operational works that is the clearing of native vegetation.
    - Prior to, during and post clearing of assessable native vegetation, sediment and erosion controls must be implemented in accordance with the site management plan titled 'Westlink Power Project Erosion Management Plan' prepared by GHD, dated February 2010; and
    - Clearing of assessable native vegetation must be staged in accordance with operational needs; and
    - Any clearing or activities associated with clearing within Permit Area A on the attached Referral Agency Response (Vegetation) Plan that has the reference RARP2009/009249 must not adversely impact on assessable native vegetation outside Permit Area A; and

- Within Permit Area A as shown on the attached Referral Agency Response (Vegetation) Plan that has the reference RARP2009/009249 clearing must only commence once the clearing area has been clearly defined; and
- Land clearing debris must not be pushed into gullies, watercourses, other drainage line or waterlogged areas; and
- Site briefings for all construction staff must occur prior to any major works and before commencement of works daily to discuss approved clearing processes and provide clear understanding of areas to be protected from construction; and
- No clearing as a result of the Material Change of Use shall occur in any High Value Regrowth vegetation unless clearing is exempt under schedule 24 of the *Sustainable Planning Regulation 2009* or done in accordance with *the Regrowth Vegetation Code – Version 1*, October 2009.

Reasons

1. The application complies with the performance requirements of the departmental concurrence agency policy for material change of use.
2. The application is consistent with purpose of the concurrence agency policy for material change of use which achieves the outcomes of the *Vegetation Management Act 1999*.

To ensure that any decision regarding this application is consistent with the purpose of the Vegetation Management Act 1999, conditions 2.1 to 2.10 of this referral agency response must be applied.

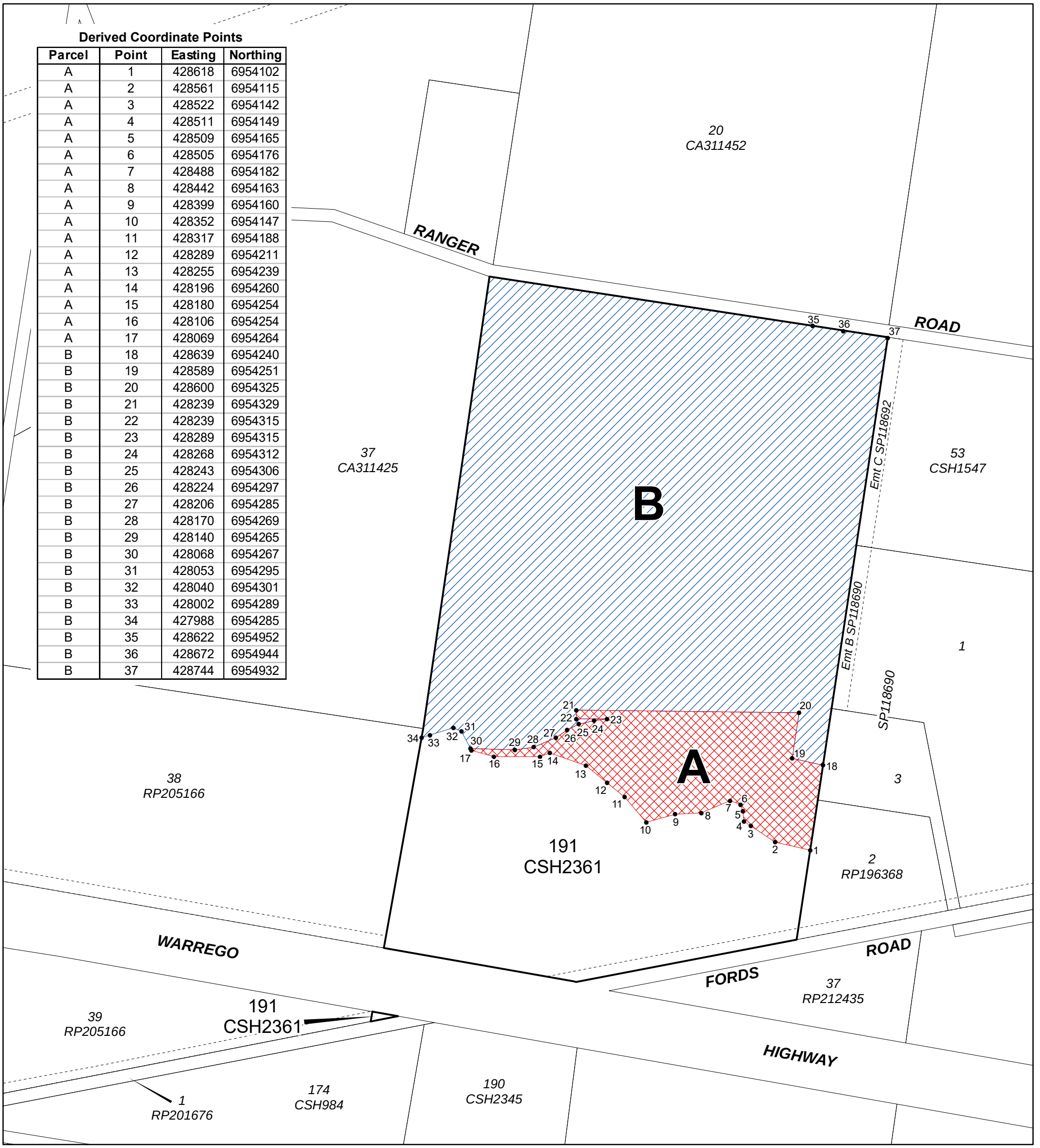


Shannon Cooper
Vegetation Management Officer
South East Region

23 March 2010

Derived Coordinate Points

Parcel	Point	Easting	Northing
A	1	428618	6954102
A	2	428561	6954115
A	3	428522	6954142
A	4	428511	6954149
A	5	428509	6954165
A	6	428505	6954176
A	7	428488	6954182
A	8	428442	6954163
A	9	428399	6954160
A	10	428352	6954147
A	11	428317	6954188
A	12	428289	6954211
A	13	428255	6954239
A	14	428196	6954260
A	15	428180	6954254
A	16	428106	6954254
A	17	428069	6954264
B	18	428639	6954240
B	19	428589	6954251
B	20	428600	6954325
B	21	428239	6954329
B	22	428239	6954315
B	23	428289	6954315
B	24	428268	6954312
B	25	428243	6954306
B	26	428224	6954297
B	27	428206	6954285
B	28	428170	6954269
B	29	428140	6954265
B	30	428068	6954267
B	31	428053	6954295
B	32	428040	6954301
B	33	428002	6954289
B	34	427988	6954285
B	35	428622	6954952
B	36	428672	6954944
B	37	428744	6954932



Scale 1:6000 at A3 paper size

0 50 100 200 300 400 500 600 m

Projection: UTM (MGA Zone 56) **Datum: GDA94**

Note: This is a colour plan and should only be reproduced in colour. All Derived Coordinate Points continue sequentially when labels are missing.

Note: Derived Coordinate Points are provided to aid in the location of the Referral Agency Response (Vegetation) Plan boundaries. Responsibility for locating these boundaries lies solely with the landholder and delegated clearing contractor(s).

The property boundaries shown on this plan are APPROXIMATE ONLY. They are NOT an accurate representation of the legal boundaries.

Note: This plan must be read in conjunction with Referral Agency Response 2009/009249

LEGEND

- Derived Coordinate Point.
- Subject Lot.
- Area A - Specific Conditions Apply. See Referral Agency Response 2009/009249 for Details.
- Area B - Specific Conditions Apply. See Referral Agency Response 2009/009249 for Details.

Referral Agency Response (Vegetation) Plan

Plan of Area A and Area B in Lot 191 on CSH2361

Trackjob No. IC0908BEE0028

N

Queensland Government

CENTRE: IPSWICH **REGION: SOUTH EAST**
LOCALITY: ADARE, GATTON **LGA: REGIONAL COUNCIL OF LOCKYER VALLEY**

Map Reference: 9342 | For data compilation sources see SER/017011/GIS

Keeper Reference: SER/017011 | Prepared by: NWF Date: 19 March 2010

RARP 2009/009249

Notice

Concurrence Agency Response

This notice is issued by the Department of Environment and resource Management pursuant to sections 3.3.16 and 3.3.18 of the Integrated Planning Act 1997 to advise of a decision.

Lockyer Valley Regional Council
PO Box 82
GATTON QLD 4343

CC: Westlink Pty Ltd
PO Box 1803
MILTON QLD 4064

Assessment Manager Ref: DA6538
Our reference: 341117

Dear Sir/Madam

Re: Referral for Concurrence Agency Response

The Department of Environment and Resource Management (DERM), wishes to advise that the referral for a concurrence agency response, received on 24-SEP-2009, has been assessed, and on 01-JUN-2010 it was approved subject to conditions.

1. Property/Location:

Street address - Ranger Road ADARE QLD 4343
Lot/Plan - Lot 191 Plan CSH2361

2. Details of the recommendation

Aspect of Development:

- Concurrence Response for a MCU involving an ERA.
- ERA 14 Electricity generation Threshold 1 - generating electricity by using gas at a rated capacity of 10MW electrical or more.

Recommendation:

- Approved subject to conditions.

DERM Ref Number:

- IPCE01630209.

~~3. Currency period~~

~~This approval will lapse unless substantially started within the standard currency periods stated in section 3.5.21 of the *Integrated Planning Act 1997* applying to each aspect of development in this approval.~~

Queensland Government

Department of Environment and Resource Management
www.derm.qld.gov.au ABN 46 640 294 485

4. Codes for self-assessable development

Any self-assessable development for an environmentally relevant activity conducted in conjunction with this approval, must comply with the relevant code of environmental compliance.

5. Assessment Manager Responsibilities

Please note that it is a requirement under Sections 3.5.15 and 3.5.17 of the Integrated Planning Act 1997 that a copy of the final Decision Notice (which includes the DERM's concurrence response) for this application issued by the Lockyer Valley Regional Council, be forwarded to each referral agency. Therefore could you please send a signed hardcopy to DERM's Permits and Licences Management Unit (PALM), GPO Box 2454 BRISBANE QLD 4001 and an electronic copy to palm@derm.qld.gov.au.

In addition, the State's Native Title Work Procedures indicate that responsibility for assessment of native title issues for an IDAS application rest with the Assessment Manager. Therefore in this instance, the EPA has not provided a notification to native title parties.

If you require more information please contact John Rice, DERM's project manager for application, on the telephone number listed below.

Yours sincerely

John Rice
Delegate of the Administering Authority
Department of Environment and Resource Management
01-JUN-2010

Enquiries:
ES-RSD-SER-Ipswich
PO Box 864
IPSWICH QLD 4305
Phone: (07) 3381 7550
Fax: (07) 3381 7560

Section 3.3.16 and 3.3.18 *Integrated Planning Act 1997*

DERM Permit[1] number: IPCE01630209

EPA Permit[1] number:	IPCE01630209
Assessment Manager reference:	Assessment Manager application number: DA6538
Date application received by EPA:	24-SEP-2009
Permit[1] Type:	Concurrence Response for a MCU involving an ERA
Date of Decision:	01-JUN-2010
Decision:	Granted with conditions
Relevant Laws and Policies:	*Environmental Protection Act 1994* and any subordinate legislation
Jurisdiction:	Item 1 in Table 2 of Schedule 2 of the *Integrated Planning Regulation 1998*

Development Description

Property	Lot/Plan	Aspect of Development
Ranger Road, ADARE QLD 4343	Lot 191 Plan CSH2361	ERA 14 Electricity generation Threshold 1 - generating electricity by using gas at a rated capacity of 10MW electrical or more

Reasons for inclusion of development conditions

In accordance with section 3.3.18(8) of the *Integrated Planning Act 1997* and section 27B of the *Acts Interpretation Act 1954*, the reasons for the inclusion of development conditions are:

1) the Department of Environment and Resource Management (DERM) is a concurrence agency under the *Integrated Planning Regulation 1998* for the purposes of the *Environmental Protection Act 1994*.
2) any development conditions placed on this permit for an environmentally relevant activity are in accordance with section 73B of the *Environmental Protection Act 1994*.

Additional comments or advice about the application

Nil.

Additional information for applicants

Trackable Waste

Where regulated waste is removed from site, the registered operator must monitor and keep records in accordance with schedule 2 of the *Environmental Protection (Waste Management) Regulation 2000* – Prescribed information for waste tracking.

[1] Permit includes licences, approvals, permits, authorisations, certificates, sanctions or equivalent/similar as required by legislation administered by the Department of Environment and Resource Management

Contaminated Land

It is a requirement of the *Environmental Protection Act 1994* that if an owner or occupier of land becomes aware a notifiable activity (as defined by Schedule 2 of the *Environmental Protection Act 1994*) is being carried out on the land or that the land has been affected by a hazardous contaminant, they must, within 22 business days after becoming so aware, give notice to the Department of Environment and Resource Management.

Environmentally Relevant Activities

The aforementioned description of any environmentally relevant activity (ERA) for which this permit is issued is simply a restatement of the ERA as prescribed in the legislation at the time of issuing this permit. Where there is any conflict between the abovementioned description of the ERA for which this permit is issued and the conditions specified herein as to the scale, intensity or manner of carrying out of the ERA, then such conditions prevail to the extent of the inconsistency.

This permit authorises the ERA. It does not authorise environmental harm unless a condition within this permit explicitly authorises that harm. Where there is no such condition, or the permit is silent on a matter, the lack of a condition or silence shall not be construed as authorising harm.

In addition to this permit, the person to carry out the ERA must be a registered operator under the *Environmental Protection Act 1994*. For the person to become a registered operator, they must apply for a registration certificate under section 73F of the *Environmental Protection Act 1994*.

John Rice
Delegate of Administering Authority
Department of Environment and Resource Management
01-JUN-2010

CONDITIONS OF APPROVAL

Condition for: ERA 14 Electricity generation Threshold 1 - generating electricity by using gas at a rated capacity of 10MW electrical or more

Agency Interest: General

General 1 In carrying out the activity to which this approval relates, all reasonable and practicable measures must be taken to prevent or to minimise the likelihood of environmental harm being caused.

General 2 Subject to condition General 3, the person undertaking the activity to which this approval relates must do each of the following—
(a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this approval;
(b) maintain such measures, plant and equipment in a proper and efficient condition; and
(c) operate such measures, plant and equipment in a proper and efficient manner.

General 3 Condition General 2 applies to measures, plant or equipment intended to measure compliance with condition Air 4 only if the person undertaking the activity to which this approval relates is directed by the administering authority under condition Air 5 to undertake monitoring for these contaminants, and then only for the period of time stated in the direction.

Qualified persons only to undertake monitoring, maintenance and calibration of measuring devices

General 4 The following activities, as required under this approval or a site based management plan applying to the site, must be carried out only by a person with appropriate experience or qualifications —
(a) all monitoring assessments and reports;
(b) maintenance of measures, plant and equipment; and
(c) calibration of instruments or equipment used for maintenance, measuring and monitoring the operational performance of, and emissions from, the power station.

Site based management plan

General 5 From commencement of the activity to which this approval relates, a site based management plan that addresses the following matters must be implemented —
(a) environmental commitments — a commitment by the person undertaking the activity to which the approval relates to achieve environmental goals stated in the plan and undertake continuous improvement in the overall environmental performance of the environmentally relevant activity;
(b) identification of environmental issues (including all sources or potential sources of environmental harm) and potential impacts of those issues on the environment;
(c) control measures for routine operations and all sources of actual or potential environmental harm mentioned in (b) to prevent or minimise the likelihood of environmental harm;
(d) contingency plans and emergency procedures for non-routine situations;
(e) organisational structure and responsibility;
(f) effective communication;
(g) monitoring of contaminant releases;
(h) conducting environmental impact assessments;
(i) staff training;
(j) record keeping;
(k) periodic review of environmental performance and benchmarks against which compliance with the terms of the site based management plan can be measured; and
(l) commitment by the operator to undertake continuous improvement in the overall environmental performance of the environmentally relevant activity.

General 6 The site based management plan, or any amendments made to it, must not be inconsistent with any condition(s) of this approval if the inconsistency would result in a lower standard of environmental performance than is required under the conditions of the approval.

Example for condition General 6: A lower standard of environmental performance might include, for example—
(a) specifying targets for the release of contaminants (incl. air, noise or water) at concentrations higher than those permitted for the contaminant under this approval, or where the concentrations of contaminants are specified under this approval as a range, by specifying concentrations targets for emissions outside that range; or
(b) requiring less frequent monitoring or reporting than required under the conditions of this approval.

General 7 To the extent of any inconsistency between a site based management plan and any condition(s) of this approval, other than where the inconsistency is of a type authorised under condition General 6, or any law of the State or Commonwealth in force at the relevant time, the site based management plan is invalid.

General 8 To remove any doubt, if a site based management plan imposes a higher standard of environmental performance than the standard required under the conditions of this approval, the registered operator must, under condition General 5, give effect to higher standard stated in the site based management plan.

Example for condition General 8: a higher standard of environmental performance requirement might include, for example—
(a) specifying lower emissions targets for contaminants to air or lower noise emissions than the limits specified for the contaminant under this approval;
(b) requiring more frequent monitoring or reporting of emissions than is required under this approval ; or
(c) requiring more frequent training for employees undertaking the activity about environmental issues than is required under the conditions of this approval.

General 9 If a site based management plan prescribes a higher standard of environmental performance than is required under the conditions of this approval, the plan can only be amended in a way that lowers the standard of environmental performance with the written approval of the administering authority.

Record keeping

General 10 The person undertaking the activity to which this approval relates must keep the following documents in a location accessible by all employees at the authorised place—
(a) a copy of this approval, incorporating any amendments made to the approval;
(b) a copy of the site based management plan, incorporating any amendments made to the site based management plan;
(c) all records kept under a condition of this approval; and
(d) all monitoring results compiled in accordance with the conditions of this approval.

General 11 The person undertaking the activity to which this approval relates must give the documents mentioned in condition General 10 to an authorised person or the administering authority as soon as possible upon request.

General 12 The person undertaking the activity to which this approval relates must keep all records or monitoring results made or compiled in accordance with the conditions of this approval for a minimum of five (5) years from the date the record is made or the result is compiled.

Auditing compliance with conditions of approval

General 13 The person undertaking the activity to which this approval relates must ensure that an audit of compliance with the conditions of this approval is commenced, by a suitably qualified third party auditor who is nominated by the approval holder and accepted by the administering authority, within 28 days following the commissioning of the power station.

General 14 The person undertaking the activity to which this approval relates must submit to the administering authority a complete and final report prepared by the auditor (the "auditor's report") mentioned in condition General 13 describing the auditor's findings and accompanied by a statutory declaration made under the *Oaths Act 1867* signed by the auditor declaring that the contents of the auditor's report are true and correct to the auditor's belief, within the timeframes specified below —
(a) if the audit is completed within 6 months of its commencement — within 28 days after the audit is completed; or
(b) if the audit is not completed within 6 months of its commencement — within 28 days after a period of 6 months has passed since the audit commenced.

General 15 If the auditor's report submitted under condition General 14 shows non-compliance with the conditions of this approval, the person undertaking the activity to which this approval relates

must, within 14 days after giving the auditor's report to the administering authority, give the administering authority a complete and final report —

(a) describing the person's response to the findings stated in the auditor's report;
(b) describing the actions that the person intends to undertake to rectify each non-compliance issue identified in the auditor's report; and
(c) if the action(s) mentioned in (b) will take more than 28 days to complete — describing the timeframes by which the action will be completed and specifying benchmarks against which compliance with the conditions of the approval will be achieved.

General 16 The total financial cost of the audit(s), and preparation and lodgement of the auditor's report, will be the responsibility of the person undertaking the activity to which this approval relates.

General 17 If the person undertaking the activity to which this approval relates gives the administering authority a report to which condition General 15(c) applies, the person must comply with the timeframes specified in the report.

General 18 If condition General 15(c) applies, the administering authority may, at the end of the timeframes specified in 15(c), by written notice, require the person undertaking the activity to which this approval relates to submit a further auditors report prepared by the same auditor in accordance with conditions General 13 to 15 and the person must comply with the requirement forthwith.

Notification of non-conforming discharges to the environment

General 19 The person undertaking the activity to which this approval relates must telephone the administering authority as soon as practicable after becoming aware of any release of contaminants not in accordance with the conditions of this approval.

General 20 The person undertaking the activity to which this approval relates must give the administering authority a written notice detailing the following information within 14 days of any advice provided in accordance with condition General 19 —

(a) the name of the person undertaking the activity, the number of this approval and the number stated on the registration certificate under which this activity is undertaken;
(b) the name and telephone number of a designated contact person;
(c) quantity and substance released;
(d) vehicle and registration details (if applicable);
(e) person/s involved (driver and any others);
(f) the location and time of the release;
(g) the suspected cause of the release;
(h) a description of the effects of the release;
(i) the results of any sampling performed in relation to the release;
(j) actions taken to mitigate any environmental harm caused by the release; and
(k) proposed actions to prevent a recurrence of the release.

Equipment must be calibrated to appropriate standard

General 21 All instruments, equipment and measuring devices used for measuring or monitoring in accordance with any condition of this approval must be calibrated —

(a) if a statutory instrument or standard made under a law of the State prescribes standards for calibrating the equipment — in accordance with that statutory instrument or standard; or
(b) otherwise — according to any relevant Australian Standard applicable to the calibration of the equipment.

Spill kits and training requirements

General 22 The person undertaking the activity to which this approval relates must keep an appropriate spill kit, personal protective equipment, operator instructions and emergency procedure guides for the management of wastes and chemicals associated with the activity in a place accessible to all employees at the authorised place.

General 23 The person undertaking the activity to which this approval relates must ensure that all employees undertaking the activity at the authorised place have received training in the use of the spill kit and the handling of chemicals stored at the authorised place.

General 24 The training mentioned in condition General 23 must be repeated for each employee at the authorised place at intervals of not greater than two (2) years.

General 25 The person undertaking the activity to which this approval relates must keep a record of the training provided to employees, including —
(a) the names of all persons who undertook the training;
(b) the date on which the training was provided; and
(c) an outline of the training provided.

General 26 The site layout for the power station, and associated structures, must comply with the document titled “PLANT LAYOUT OPTION 1 PLAN VIEW” with the reference number “Drawing No: 41-21379-SK004 rev: E” attached to this approval.

General 27 The proposed power station may be comprised of not more than 6 generators with a total electrical generating capacity of ≤1000MW.

Agency Interest: Air

Air 1 The only fuel that may be used to power the power station gas turbines is natural gas.

Air 2 The nitrogen dioxide (NO_2) emissions control technology known as a “low NO_x burner” must be installed for each generator.

Air 3 The release of dust or particulate matter resulting from the activity to which this approval relates must not cause an environmental nuisance at any nuisance sensitive place or commercial place.

Air 4 Dust and particulate matter must not exceed the following levels when measured at any nuisance sensitive place or commercial place:
(a) dust deposition of 120 milligrams per square metre per day, when monitored in accordance with Australian Standard AS 3580.10.1 of 2003 (or more recent editions); or
(b) a concentration of particulate matter with an aerodynamic diameter of ≤10 micrometre (µm) (PM_{10}) suspended in the atmosphere of 50 micrograms per cubic metre over a 24 hour averaging time, at a nuisance sensitive or commercial place downwind of the authorised place, when monitored in accordance with —
- Australian Standard AS 3580.9.6 of 2003 (or more recent editions) 'Ambient air — Particulate matter - Determination of suspended particulate PM_{10} high-volume sampler with size-selective inlet — Gravimetric method'; or
- any alternative method of monitoring PM_{10} which may be permitted by the 'Air Quality Sampling Manual' as published from time to time by the administering authority; or

(c) a concentration of particulate matter with an aerodynamic diameter of ≤2.5 micrometre (µm) ($PM_{2.5}$) suspended in the atmosphere of 25 micrograms per cubic metre over a 24 hour averaging time, at a nuisance sensitive or commercial place downwind of the authorised place, when monitored in accordance with —
- any relevant Australian Standard to the extent it is relevant to the measurement of $PM_{2.5}$ particles; or
- any alternative method of monitoring $PM_{2.5}$ which may be permitted by the 'Air Quality Sampling Manual' as published from time to time by the administering authority.

Monitoring dust or particulate matter

Air 5 The administering authority may, by written notice, direct the person undertaking the activity to which this approval relates to undertake monitoring for dust or particulate matter (PM_{10} or $PM_{2.5}$) if, based upon information available to the authority, the authority reasonably believes the activity to which this approval relates is causing, or is likely to cause, either or both of the following:
- environmental nuisance contrary to condition Air 3; or
- an exceedence of the concentration specified in condition Air 4 for the contaminant.

Air 6 If directed by the administering authority under condition Air 5 to undertake monitoring for dust or particulate matter, the person undertaking the activity to which this approval relates must undertake the monitoring for the contaminant, and a copy of the results must be given to the administering authority within 14 days following completion of monitoring. Monitoring must be carried out at a place(s) relevant to the potentially affected dust sensitive place and at upwind control sites and must include —
(a) for a complaint alleging dust nuisance — dust deposition; and

(b) for a complaint alleging adverse health effects caused by dust — the concentration per cubic metre of particulate matter with an aerodynamic diameter of ≤ 10 micrometre (μm) (PM_{10}) suspended in the atmosphere over a 24 hour averaging time.

Air 7 Subject to condition Air 8, the concentration of contaminants must not exceed the maximum release limits specified in the following table —

Table 1— Contaminant release limits to air

Release point number	Minimum release height (metres)	Minimum velocity (m/sec)	Contaminant release	Maximum release limit	Sampling frequency
All generator stacks	25	25 at full power output or pro-rata at lower output	Oxides of nitrogen	143.3 grams per second.	Continuous
			Carbon Monoxide	28.3 grams per second.	First sample within 28 days of commissioning of power plant. Thereafter, once in each period of six months or 876 hours of operating, whichever is the longer interval, but no longer than 12 months.
			Sulphur dioxide	6.9 grams per second	
			PM_{10}	22.7 grams per second	
			$PM_{2.5}$	11.35 grams per second	

Air 8 The release limits for oxides of nitrogen are applicable at all times except during start up and shut down phases of operation.

Air 9 Start-up and shut-down phases for the power plant must not exceed the time specified for the phase as follows —
(a) start-up (cold) — 1 hour;
(b) start-up (warm) — 30 minutes; or
(c) shut down — 30 minutes.

Air 10 Contaminants may be discharged only from the release points mentioned in the table called "Table 1 — Contaminant release limits to air" forming part of condition Air 7.

Air 11 Contaminants must be directed vertically upwards and without any impedance or hindrance, other than arising from the installation of the stack outlet silencer required under condition Noise 1.

Air 12 Sampling for each contaminant mentioned in the table called "Table 1 — Contaminant release limits to air" forming part of condition Air 7 must be performed at the frequency specified for the contaminant in that table.

Note: the plant is taken to operate for one (1) hour where one or more generators are generating electricity over that period, regardless of the configuration or electrical output of each generator. Therefore, sampling of all stacks for each contaminant should occur at or about the same time (e.g. emissions from stacks should be undertaken within 1 week, or where a single sampler is used to sample all stacks, sampling of each stack should be undertaken consecutively).

Air 13 The combustion efficiency and electrical efficiency of each gas turbine must be monitored and recorded at all time whilst operational. This continuous monitoring, which is based on process parameters, is required to ensure combustion efficiency and power station efficiency are maintained all the time at the manufacturer's guaranteed performance levels.

Air 14 An audible and visual alarm is to be installed, and the person undertaking the activity to which this approval relates must implement a process to investigate and address instances where the combustion efficiency falls below the manufacturer's guaranteed performance levels and all such alarm instances must be recorded.

Air 15 Monitoring of any releases to the atmosphere required by a condition of this approval must be carried out in accordance with the following requirements —
(a) monitoring provisions for the release points listed in the following table must comply with the Australian Standard AS 4323.1 - 1995 'Stationary source emissions Method 1: Selection of sampling positions' (or more recent editions);
(b) the following tests must be performed for each contaminant specified in the table called "Table 1 — Contaminant release limits to air" forming part of condition Air 7 —
- gas velocity and volume flow rate;
- temperature;

- water vapour concentration (moisture content);

(c) where practicable, samples must be taken when emissions are expected to be at maximum rates;

(d) during the sampling period the following additional information must be gathered —
- power station and turbine load;
- number of turbines operating; and
- reference to the actual test methods and accuracy of the methods.

Air 16 Contaminants must be released to the atmosphere from a release point at a height and a flow rate not less than the corresponding height and velocity stated for that release point in the table called "Table 1 — Contaminant release limits to air" forming part of condition Air 7.

Air 17 The person undertaking the activity to which this approval relates must submit a report to the administering authority each period of 12 months describing the quality characteristics of emissions from the power station for the contaminants (averaged over the term specified for each characteristic) specified in the following table —

Table 2 — Reporting emissions characteristics

Monitoring point	Quality characteristics	Data report as	Averaging period for reporting of emissions
All stack discharge points	Combustion efficiency [CO] v [CO_2]	$\frac{[CO_2]-[CO]}{[CO_2]} \times \frac{100}{1}$ or as agreed in writing by the administering authority	Six monthly
All stack discharge points	Oxides of Nitrogen	Parts per million & Grams/Second	Six monthly
All stack discharge points	Sulphur dioxide	Parts per million & Grams/second	Twelve monthly

Note: [CO_2] means the concentration of carbon dioxide and [CO] means the concentration of carbon monoxide.

Air 18 The person undertaking the activity to which this approval relates must—

(a) implement a monitoring program to regularly leak test all components including pumps, piping and controls, vessels and tanks;

(b) implement operating, maintenance and management practices to mitigate fugitive emission sources; and

(c) ensure ducting and extraction systems that transfer effluent gases from one location to another must be constructed, operated and maintained so as to minimise any leakage of effluent gases and vapours to the atmosphere occurring from these sources.

Air 19 The release of noxious or offensive odours or any other noxious or offensive airborne contaminant resulting from the activity to which this approval relates must not cause a nuisance at any nuisance sensitive place or commercial place.

Air 20 The person undertaking the activity to which this approval relates must install a monitoring station, in accordance with Australian Standard AS2923 — 1987 (Ambient air – guide for measurement of horizontal wind for air quality applications) (or a later standard), to record and log the following parameters —
- barometric pressure;
- humidity;
- temperature; and
- wind speed and direction.

Air 21 The data from the monitoring station mentioned in condition Air 20 must be given to the administering authority or an authorised person upon request.

Air 22 The person undertaking the activity to which this approval relates must install and operate a device to measure and record the total hours of operation of each generator, and the total accumulated hours of operation where the plant is generating electricity, and the record must be given to the administering authority or an authorised person upon request.

Agency Interest: Land

Land 1 A person must not, at any time, release contaminants to land, except to an evaporation pond at the authorised place that complies with condition Water 6 and that is designed and maintained specifically for the purpose of containing or treating the contaminant.

Land 2 If contaminants are released from the authorised place to land outside the authorised place, the person undertaking the activity to which this approval relates must as soon as reasonably practicable, notify, in writing, all persons affected or likely to be affected by the release, by providing the following information:

(a) the nature and extent of the contaminant release;
(b) a description of the contaminant released;
(c) if the incident involves the release of a chemical — a copy of the Material Safety Data Sheet for the chemical; and
(d) stating that the person who released the contaminant to land, or if the person who released the contaminant is not known, the person undertaking the activity to which the approval relates is required to remove or neutralise the contamination at the place.

Land 3 If contaminants are released from the authorised place to land contrary to this approval, the person who released the contaminant from the authorised place, or if the person who released the contaminant is not known, the person undertaking the activity to which this approval relates, must take all reasonable and practicable measures to remove or neutralise the contamination from the affected land, subject to directions of the landholder or occupier of the affected land and the administering authority or an authorised person.

Land 4 To remove any doubt, condition Land 3 does not authorise any person to enter another person's land without the consent of the landowner or occupier.

Land 5 The person who released the contaminant, or if the person who released the contaminant is not known, the person undertaking the activity to which this approval relates, shall be liable to pay all costs for removal or neutralisation of contaminants released to land contrary to this approval.

Land 6 All fuels and chemicals must be stored in an on-site containment system of a type suitable to prevent the spillage of the material and its discharge to the environment.

Land 7 In all instances, the storage and handling of chemicals and fuels done in accordance with the relevant Australian Standard (as amended or substituted by a later standard) shall be taken to be sufficient for compliance with condition Land 6.
At this date, see Standards:

- AS1940 — 2004 The storage and handling of flammable and combustible liquids;
- AS3780 — 2008 The storage and handling of corrosive substances; and
- AS/NZS 3833:2007 The storage and handling of mixed classes of dangerous goods, in packages and bulk intermediate containers.

Agency Interest: Noise

Noise 1 The following noise attenuation devices and design specifications must be installed or applied to the power plant before it is commissioned —

- air inlet attenuator;
- stack outlet silencers;
- stack body noise absorbing material;
- transformer noise attenuation barriers; and
- gas turbine and generator hall enclosures.

Noise 2 Noise from the activity to which this approval relates must not cause an environmental nuisance at any nuisance sensitive place or commercial place.

Noise 3 All noise from the power station, in any phase of operation, must not exceed the levels specified in Table 3 — Noise limits at any nuisance sensitive place or commercial place, following —

Table 3 — Noise limits at any nuisance sensitive place or commercial place

Noise level dB(A) measured as	7am - 6pm	6pm - 10pm	10pm - 7am
	Noise measured at a "nuisance sensitive place"		
$L_{Aeq, adj, 15 mins}$	43	38	37
	Noise measured at a "commercial place"		
$L_{Aeq, adj, 15 mins}$	48	43	42

Noise 4 When requested by the administering authority, the person undertaking the activity to which this approval relates must undertake, or commission the undertaking of, noise monitoring to investigate any complaint of noise nuisance, and the administering authority given a copy of the results of the monitoring within 14 days of the completion of monitoring. Monitoring must include the following —

(a) background noise level;
(b) $L_{Aeq, adj, 15 min}$;
(c) the level and frequency of occurrence of impulsive or tonal noise;
(d) atmospheric conditions including wind speed and direction;
(e) effects due to extraneous factors such as traffic noise; and
(f) location, date and time of recording.

Noise 5 The method of measurement and reporting of noise levels must comply with the latest edition of the 'Noise Measurement Manual' as published from time to time by the administering authority.

Agency Interest: Social

Social 1 The person undertaking the activity to which this approval relates must record the following information for each complaint received about the activity —

(a) time, date, name and contact details of the complainant;
(b) reasons for the complaint;
(c) any investigations undertaken by the person undertaking the activity to which this approval relates;
(d) conclusions formed by the person undertaking the activity to which this approval relates following the investigation; and
(e) any actions taken by the person undertaking the activity to which this approval relates to resolve the complaint(s).

Social 2 External lighting at the authorised place must conform to AS 4282 — 1997 (Control of the obtrusive effects of lighting) (or a later Australian Standard).

Social 3 Light emitted from the authorised place must not cause nuisance at a nuisance sensitive place.

Agency Interest: Waste

Waste 1 Sludges or any industrial wastewaters from the evaporation ponds may be disposed of only in the following ways:

- discharging to trade waste infrastructure (whether by direct connection to the authorised place or otherwise) in accordance with a trade waste approval; or
- tankering off-site to a facility authorised under the *Environmental Protection Act 1994* to receive the waste.

Waste 2 The person undertaking the activity to which this approval relates must ensure that regulated waste that are to be sent to another facility for disposal or treatment are transported only by a person authorised under the *Environmental Protection Act 1994* to transport it.

Waste 3 Waste (other than wastewater or sludges in the evaporation pond) must be removed from the authorised place within the timeframe specified for the waste as follows —

(a) if the waste is surplus from the construction of the power station — within three (3) months after the power station is commissioned; or
(b) otherwise — within three (3) months of the waste being generated.

Waste 4 Waste generated by the activity to which this approval relates must be stored, pending its lawful disposal to landfill or to a recycling facility, or another place with the written approval of the administering authority, in a location at the authorised place where it is not visible to a person outside the authorised place.

Waste 5 Waste must not be imported for storage or disposal at the authorised place.

Waste 6 Waste must not be buried or burned at the authorised place.

Agency Interest: Water

Water 1 Erosion protection and sediment control measures must be implemented and maintained to minimise erosion and prevent the release of sediment to any surface waters during construction of the power plant.

Water 2 A person must not allow or cause industrial wastewater or stormwater from the authorised place that has been in contact with any contaminant arising from the activity to be released to land or waters, other than to an on-site evaporation pond that complies with condition Water 6, at any time.

Water 3 All industrial wastewater or stormwater that has been in contact with any contaminant associated with the conduct of the activity to which this approval relates must be diverted to an on-site evaporation pond that complies with condition Water 6.

Water 4 All evaporation ponds must be constructed in a way that achieves Q100 flood line immunity.

Water 5 Evaporation ponds must have sufficient capacity to contain runoff expected from a 24-hour storm with an average recurrence interval of 1 in 5 years.

Water 6 The person undertaking the activity to which this approval relates must ensure that all evaporation ponds used for the storage or treatment of industrial wastewater or contaminated stormwater are constructed, installed and maintained —

(a) so as to prevent any release of contaminants through the bed or banks of the pond to any waters (including ground water);
(b) so that a freeboard of not less than 0.5 metres is maintained at all times; and
(c) so as to ensure the stability of the ponds construction.

Water 7 The person undertaking the activity to which this approval relates must ensure that industrial wastewater or contaminated stormwater is disposed of in accordance with condition Waste 1 if the evaporation ponds are not in compliance with condition Water 6, until such time as the non-compliance with condition Water 6 is rectified.

Water 8 The person undertaking the activity to which this approval relates must ensure that suitable banks or diversion drains are built and maintained to prevent stormwater runoff from entering any ponds or other structures used for the storage or treatment of industrial wastewater or contaminated stormwater.

Water 9 Banks and diversion drains must be of suitable design and capacity to disperse non-contaminated stormwater so as not to cause flooding, or contribute to increased flood potential, of the area.

DEFINITIONS

Words and phrases used throughout this permit are defined under the *Environmental Protection Act 1994*. Where a term is not defined under the *Environmental Protection Act 1994*, or the term is defined below, the definition in this permit prevails.

"activity" include that part, if any, of an activity relating to:

- preparing the authorised place for the activity before carrying out the activity; or
- rehabilitating the authorised place after it has been used for carrying out the activity.

"authorised place" means Lot 191 CSH2361 situated at Ranger Road, ADARE QLD 4343.

"background noise" means either —

- $L_{A90, T}$ being the A-weighted sound pressure level exceeded for 90 percent of the time period not less than 15 minutes, using Fast response, or
- $L_{Abg, T}$ being the arithmetic average of the minimum readings measured in the absence of the noise under investigation during a representative time period of not less than 15 minutes, using Fast response.

"commercial place" means a place, other than a nuisance sensitive place, that is used as an office or for business or commercial purposes, and includes a place within the curtilage of such a place reasonably used by persons at that place.

"dwelling" means any of the following structures or vehicles that is principally used as a residence –

- a house, unit, motel, nursing home or other building or part of a building;
- a caravan, mobile home or other vehicle or structure on land; or
- a water craft in a marina.

"$L_{Aeq,adj,15min}$" means an A-weighted sound pressure level of a continuous steady sound, adjusted for tonal character, that within a 15 minutes period has the same mean square sound pressure as a sound level that varies with time.

"land" in the "land schedule" of this document means land excluding waters and the atmosphere.

"noxious" means harmful or injurious to health or physical well being.

"nuisance sensitive place" means –

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- a motel, hotel or hostel; or
- a kindergarten, school, university or other educational institution; or
- a medical centre or hospital; or
- a protected area; or
- a public thoroughfare, park or gardens.

"offensive" means causing offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive.

"protected area" means –

- a protected area under the *Nature Conservation Act 1992*; or
- a marine park under the *Marine Parks Act 2004*; or
- a World Heritage Area.

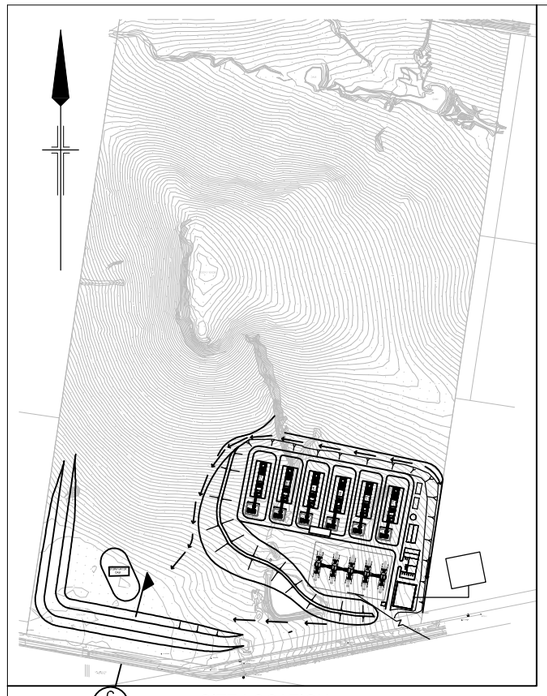
"site" means land on or in which it is proposed to carry out the development approved under this development approval.

"watercourse" means a river, creek or stream in which water flows permanently or intermittently-

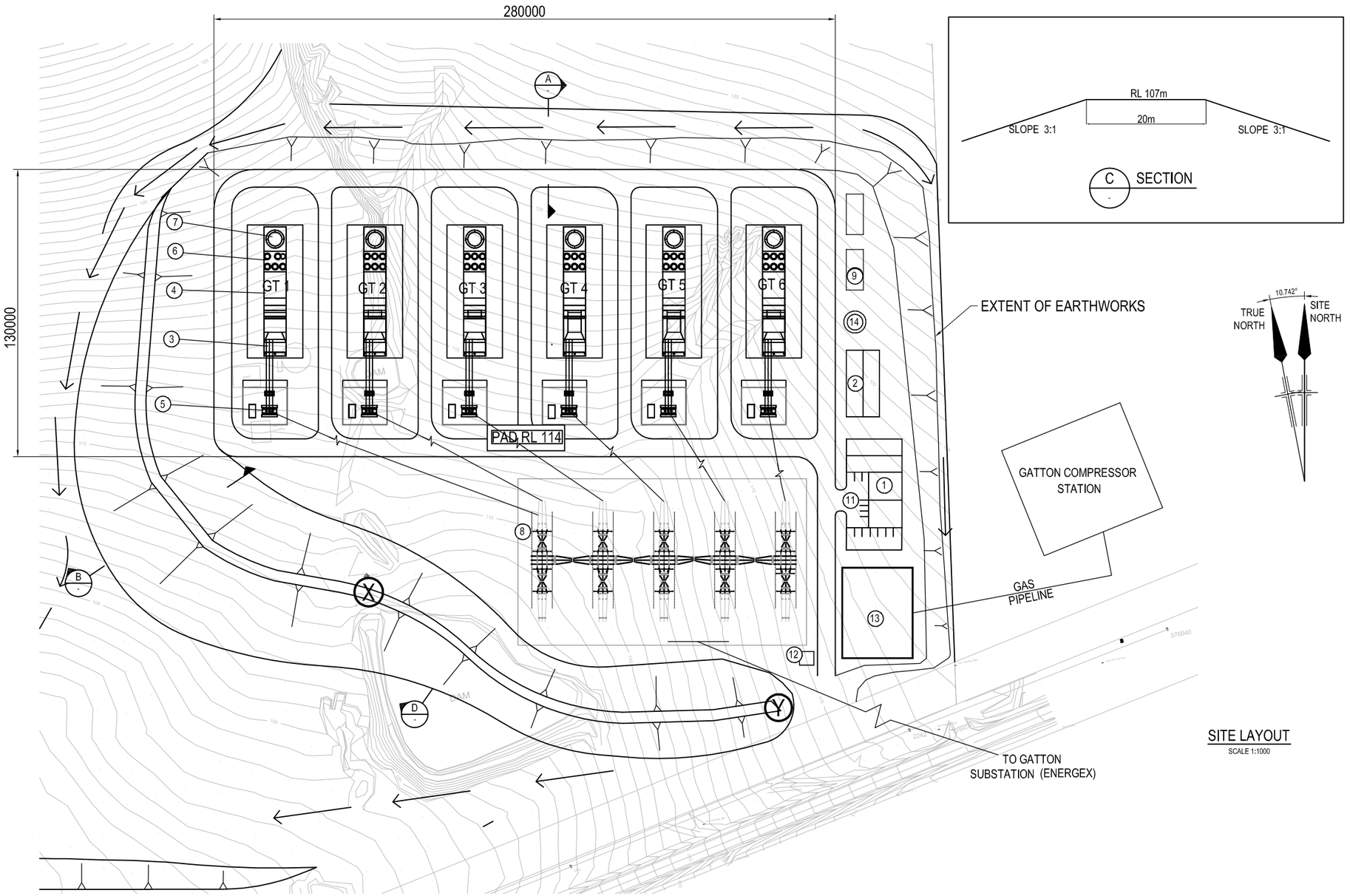
- in a natural channel, whether artificially improved or not; or
- in an artificial channel that has changed the course of the watercourse.

"waters" includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater and any part-thereof.

END OF CONDITIONS



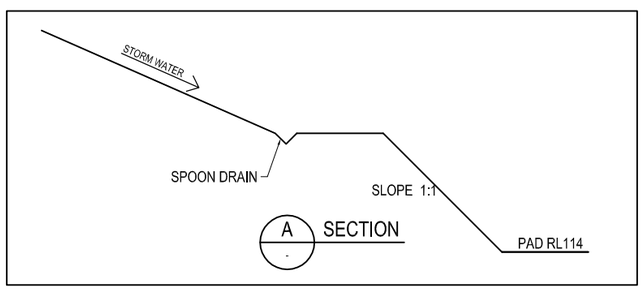
C
SITE LOCATION
SCALE 1:5000

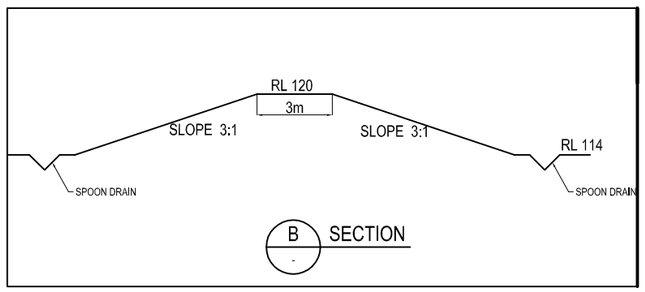


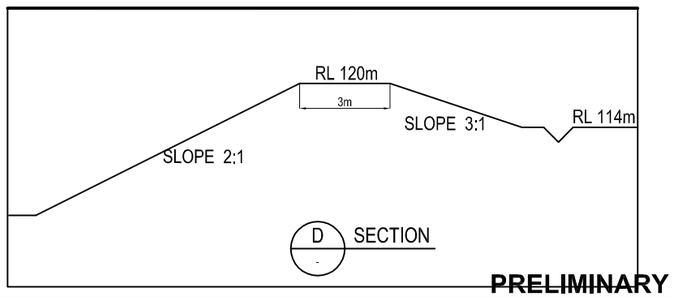
	DESCRIPTION	HEIGHT (m)
1	CONTROL AND ADMIN BUILDING	7.0
2	WAREHOUSE AND WORKSHOP	14.0
3	GAS TURBINE AIR INTAKE	26.0
4	GAS TURBINE ENCLOUSRE	8.5
5	TRANSFORMER	5.0
6	COOLING FANS	13.0
7	EXHAUST STACK	30.0
8	SWITCHYARD	11.0
9	OTHER TANKS & PUMPS	7.0
10	FIRE SYSTEM	4.0
11	CAR PARK	-
12	SECURITY HOUSE	4.0
13	GAS SKID (IF REQUIRED)	6.0
14	FIRE TANK	9.0

NOTES:
1. SITE LOCATION, SIZING AND LAYOUT INDICITIVE ONLY.
2. EXISTING DAM TO BE FILLED IN.
3. ARROWS INDICATE STORMWATER FLOW
4. FOR BUND LENGTH X-Y, REFER TO SECTON D.

SITE LAYOUT
SCALE 1:1000







PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
E	BUND MODIFIED		GHD			03/12/09
D	BUND & STORMWATER ADDED		GHD			24/11/09
C	EXTERNAL INFRASTRUCTURE INCLUDED		GHD			25/08/09
B	CLIENT COMMENTS INCORPORATED		GHD			17/07/09
A	ISSUED FOR CLIENT REVIEW		GHD			

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

Drawn GHD		Designed	
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: WESTLINK PTY. LTD.
Project: WESTLINK POWERSTATION DEVELOPMENT ASSISTANCE
Title: PLANT LAYOUT OPTION 1
PLAN VIEW

Original Size: A1
Drawing No: 41-21379-SK004
Rev: E

Plot Date: 7 December 2009 - 4:02 PM Plotted by: Ben Dunstan Cad File No: G:\41\21379\CADD\Drawings\41-21379-SK004_ALT_E.dwg

5 October 2009

energex
positive energy

Westlink Power Project
PO Box 1803
MILTON QLD 4064

Attention: Peter Dalton

cc Lockyer Valley Regional Council
PO Box 82
GATTON QLD 4343
Attention: Tracy Ryan

Dear Peter,

Development Application – Material Change of Use (Impact Assessment) for Electricity Generation Infrastructure and Development Permit for ERA and Operational Works for Vegetation Clearing located at Ranger Road Adare, described as Lot 191 on CSH2361.
Council Ref: DA6538
Our Ref: HBD 1183133 206042

We refer to your correspondence regarding the above application. ENERGEX Limited acting as an Advice Agency has **no objection** to the proposed Material Change of Use, subject to the following conditions:

1. All easement conditions must be maintained

2. All previous conditions must be adhered to and ENERGEX may, at its discretion, audit the finished development to check that it conforms to the conditions of the development.

3. Detailed civil design drawings showing any proposed cut and fill levels on the easement and the location of the ENERGEX assets in relation to the proposed development must be approved by ENERGEX before any works can commence on site.

When considering the construction of a Power Generation Plant either on ENERGEX easements or in the vicinity of ENERGEX assets, please be aware of the following general conditions:

- Satisfactory clearance from your proposed structure to the existing (and/or future) electricity wires must be maintained in accordance with the Electrical Safety Regulations 2002.

Reference: HBD 1183133 206042

INTERNATIONAL QUALITY MANAGEMENT SYSTEM

Enquiries
Kirsten Sellers
Telephone
(07) 3407 4815
Facsimile
(07) 3407 4144
Email
kirstensellers
@energex.com.au

Corporate Office
150 Charlotte Street
Brisbane Qld 4000
GPO Box 1461
Brisbane Qld 4001
Telephone (07) 3407 4000
Facsimile (07) 3407 4609
www.energex.com.au

ENERGEX Limited
ABN 40 078 849 055

- No civil works are to occur within 5 metres of any part of an ENERGEX Structure (e.g.- tower base, pole or stay) without ENERGEX approval.

- If the minimum 5m horizontal separation to the ENERGEX structure cannot be achieved, the Developer must consult ENERGEX with regards to allowable construction methods. This may include full depth shoring of the excavation sides for a minimum of 5 metres either side of the structure.

- Any excavations deeper than 5m must have a minimum horizontal separation from the excavation to any tower, base or pole at least equal to the excavation depth . The excavation is not to be left open overnight and backfill is to be compacted in 150mm layers in the immediate vicinity of the structure.

- 10 metres clear access must be provided around all towers and pole structures after the completion of any works on the easement.

- Natural ground level on the easement should not be disturbed without ENERGEX approval.

- Final ground levels should slope gently to the edge of the easement, surrounding area or kerb such that pooling of water on the easement is avoided and conductor ground clearances are not decreased.

- Stockpiling of spoil on the easement is prohibited.

- Lighting structures are not permitted in the easement without prior written consent of ENERGEX. Lighting designs for proposed developments (e.g. road, carparks etc) on the easement are likely to require reduced height structures. Please submit detailed design to ENERGEX for approval. These drawings must clearly show the following;
  - Proposed height of the lighting structures and the ground level at the structure base,
  - Relative (to lighting structures) ground levels at ENERGEX structures (towers, pole etc) either side of the lighting structures, and
  - The location of the ENERGEX structures in relation to the proposed lighting

- Proposed underground services such as stormwater, sewerage, water and the like are to be kept to the outer edge of the easement. Services crossing the easement should be as near as practicable to right angles to the overhead conductor direction and not within 10 metres of any tower, pole or stay. **Pipelines and crossings are to be clearly marked.** Please submit the relevant design drawings to the Principal Mains Design Engineer for review.

  The identification, assessment and mitigation of any possible hazards in the service due to electromagnetically induced voltages, is the responsibility of the Developer.

- Any cut in the vicinity of a structure or between a structure and the road kerb will need to be stabilised by a retaining wall. The retaining wall design and location is to be submitted to ENERGEX for approval.

- Access to the easement and access along the easement must be available to ENERGEX personnel and heavy equipment at all times. ENERGEX will require the Developer / owner to supply and install gates where fencing prohibits access to and along the easement area. To enable travel along the easement at anytime the gates

must be series locked with an ENERGEX padlock. Both the padlock and a design drawing of an acceptable gate will be provided by ENERGEX.

- Any costs incurred by ENERGEX as a result of the works on the easement are to be met by the property Developer / owner.

- At all times the following clearance must be maintained from the top of any machinery moving in the vicinity of energised conductors:

  - 132kV and 110kV conductors – 4.5m minimum clearance
  - 33kV and 11kV conductors – 3m minimum clearance
  - Should it be necessary to transport equipment or extend any equipment, such that these clearances cannot be confidently maintained, you are required to contact our office to ascertain whether a Safety Officer is required on–site. All operators of machinery are to be made aware of the presence of high voltage conductors.

- Any proposal for landscaping on the easement must have prior approval from ENERGEX. Please submit the relevant landscaping design to Principal Mains Design Engineer for approval. When considering landscape designs the planting of trees must be kept to the edges of the easement and not under any overhead conductors. When mature, plants or trees must not grow in excess of 3.5 metres in height. If pertinent the ENERGEX Guide to "Powerline Friendly Plants" will be enclosed, please refer to this Guide for recommended species.

Should you require any further information on the above matter, please contact Sarah Davies on (07) 3405 9511.

Yours faithfully,

Kirsten Sellers
Town Planner
Network Development and Property Department
ENERGEX Limited

Reference: HBD 1183133 206042

APPENDIX 2: EPBC APPROVAL CONDITIONS

Australian Government
Department of the Environment and Energy

APPROVAL

Lockyer Energy Project, 2.5km north of Gatton, Queensland (EPBC 2017/7994)

This decision is made under sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999 (Cth).*

Details

Person to whom the approval is granted (approval holder)	Capital Partners Australia Pty Limited
ACN or ABN of approval holder	ACN: 152 374 895
Action	To develop a natural gas-fired power generation plant, 2.5 km north of Gatton, Queensland [see EPBC referral 2017/7994].

Approval decision

My decision on whether or not to approve the taking of the action for the purposes of each controlling provision for the action are as follows.

Controlling Provisions

Listed Threatened Species and Communities	
Section 18	Approve
Section 18A	Approve

Period for which the approval has effect

This approval has effect until Wednesday, 30 January 2047

Decision-maker

Name and position	James Barker Assistant Secretary Assessments and Governance Branch
Signature	
Date of decision	29 January 2018

Conditions of approval

This approval is subject to the conditions under the EPBC Act as set out in ANNEXURE A.

ANNEXURE A – CONDITIONS OF APPROVAL

Part A – Conditions specific to the action

Project site

1. The **approval holder** must not **clear** vegetation outside of the **project site** and the **approval holder** must not **clear** more than 18.38 hectares of vegetation within the **project site**.

Management measures

2. The **approval holder** must ensure a pre-clearance survey is undertaken by a **suitably qualified person** within 24 hours before any **clearing** of vegetation within the **project site**, to identify any **koalas** present.
3. The **approval holder** must not **clear** any vegetation supporting any **koalas** until such time that any present **koalas** vacate the vegetation or are relocated by a **suitably qualified person**. Veterinary care, or assistance from a wildlife refuge, must be sought if any **koalas** are found injured within the **project site** while **clearing** and/or **construction** occurs within the **project site**.
4. Prior to the **commencement of the action,** the **approval holder** must develop a Construction Environment Management Plan. The Construction Environment Management Plan must incorporate all of the management objectives, performance criteria and management controls described in Attachment A of these **conditions** and be implemented until the **end date**.

Compensation measures

5. The **approval holder** must, prior to the **commencement of the action**, **legally secure** a minimum of 41.58 hectares of **koala habitat** at the **offset site**. Within 20 **business days** of **legally securing** the **offset site**, the **approval holder** must provide the **Department** with evidence of when the **offset site** was **legally secured**, and what mechanism was used to **legally secure** the **offset site**.
6. Prior to the **commencement of the action**, the **approval holder** must develop an Offset Management Plan. The Offset Management Plan must incorporate all of the aspects described in Attachment B of these **conditions** and be implemented until the **end date**.
7. The **approval holder** must, from the date of approval until the **end date,** ensure there is no decline in the extent, or **habitat quality** of **baseline condition,** at the **offset site**.
8. If, at any time before the **end date**, the **approval holder** identifies that the outcomes specified in **condition** 7 are not being, or unlikely to be achieved, the **approval holder** must report to the **Department** in writing within 20 **business days** of becoming aware. The report must state the cause, the response measures (including timeframes for reporting the success of those measures to the **Department**) and the actions to prevent further occurrences.

Preparation and publication of management plans

9. The **approval holder** must ensure that **management plans** are prepared in accordance with the **Environmental Management Plan Guidelines**. Each **management plan** must also:
    a. include details on how the **management plan** is consistent with the **Environmental Management Plan Guidelines** and the conservation advice for **koalas**.
    b. provide a statement signed by the **approval holder** declaring that the information is true and has been prepared in accordance with the **Environmental Management Plan Guidelines**.

10. The **approval holder** must publish all **management plans** on its website prior to **commencement of the action**. The **approval holder** may choose to revise a **management plan** provided the revised **management plan** is consistent with the requirements listed in either **condition** 4 (for the Construction Environment Management Plan) or **condition** 6 (for the Offset Management Plan). The revised **management plan** must be published on the **approval holder's** website at least 10 **business days** before being implemented. All **management plans** must remain on the **approval holder's** website until the **end date**.

Part B – Standard administrative conditions

11. Within 20 **business days** after the **commencement of the action**, the **approval holder** must advise the **Department** of the actual date of **commencement of the action**.

12. The **approval holder** must maintain accurate records substantiating all activities associated with or relevant to the **conditions**, including measures taken to implement any **management plans** required by this approval, and make them available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, or used to verify compliance with the **conditions**. Summaries of audits will be posted on the **Department's** website. The results of audits may also be publicised through the general media.

13. Within 60 **business days** of every 12 month anniversary of the **commencement of the action**, the **approval holder** must publish a report on its website addressing compliance with each of the **conditions**, including implementation of any **management plans** as specified in the **conditions**. Documentary evidence providing proof of the date of publication and non-compliance with any of the **conditions** must be provided to the **Department** at the same time as the compliance report is published. The **Minister** may provide written consent to the **approval holder** to cease reporting if satisfied additional reports are not warranted.

14. The **approval holder** must report any potential or actual contravention of the **conditions** to the **Department** in writing within 5 **business days** of the **approval holder** becoming aware of the potential or actual contravention.

15. Upon the direction of the **Minister**, the **approval holder** must ensure that an independent audit of compliance with the **conditions** is conducted and a report submitted to the **Minister**. The independent auditor and criteria must be approved by the **Minister** prior to the commencement of the audit. The audit report must address the criteria to the satisfaction of the **Minister**.

16. If, at any time after 5 years from the date of this approval, the **approval holder** has not **commenced the action**, then the **approval holder** must not **commence the action** without the written agreement of the **Minister**.

Part C - Definitions

In these **conditions**, except where contrary intention is expressed, the following definitions are used:

Approval holder: means the name of the person to whom the approval is granted;

Baseline condition: means a **habitat quality** score of 8;

Business days: means a day that is not a Saturday, a Sunday or a public holiday in the location of the **action**;

Clear: means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of native vegetation;

Commencement of the action: means the point at which **clearing** of vegetation and/ or **construction** for the purposes of the action begins;

Conditions: means the conditions in Annexure A of this approval;

Construction: means the erection of a building or structure that is or is to be fixed to the ground and wholly or partially fabricated on-site; preliminary site preparation work which involves breaking of the ground (including pile driving); the laying of pipes and other prefabricated materials in the ground, and any associated excavation work; but excluding the installation of fences and signage;

Department: means the Commonwealth Department of Environment and Energy or any other agency that administers the **EPBC Act** from time to time and includes, where the context permits, the officers, delegates, employees and successors of the **Department**;

End Date: means the date after which the approval ceases to have effect;

Environmental management plan guidelines: means Department of the Environment (2014) *Environmental Management Plan Guidelines*. Commonwealth of Australia, Canberra, or subsequent published versions of that document.

EPBC Act: means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth);

Habitat quality: means the habitat quality score as calculated by biocondition surveys in accordance with Queensland's *Biocondition: A condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual (Version 2.2)* (Eyre *et al.*, 2015), or any subsequent revised version;

Koala: the koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (*Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)*) listed as a threatened species under the **EPBC Act**;

Koala habitat: any habitat, including forest or woodland, which contains species that are known food trees (being species of tree whose leaves are consumed by **koalas**), including *Eucalyptus*, *Corymbia* and *Angophora* species;

Legally secure: means ongoing protection under a legal mechanism that is either establishing a conservation covenant under the *Land Title Act 1994* (Qld) or establishing a Nature Refuge under the *Nature Conservation Act 1992* (Qld);

Management plans: means the following listed management plans and subsequent revised versions of those management plans, including the:

a. Construction Environment Management Plan (required at **condition** 4); and

b. Offset Management Plan (required at **condition** 6).

Minister: means the Minister administering the **EPBC Act** including any delegate of the Minister;

Offset site: includes Offset Area A and Offset Area B on the map at Attachment C of this approval;

Project site: the area defined as 'Impact Area' on the map at Attachment C of this approval;

Suitably qualified person: a person who has professional qualifications, training, skills and/or experience relevant to **koalas** who can give authoritative assessment, advice and analysis in

relation to the identification, safe capture and release and management of **koalas** using the relevant protocols, standards, codes of conduct, methods or literature;

In these **conditions**, unless contrary intention is expressed:

a. the singular includes the plural and vice versa, and a gender includes other genders;

b. another grammatical form of a defined word or expression has a corresponding meaning;

c. a reference to a **condition** or attachment is to a **condition** of or attachment to, the approval; and

d. a reference to time is to the time in the place where the obligation is to be performed.

ATTACHMENTS

1. **Attachment A** – Koala management objectives, performance criteria and management controls
2. **Attachment B** - Offset aspects
3. **Attachment C** - Map – Project offset site and impact areas

Koala/Grey-headed Flying-Fox Management Framework

Management Objective

- Avoid or effectively mitigate direct and indirect impacts on the koala/grey-headed flying-fox and their habitat within the project footprint.

Performance Criteria

1. No vegetation clearing outside the specified boundaries.
2. Laydown areas placed within previously cleared areas or on project pad.
3. No evidence of erosion or sedimentation of waterways as a result of the project.
4. Fauna spotter/catcher present during all clearing works.
5. No injury or death of the koala/grey-headed flying-fox as a result of the project.
6. No new weed species are introduced and existing weed infestations are controlled so as not to increase in habitat areas.
7. No possible predators are introduced to the site.
8. No new disease or pathogen is introduced.
9. Koala exclusion fencing is clear of vegetation on the habitat side and no holes or gaps are present.
10. Disturbed areas are stabilised and rehabilitated sequentially and as soon as possible following disturbance.
11. All site personnel undertake environmental induction prior to commencing work.

Management Controls

Table 12 Design Management Controls

Performance Criteria	Management Control / Activity	Responsibility	Effectiveness of Management Action	Environmental Outcomes	Measure, Monitor, Audit Activity & Frequency
2, 3, 10	Environmental contract documentation to address specific erosion and sediment control and landscape and revegetation requirements to be	Owner's Engineer, Proponent	This will assist in minimising indirect impacts to habitat through a reduction in sediment loss and associated water quality impacts.	Minimisation of indirect impacts on the koala/grey-headed flying-fox	Audit prior to request for tender release. Auditing of contract documentation will be undertaken in accordance with the

Performance Criteria	Management Control / Activity	Responsibility	Effectiveness of Management Action	Environmental Outcomes	Measure, Monitor, Audit Activity & Frequency
	managed during the construction and post-construction phase of the project.				Construction Environmental Management Plan (CEMP)
All	Incorporate into the CEMP appropriate measures (including the below provisions) for fauna management, vegetation management, weed management, rehabilitation management	Construction Contractor, Proponent	This will reduce impacts on the koala/grey-headed flying-fox and habitat through appropriate management of rehabilitation areas and inclusion of procedures for vegetation clearing, fauna management and general environmental management.	Minimisation of direct and indirect impacts on the koala/grey-headed flying-fox	CEMP to be audited for completeness prior to mobilisation, as well as auditing for compliance during and post-construction
1, 2, 3	Vegetation clearing limits will be defined under the contract documentation, to minimise the extent of vegetation clearing whilst allowing construction to occur, taking into account erosion and sediment control devices.	Owner's Engineer, Proponent	Vegetation clearing limits will ensure minimisation of clearing required for the project and reduce impacts on the koala/grey-headed flying-fox supporting habitat.	Avoid unnecessary removal of fauna habitat.	Audit prior to request for tender release. Auditing of contract documentation will be undertaken in accordance with the CEMP
1, 2, 3	Additional workspace areas (laydown areas) are to be placed in previously cleared areas or on the project pad, where possible.	Construction Contractor	This will minimise the vegetation clearing required for the project.	Avoid unnecessary removal of fauna habitat.	CEMP to be audited for completeness prior to mobilisation, as well as auditing for compliance during and post-construction
1, 2, 5	Incorporation of No-Go Zones and vegetation clearing limits with specific vegetation clearing requirements and methodologies within the contract documentation. All vehicles and plant will stay on pre-determined routes and adhere to site construction and operation rules relating to speed limits. Speed limits would be clearly signposted to minimise the potential for fauna impact.	Owner's Engineer, Proponent	Implementation of No-Go Zones and restricted access routes will prevent inadvertent disturbance within habitat to be retained.	Avoid fauna collisions mortality from construction equipment and enable the relocation of MNES away from the working areas as appropriate.	Audit prior to request for tender release. Auditing of contract documentation will be undertaken in accordance with the CEMP A register of wildlife incidents (fauna strike and mortality) will be established and maintained as part of the CEMP.

Performance Criteria	Management Control / Activity	Responsibility	Effectiveness of Management Action	Environmental Outcomes	Measure, Monitor, Audit Activity & Frequency
5, 9	Locations and design of koala exclusion fencing to be incorporated into contract documentation and construction schedule to ensure appropriate structures, placement and timing. Replacement of all cattle fencing with wildlife friendly fencing to the site's eastern, western and northern boundaries. Koala exclusion fencing will be installed along the southern boundary in accordance with Road and Traffic Authority (NSW) Standard Drawing and include the following specifications: - Galvanised wire 50 mm chain-link fence, with additional 0.5 m overhang "floppy top" (outward of road formation). - 3 m buffer free of vegetation (excluding grasses) on habitat side of the fence.	Owner's Engineer, Proponent	Fauna exclusion fencing is an effective management measure to reduce vehicle collisions with koalas (and other native fauna). This fencing is also dog-proof, therefore helping reduce predator movements onto the site.	Prevent increased fauna mortality from the project and guide and direct fauna movement between retained/rehabilitated bushland habitat and away from the road.	Audit prior to request for tender release. Auditing of contract documentation will be undertaken in accordance with the CEMP

Table 13 Construction Management Controls

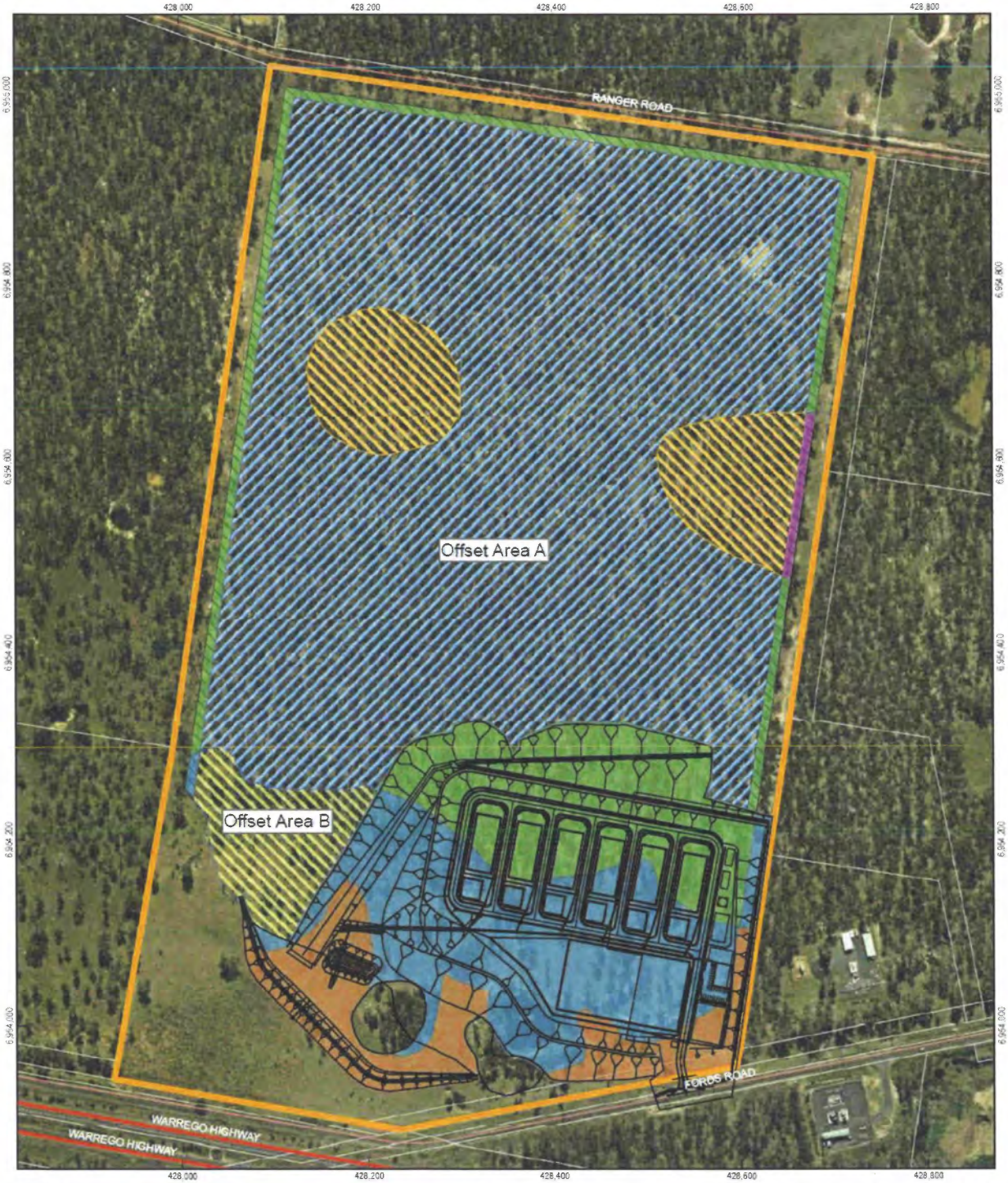
Performance Criteria	Management Control / Activity	Responsibility	Effectiveness of Management Action	Environmental Outcomes	Measure, Monitor, Audit Activity & Frequency
10	Undertake an environmental induction to all site personnel to outline responsibilities in relation to the koala.	Construction Contractor	This will assist in training all onsite personnel in regards to the koala and their environmental obligations where MNES are found onsite.	Avoid any unnecessary and avoidable fauna collisions and mortalities as all personnel will be trained on their appropriate obligations.	Review CEMP prior to mobilisation. Audit implementation shortly after mobilisation and then quarterly for the duration of construction

Table 2 Offset Strategy Details

Aspect	Description
Type of offset	Direct offset
Location	Lot 191 on CSH2361 – vegetated extent including remnant and regrowth areas of lot to be retained as an offset described as Offset Area A (remnant) and Offset Area B (regrowth) (refer to Figure 5).
Suitability	Suitable habitat known to be present on-site for koala
Land tenure	Freehold, owned by the proponent
Method of securing	Conservation covenant placed on the land title in perpetuity in accordance with the Queensland *Land Title Act 1994* (as per the EPBC Act Environmental Offset Policy)
Management	The offset (Areas A and B) will be managed by the proponent (or a related entity on behalf of The Australian Clean Power Trust). An Offset Management Plan will be prepared that outlines the management of the offset area and will include measures, reporting, corrective actions and responsibilities for the following activities to be undertaken: • Annual monitoring of the offset to assess koala usage of the site, evidence of predators, evidence of plant pathogens or fauna disease, and habitat condition aspects such as extent of weed infestations, eroding land, and presence of water. • Monitoring of wildlife friendly boundary fencing (including koala exclusion fencing around the project infrastructure and along the southern boundary of the lot) on a 6-monthly basis to identify maintenance requirements, such as trimming regrowth within 3 m of koala exclusion fence and repairing fences to assist in excluding predators. • Monitoring and management of weed infestations to maintain free movement of koalas and regeneration of food trees. • Restriction of livestock of a species and number that is incompatible to maintaining or improving koala habitat. • Should predators, such as wild dogs, be observed on-site, a management program of baiting may be undertaken and assessment of fencing for their future exclusion. • Monitoring and management of the two small farm dams located in Offset Area A and the ephemeral creek lines to reduce siltation and control erosion in this area as part of

Aspect	Description
	general land management and improvement of the habitat condition for the koala. • Controlled fire management to maintain eucalypt species diversity and heath, as appropriate to koala habitat, season and ecosystem. • Offset Area B will include revegetation in accordance with Landscape Management and Revegetation Plan including incorporation of eucalypt species suitable for providing koala food trees and winter/spring foraging habitat for the grey-headed flying-fox.
Estimated cost	$500,000 - $800,000
Outcomes	The outcomes proposed to be achieved for the duration of the offset for koala are: • The habitat for koala is maintained or improved • The on-site threats to koala and its habitat are monitored and managed These outcomes were based on priority objectives within the below conservation advice and recovery plan documents.
Risks	Risks associated with achieving the outcomes include: • Other development in connected habitat areas having an impact on the local koala population • Weed infestations that are not controlled may impact the habitat quality and condition for koalas • If pathogens are introduced, they may be difficult to eradicate or prevent from spreading between individuals (fauna or flora) • Extreme weather events cause damage to the habitat within the offset area, therefore reducing its use by koala
Measurability of outcome	The Offset Management Plan will include monitoring schedules and recording requirements for habitat conditions, on-site koala usage, evidence of weeds and evidence of threats such as predators and pathogens/disease. Specific performance and management measures and reporting will be included in the Plan.
Baseline data	These outcomes are derived from baseline data collected during field surveys, particularly relating to habitat characteristics and conditions, vegetation community descriptions, koala utilisation rates (using Spot Assessment Technique surveys) and dominant food species for koalas and grey-headed flying-fox. Baseline data can also be sourced from local community/action groups regarding local sightings of koalas and desktop sources such as Atlas of Living Australia and Wildlife Online for historical records. The Offset Management Plan will detail the monitoring and reporting schedule and methods.
Conservation gains	Conservation gains to be achieved include the maintenance of high quality habitat for the species, information relating to the abundance of the local koala population, and engaging in strategies that actively protect the species from the introduction or spread of threats (the management of which aids in the overall recovery of the species).
Conservation advice	The outcomes above are consistent with the following conservation advice for the koala:

Aspect	Description
	• Priority Management Actions within the Approved Conservation Advice for Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory) (TSSC, 2012) • Recovery objectives of the Recovery plan for the koala (Phascolarctos cinereus) (DECC, 2008)
Audit	The Offset Management Plan will include an auditing schedule that assesses the performance of the monitoring and management strategies in achieving the outcomes.
Assessment of level of control	The project proponent will have total control over the offset area and the implementation of monitoring and maintenance in accordance with the Offset Management Plan.
Management measures	Monitoring: • Baseline data is collected annually during Stage 1 construction of the project, and thereafter for the duration of the offset. One monitoring event will be undertaken prior to the offset commencing in order to establish the monitoring locations and provide an initial baseline for the monitoring program within the offset site. Milestones: • At 5 years after the start of the offset, the habitat has been maintained or improved and no increase in threats have occurred. Performance indicators: • Density and abundance of koala food trees is maintained or increased. • Threats that have been identified have not spread or increased. Further details of monitoring, adaptive management/corrective actions, record keeping, publication and reporting procedures will be included in the Offset Management Plan. Offset Area B will also be monitored and managed in accordance with the Project's Landscape Management and Revegetation Plan with the aim of establishing and improving koala habitat value to a level which is consistent with Offset Area A.



LEGEND

- Highway
- Street/Local Road
- Design
- Cadastre

Impact Area
- 1 (7.24Ha)
- 2 (0.17Ha)
- 3 (3.51Ha)
- 4 (7.46Ha)

Offset Area A
- 5 (35.47Ha)
- 6 (3.98Ha)

Offset Area B
- 7 (2.13 Ha)

- Fire break 10m clearing
- Subject Site (70.15 Ha)

Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Quinbrook Infrastructure Partners Pty Ltd
Lockyer Energy Project

Job Number 91-10341
Revision 4
Date 27 Nov 2017

Offset area and assessment units

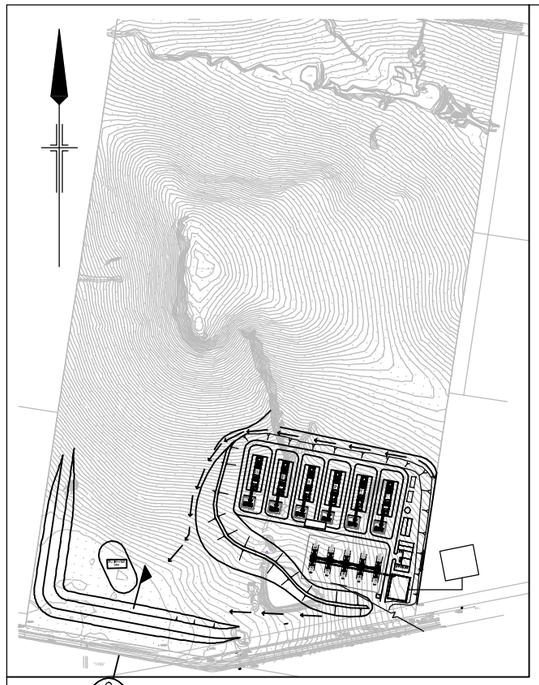
Figure 5

\\ghdnet\ghd\AU\Melbourne\Projects\91\10341\GIS\Maps\MXD\91103341_005_Rev4.mxd

145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: GHD: Extent of concept design, SAT Sites, Suitable Habitat (2017); DNRM: Imagery web service (2017), Road (2016), Cadastre (2017). Created by:ihamilton

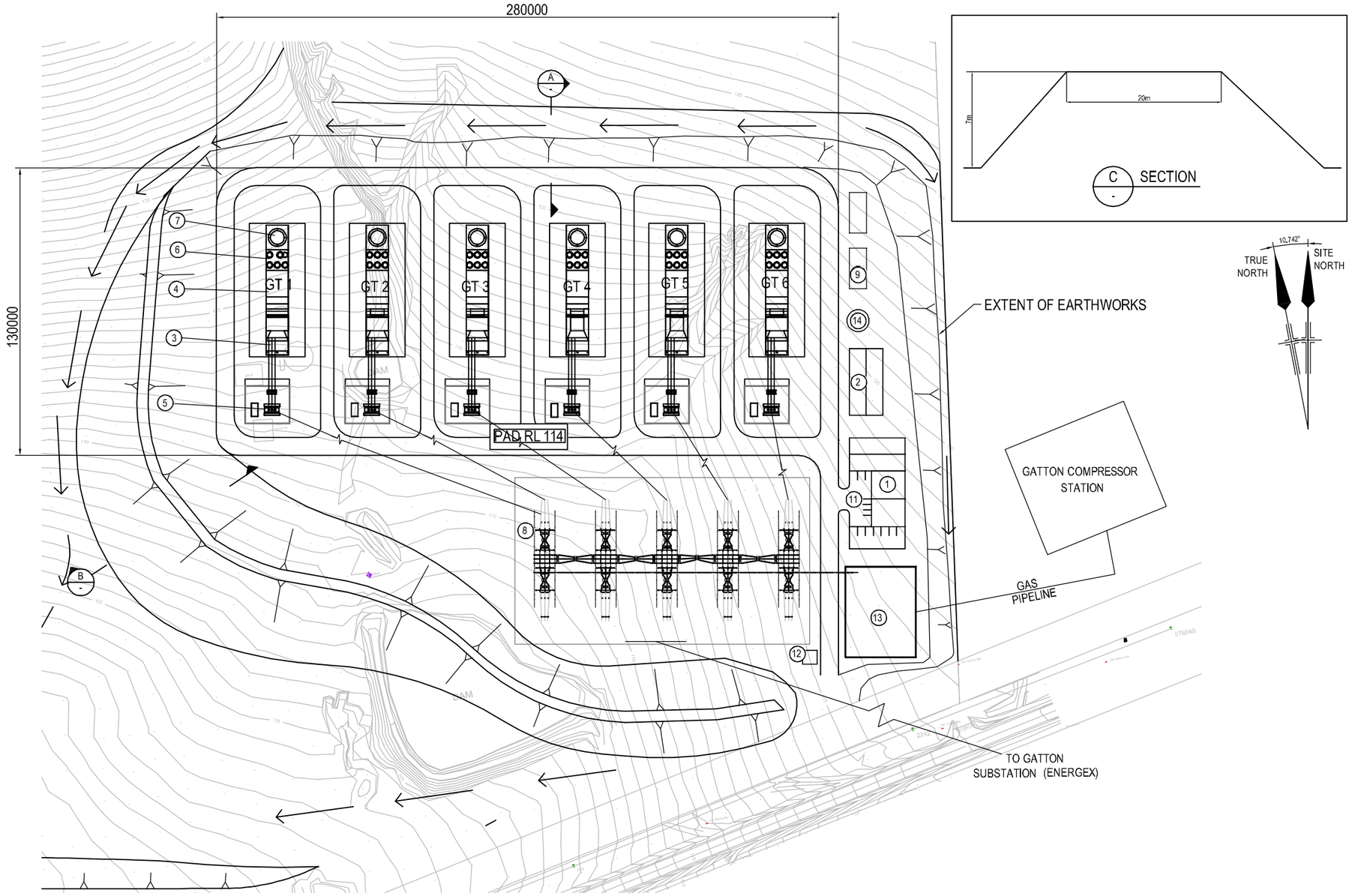
APPENDIX 3: PLANT LAYOUT VIEW 41-21379-SK004 MCU APPROVAL CONDITIONS



C
-

SITE LOCATION

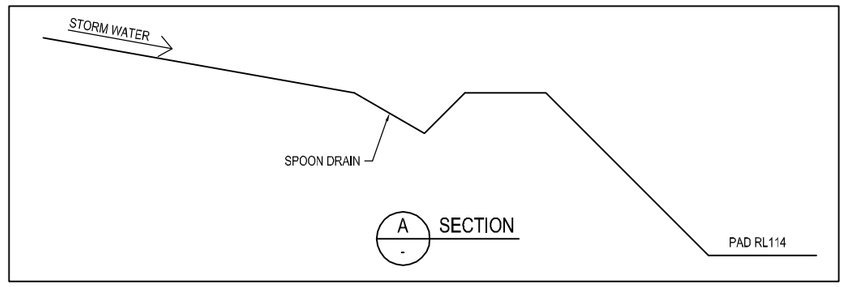
SCALE 1:5000



	DESCRIPTION	HEIGHT (m)
1	CONTROL AND ADMIN BUILDING	7.0
2	WAREHOUSE AND WORKSHOP	14.0
3	GAS TURBINE AIR INTAKE	26.0
4	GAS TURBINE ENCLOUSRE	8.5
5	TRANSFORMER	5.0
6	COOLING FANS	13.0
7	EXHAUST STACK	30.0
8	SWITCHYARD	11.0
9	OTHER TANKS & PUMPS	7.0
10	FIRE SYSTEM	4.0
11	CAR PARK	-
12	SECURITY HOUSE	4.0
13	GAS SKID (IF REQUIRED)	6.0
14	FIRE TANK	9.0

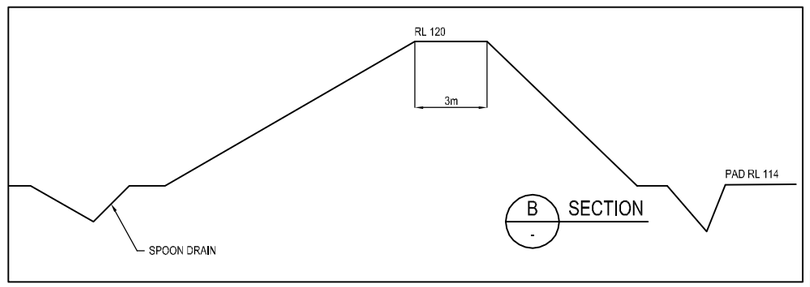
NOTES:

1. SITE LOCATION, SIZING AND LAYOUT INDICITIVE ONLY.
2. EXISTING DAM TO BE FILLED IN.
3. ARROWS INDICATE STORMWATER FLOW



SITE LAYOUT

SCALE 1:1000



PRELIMINARY

No	Revision	Drawn	Checked	Approved	Date
E	BUND MODIFIED	GHD			03/12/09
D	BUND & STORMWATER ADDED	GHD			24/11/09
C	EXTERNAL INFRASTRUCTURE INCLUDED	GHD			25/08/09
B	CLIENT COMMENTS INCORPORATED	GHD			17/07/09
A	ISSUED FOR CLIENT REVIEW	GHD			

Notes " Indicates signatures on original issue of drawing or last revision of drawing

GHD CLIENTS | PEOPLE | PERFORMANCE

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E brsmail@ghd.com W www.ghd.com

Drawn	GHD	Designed	
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: **WESTLINK PTY. LTD.**

Project: **WESTLINK POWERSTATION DEVELOPMENT ASSISTANCE**

Title: **PLANT LAYOUT OPTION 1**
PLAN VIEW

Original Size **A1**

Drawing No: **41-21379-SK004**

Rev: **E**

Plot Date: 3 December 2009 - 2:55 PM Plotted by: Cameron Cassar

Cad File No: G:\41\21379\CADD\Drawings\41-21379-SK004_ALT_E.dwg

APPENDIX 4: PERSONNEL REGISTER AND ACTIVITY CHECKLIST

PERSONNEL REGISTER AND ACTIVITY CHECKLIST

To be signed by all personnel entering or active on the site.

Signature confirms that the person (named) has reviewed and will comply with the requirements of the Construction Environment Management Plan.

Name	Organisation and Address	Signature	Date

APPENDIX 5: CONTACTS LIST

Internal Contacts	Name / Company	Phone Number
Fauna Spotter Catcher	Litoria Consulting	07 3852 4855
Site Environmental Manager	Litoria Consulting	07 3852 4855
Project Manager	TBA	TBA
External Contacts	**Name / Company**	**Phone Number**
Ambulance/Police/Fire Brigade	N/A	000
RSPCA Animal Emergency Hotline	N/A	1300 264 625

APPENDIX 6: ENVIRONMENTAL INSPECTION CHECKLIST

ENVIRONMENTAL INSPECTION CHECKLIST

Recorder Details	
Name of recorder:	Date:
Location:	

1.0 Documents and Records

Question	Response Y/N	Details
Required documents, permits and/or approvals in place?		
Relevant inductions completed?		
Comments:		
Photo record numbers:		

2.0 - Site Office and Amenities

Question	Response Y/N	Details
Are offices and amenities correctly located?		
Appropriate pedestrian/road access and signage?		
Comments:		
Photo record numbers:		

3.0 Vegetation Management

Are the below management actions being adhered to?	Response Y/N	Details
Prior to vegetation clearing, boundary fencing work must be completed in accordance with: • EPBC referral 2017/7994; • Development permit for operational work (clearing of native vegetation) (approved in the Planning and Environment Court, No. 2606 of 2010); • Approved drawings / plans; and, • Design specifications listed in CEMP.		
Approved clearing areas are identified and demarcated using GPS coordinates and flagged star pickets.		
Vegetation conservation areas are identified, demarcated, and where applicable tree protection fencing is erected.		
Tree protection zones (TPZ) are to be established around all trees to be conserved which are near proposed working areas (i.e. adjacent to the confirmed working areas extents).		
TPZs are to be established around all trees to be conserved which are in close proximity to proposed working areas (i.e. adjacent to the confirmed working areas extents).		

Are the below management actions being adhered to?	Response Y/N	Details
TPZs are to be established in accordance with *AS 4970 – Protection of trees on development sites*. TPZs include the assembly of mesh tree barriers/guards to protect 'at risk' retained trees from encroachment / accidental damage.		
TPZs are to be established prior to the commencement of any clearing or site works. Within the tree protection zone, the following activities are not permitted: • Storage and mixing of materials; • Vehicle parking; • Liquid disposal; • Machinery repairs and/or refueling; • Construction of site office or shed; • Combustion of any material; • Stockpiling of soil, rubble or debris; • Any filling or excavation including trenching, topsoil skimming and/or surface excavation, unless otherwise approved by the Chief Executive Officer; and, • Unauthorized application of pesticides, herbicides or chemicals.		
Restrict access to all areas outside of the approved clearing and construction areas.		
Ensure vegetation clearing, including tree felling, does not impact areas outside of approved clearing areas.		
Ensure all vehicle and personnel movement is limited to the approved clearing and construction areas.		
Ensure that all fauna management measures are strictly followed prior to, and during vegetation clearing and management.		
All vegetation that is cleared on the site shall be mulched on-site and used for onsite landscaping works.		
Vegetation cleared and not suitable for mulching shall be removed and disposed of in an approved disposal facility.		
Land clearing debris must not be pushed into gullies, watercourses, other drainage line or waterlogged areas, or any areas outside of the approved clearing extent.		
Vegetation clearing must not occur outside of the approved clearing areas and must not exceed 18.38 hectares of vegetation within the project site.		
An approved koala exclusion fence is in place on the southern boundary of the property, and the manual vehicle access gate is closed.		
Approved fencing is in place along the eastern, western and northern boundaries of the property.		
Any exposed or damaged tree roots are identified and treated in accordance with *AS 4373—2007 – Pruning of amenity trees*.		
Arborist / contractor to treat any damaged tress Works are to be undertaken by a qualified minimum Level 5 Arborist or suitably qualified person.		

Are the below management actions being adhered to?	Response Y/N	Details
Site briefings for all staff must occur prior to any major works and before commencement of works daily to discuss approved clearing processes and provide clear understanding of areas to be protected from construction.		
All rehabilitation and landscaping works are to be undertaken in accordance with the updated Landscaping and Revegetation Plan.		

4.0 – Fauna Management

Are the below management actions being adhered to?	Response Y/N	Details
A suitably qualified fauna spotter/catcher must also be present on-site during all vegetation clearance works.		
The approval holder must not clear any vegetation supporting any fauna until such time that the individual vacates the vegetation or are relocated by a suitably qualified person.		
Veterinary care, or assistance from a wildlife refuge, must be sought if any fauna are found injured within the project site while clearing and/or construction occurs within the project site.		
To reduce risk of injury to fauna, all vehicles and plant machinery must stay on pre-determined routes and roads and must adhere to site speed limits at all times.		
The approval holder must ensure a pre-clearing survey is undertaken by a suitably qualified person within 24 hours before any clearing of vegetation within the project site, to identify any fauna present.		
Immediately prior to the commencement of clearing and on each day that vegetation clearing is to take place, a licensed Fauna Spotter Catcher should be on-site in the event that fauna are observed which require protection, relocation or in case of fauna injury.		
Licensed Fauna Spotter Catcher to inspect trees to be trimmed / removed and identify hollows for retention / salvage, respectively.		
Non-itinerant fauna (other than Koalas) are, where practicable, relocated / ushered to nearby patches of vegetation or nearby bushland – refer to licensed Fauna Spotter Catcher for advice.		
Vegetation containing Koala(s) is to be demarcated with high visibility flagging tape and no further clearing is take place within 20m of the vegetation until such time as Koala(s) has completely vacated the vegetation and the site – refer to licensed Fauna Spotter Catcher for advice.		
An approved Koala exclusion fence is in place on the southern boundary of the property, and the manual vehicle access gate is closed.		
Approved fencing is in place along the eastern, western and northern boundaries of the property.		
All domesticated animals are prohibited from site.		
Personnel are prohibited from interacting with and/or feeding native or non-native fauna on-site.		

Are the below management actions being adhered to?	Response Y/N	Details
All vehicles will stay on pre-determined routes and adhere to site speed limits. Speed limits to be clearly signposted to minimise potential for fauna impact.		
A register of wildlife incidents (fauna strike and mortality) will be established and maintained as part of the CEMP.		

5.0 – Pest Management

Are the below management actions being adhered to?	Response Y/N	Details
Conduct baseline surveys of the site to determine the current level of weed and pest infestations.		
Conduct weed control for target species on a seasonal basis as per optimal control for each target species (refer to Landscaping and Revegetation plan for weed control methods).		
Conduct follow up weed and pest surveys following the completion of all clearing activities to compare with the original baseline survey.		
Ensure all vehicles, equipment and plant undergo a thorough inspection prior to access to site and are free of plant material and soil.		
Ensure soil used on-site adheres to the soil movement guidelines as outlined in the Biosecurity Regulation 2016 for fire ant movement controls.		
Ensure soil and mulch used on site is uncontaminated, and free of weeds and pests.		
Conduct herbicide spraying of weeds along the clearing line and the site boundary prior to weeds setting seed.		
Control any infestation of weeds or pests on site.		
Locate cleared vegetation and mulch stockpiles away from areas where runoff from rainfall may occur.		

6.0 – Water Quality Management

Are the below management actions being adhered to?	Response Y/N	Details
Erosion and sediment control measures installed in accordance with: • Erosion Management Plan (GHD, 2010, Rev 1); • Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites (The Institution of Engineers, Australia Queensland Division June 1996); • Best Practice Erosion and Sediment Control (International Erosion Control Association 2008); and, • Any relevant permit conditions.		
Stormwater control measures installed in accordance with: • Erosion Management Plan (GHD, 2010, Rev 1); • Stormwater Management Plan (GHD, 2010, Rev B); • Water by Design Bioretention Technical Design Guidelines Version 1.1, October 2014;		

Are the below management actions being adhered to?	Response Y/N	Details
• Healthy Waterways Water Sensitive Urban Design Technical Design Guidelines for South East Queensland Version 1, June 2006; • Water by Design Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands Version 1.1, April 2010; and, • Fire ant relevant permit conditions.		
Where required, construct earth bunds around the perimeter of the site, as detailed in the Erosion Management Plan (GHD, 2010, Rev 1) and Stormwater Management Plan (GHD, 2010, Rev B).		
Stormwater drainage structures shall be designed so that there is 'no worsening' of runoff beyond that which occurs on the existing undeveloped site.		
All complaints regarding erosion and water stormwater run-off are to be recorded within a Complaints Register immediately.		
All complaints regarding erosion and stormwater run-off are to be addressed within 24 hours if severe, or within one week for minor complaints.		
There shall be no deposition of sediment from the project site on to neighbouring properties.		
There shall be no nuisance impacts as a result of erosion, stormwater runoff, or sedimentation on to neighbouring properties.		
There shall be no channeling and/or deposition as a result of erosion, stormwater runoff, or sedimentation within the site.		

7.0 - Indigenous and Non-Indigenous Cultural Heritage

Are the below management actions being adhered to?	Response Y/N	Details
Appropriate barriers, protection and signage in place for all Cultural heritage items.		
Appropriate clearances in place.		

8.0 – Air Quality Management

Are the below management actions being adhered to?	Response Y/N	Details
Where required, install wind fencing around the perimeter of the site, taking into consideration the use of natural wind fencing (remnant vegetation) as a natural wind barrier.		
Water trucks are to water down unsealed roads and working surfaces during operation to reduce dust lift.		
All complaints regarding dust are to be recorded within a Complaints Register immediately.		
All complaints regarding dust are to be addressed within 24 hours if severe, or within one week for minor complaints.		
All trucks removing materials from site will be loaded inside site perimeter.		
All loads shall be securely covered prior to exiting site perimeter.		
Minimise stockpiling of material.		
Maintain stabilised access roads and driveways.		

Are the below management actions being adhered to?	Response Y/N	Details
Maintain clean roadways wherever possible, particularly at entry / exit points.		
Dust and particulate matter must not exceed the allowable following levels when measured at any nuisance sensitive place or downwind of the project site.		

9.0 – Noise Quality Management

Are the below management actions being adhered to?	Response Y/N	Details
Where required, install noise abatement barriers or fencing around the perimeter of the site.		
Make use of noise attenuating controls at the source, such as mufflers or acoustic screens.		
All complaints regarding noise are to be recorded within the Corrective Actions Register.		
All complaints regarding noise are to be addressed within 24 hours if severe, or within one week for minor complaints.		
Locate static sources of noise such as the generators as remotely as possible from noise sensitive receivers.		
Modification of work activities where noise or vibration is found to cause unacceptable impact.		
Hours of construction must be in accordance with: • The provisions of any relevant local law; or, • In the absence of any relevant local law or condition, the hours of construction must be limited to 0630–1830 Monday to Saturday and not at all on Sunday and public holidays.		

10.0 – Waste Management

Are the below management actions being adhered to?	Response Y/N	Details
All waste should be placed in appropriate disposal containers and areas during construction.		
All waste should be removed from site and disposed of appropriately.		
Where possible ensure that waste onsite is appropriately covered.		
Covered bins are provided to collect waste and prevent fauna being attracted to the work site.		
An adequate number of an appropriate type of commercial and bulk waste containers shall be provided at a central location to accommodate all waste produced on the site.		
All waste collected on the site to be removed not less than once per week.		
Appropriate spill kits, personal protective equipment, operator instructions and emergency procedure guides for the management of wastes and chemicals must be in a place accessible to all employees.		
All fuels and chemicals must be stored in an onsite containment system of a type suitable to prevent the spillage of the material and its discharge to the environment.		

Are the below management actions being adhered to?	Response Y/N	Details
All general and regulated waste records, including transfer station dockets and waste tracking certificates, are to be retained.		
Waste must be stored, pending its lawful disposal to landfill or to a recycling facility, or another place with the written approval of the administering authority, in a location at the authorised place where it is not visible to a person outside the authorised place.		
Waste (other than wastewater or sludges in the evaporation pond) must be removed from the authorised place within the timeframe specified for the waste as follows: • If the waste is surplus from the construction of the power station — within three (3) months after the power station is commissioned; or, • Otherwise — within three (3) months of the waste being generated.		
Waste storage areas are to be signed and located away from environmentally sensitive areas.		
Burning of waste is prohibited.		
Adequately sized refuse bins will be made available on-site and will have suitable lids to prevent access by animals.		
Construction site is to be kept in an orderly and hygienic standard, free of litter and waste.		

APPENDIX 7: INCIDENT REPORT FORM

INCIDENT REPORT FORM

Name of person(s) completing this form:
Signature of person(s) completing this form:
Date:

INCIDENT DETAILS

Date and time of incident:
Name of person(s) involved:
Description of incident:
Witness(es) of incident (include contact details):

INCIDENT REPORT FORM

INJURY DETAILS (if applicable)

Description of injury (include parts of body affected):

REPORTING OF THE INCIDENT

Incident reported to:
Date:
Reporting method (in person, email, phone etc.):

FOLLOW UP ACTION

Description of action(s) to be taken:

APPENDIX 8: CORRECTIVE ACTIONS REGISTER

CORRECTIVE ACTIONS REGISTER

Reference number	Date & location of incident, complaint, or non-conformance	Details of incident, complaint, or non-conformance	Actions taken to control the incident, complaint, or non-conformance	Date by which the corrective action will be completed (unless ongoing)	Appropriate sign-off indicating that the incident / complaint / non-conformance was investigated

APPENDIX 9: LANDSCAPE & REVEGETATION PLAN, LITORIA CONSULTING

Landscape & Revegetation Plan
Ranger Road, Adare QLD 4343
Lot 191 on CSH2361

Rehabilitation Objectives:
1. Provide a strategy for the rehabilitation and maintenance of the nominated area to achieve remnant status.
2. Revegetate and rehabilitate the nominated areas to using locally endemic species.
3. Treat and eradicate weed species.
4. Minimise the spread of weeds to and from adjacent land.
5. Ensure rehabilitated areas are appropriately maintained.
7. Protect and enhance wildlife movement opportunities including flood free terrestrial fauna movement.
8. Maintain on site vegetation, including rehabilitation, to manage the threat of bushfire exposure and or severity.

Plan Contents:

Drawing No.	Title
LRP01	Cover Page
LRP02	Overall Layout Plan
LRP03	Landscape & Revegetation Plan - Stage 1
LRP04	Landscape & Revegetation Plan - Stage 2
LRP05	Sections
LRP06	Planting Details
LRP07a - LRP07b	Revegetation Procedures
RP08	Weed Control Procedures

Litoria Consulting Pty Ltd (ABN 75 100 511 689) certifies that this plan has been prepared by a qualified environmental consultant and AQF Level 5 arborist in accordance with local, State and Commonwealth environmental regulations.

Dan Clowes MEIANZ MESA
Director
Litoria Consulting
B App Sc (Env.Sc.) (Hons)
Dip. Arb. (AQF Level 5 Arborist)

Plan References:

NATSPEC Specification - 0253 Landscape - Planting
NATSPEC Specification - 0251 Landscape - Soils / 0252 Landscape - Soil Preparation
NATSPEC Specification - 0255 Landscape - Plant Procurement
NATSPEC Specification - 0256 Landscape - Establishment
NATSPEC Specification - 0259 Landscape - Maintenance
Appendix C of the South East Queensland Ecological Restoration Framework
Best Practice Erosion & Sediment Control (IECA Australasia, November 2008)
CORVEG Regional Ecosystem Technical Descriptions
BSD-9051 Planting General Notes
BSD-9053 Planting - Typical Tree, Shrub and Tubestock
Development Permit No. 2606 of 2010 (In the Planning and Environment Court, 28/02/2014) - Condition 10.

LRP01: Cover Page

Legend

- Site (surveyed)
- Lot boundary
- Easement

NOT FOR CONSTRUCTION

This drawing has been prepared by, or compiled from information provided by, persons other than Litoria Consulting, who retain copyright and liability associated with their content:

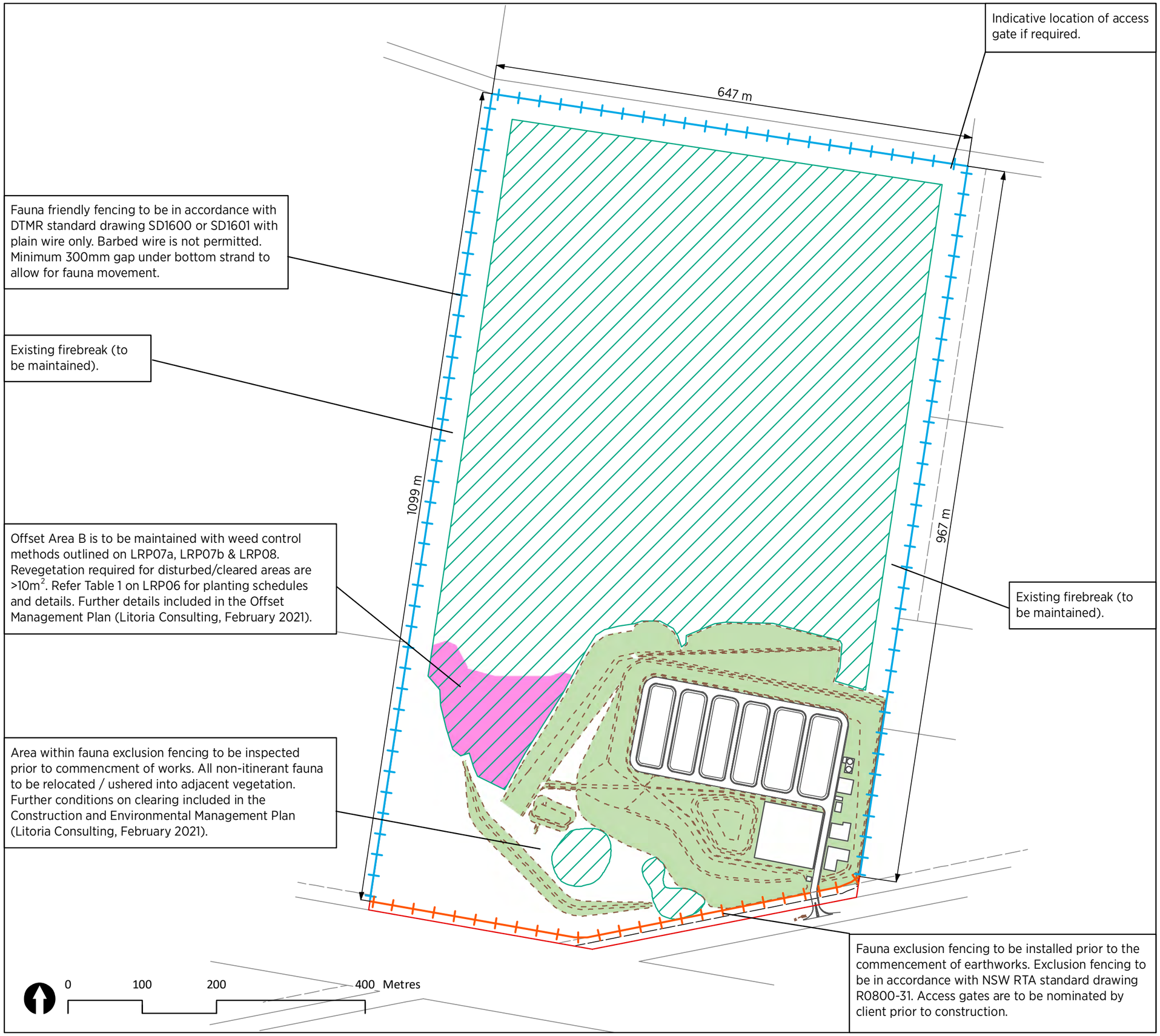
1. Site General Arrangement (Phronis, Ref 154-2-CI-DWG-0004, Rev C, 22/01/2021).
2. Nearmap 2020.

Litoria Consulting takes no responsibility for and makes no representations in relation to the completeness, accuracy or quality of any information contained in this drawing. Each user of this drawing releases Litoria Consulting from all and any loss, damage, cost, expense or liability in relation to the use of, or any reliance on, this drawing or the information contained in it. Features on this plan have been located to accuracy suitable for assessment and hence should not be used for exact measurements. Areas and dimensions shown are indicative only and subject to final survey. Users should independently verify the accuracy, fitness for purpose and application of information contained in these drawings. All written dimensions take precedence over scaled dimensions. The currency of these drawings should be checked prior to use. This drawing is provided only for the information of the person or organisation to which Litoria Consulting provides it. It may not be provided to, or used by, any other person without Litoria Consulting's prior written consent. Do not scale drawing. should dimensions be conflicting or missing, notify litoria consulting and await further instruction.

Drawing Scale	1:10,000 @ A3
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP01
Date Created	26/02/2021

ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au

LRP02: Overall Layout Plan



Legend

- Site (surveyed)

Adjacent cadastre (surveyed)

- Lot boundary
- Easement

Proposed works

- Buildings / plant area
- Earthworks
- Easement (new)
- Retained vegetation

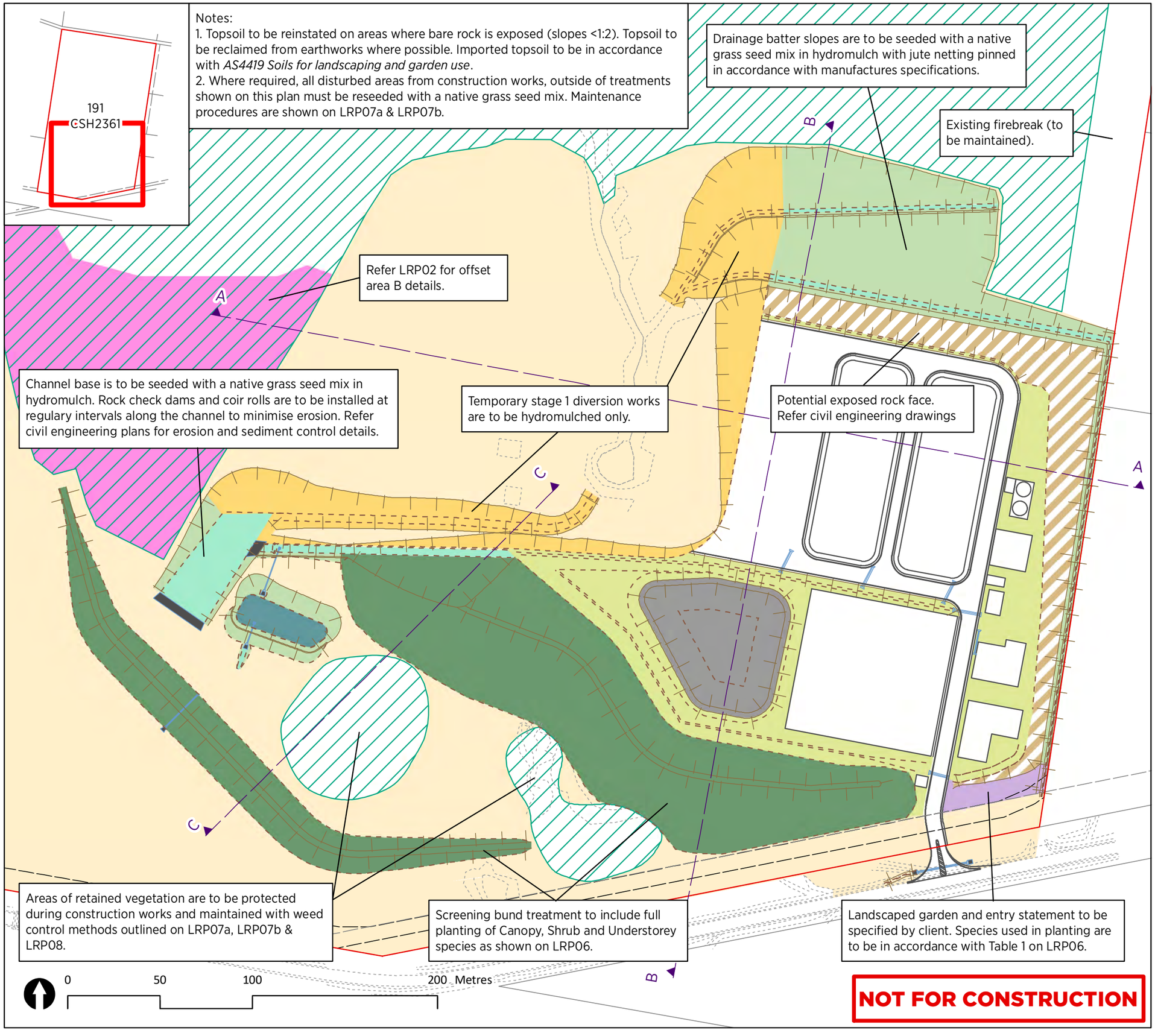
Landscaping and revegetation treatments

- Proposed treatments (Refer LRP03 & LRP04 for details)
- Offset area B
- Fauna exclusion fence
- Fauna friendly fence

NOT FOR CONSTRUCTION

Drawing Scale	1:5000 @ A3
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP02
Date Created	26/02/2021

ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au



LRP03: Landscape & Revegetation Plan - Stage 1

Legend

- Site (surveyed)

Adjacent cadastre (surveyed)

- Lot boundary
- Easement

Proposed works (Stage 1)

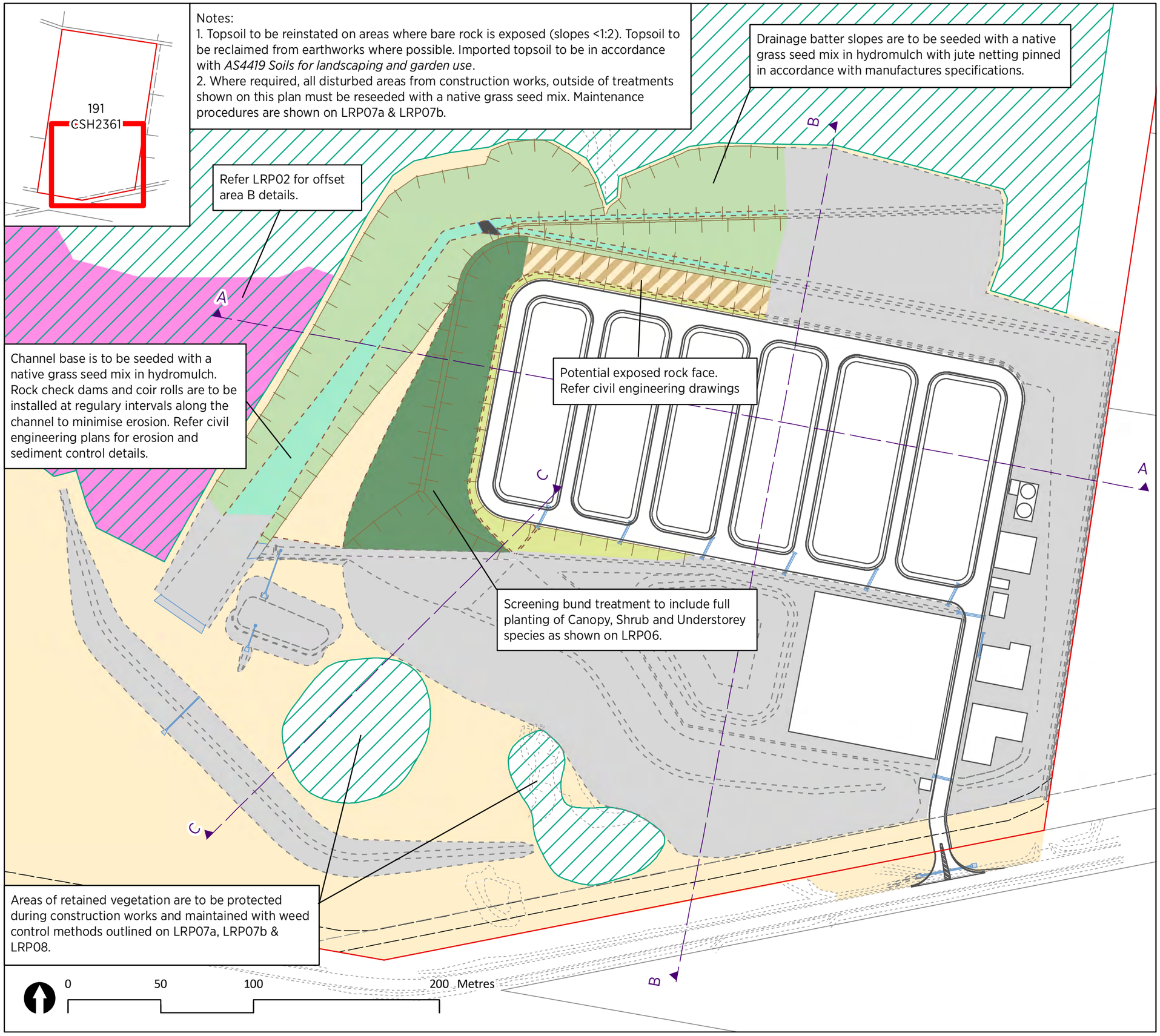
- Buildings / plant area
- Top of batter
- Bottom of batter
- Easement (new)
- Stormwater
- Existing features
- Scour protection
- Retained trees

Landscaping and revegetation treatments (Stage 1)

- Screening amenity bund (2.55ha)
- Drainage slopes (1.23ha)
- Exposed rock face (slopes >1:2)
- Channel base (0.30ha)
- Garden and entry statement (0.07ha)
- Maintained grass (includes pathways between buildings) (1.18ha)
- Bioretention basin (Refer civil engineers drawings)
- Evaporation pond (Refer civil engineers drawings)
- Offset area B
- Temporary diversion (1.07ha)
- Disturbed reseed (where required)

Drawing Scale	1:2000 @ A3
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP03
Date Created	26/02/2021

ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au



LRP04: Landscape & Revegetation Plan - Stage 2

Legend

- Site (surveyed)

Adjacent cadastre (surveyed)

- Lot boundary
- Easement

Proposed works (Stage 2)

- Buildings / plant area
- Top of batter
- Bottom of batter
- Completed earthworks
- Easement (new)
- Stormwater
- Existing features
- Scour protection
- Retained trees

Landscaping and revegetation treatments (Stage 2)

- Screening amenity bund (0.77ha)
- Drainage slope (1.65ha)
- Drainage slope / rock face (where required slopes >1:2)
- Channel base (0.31ha)
- Maintained grass (0.21ha)
- Offset area B
- Disturbed reseed (where required)
- Works completed as part of stage 1

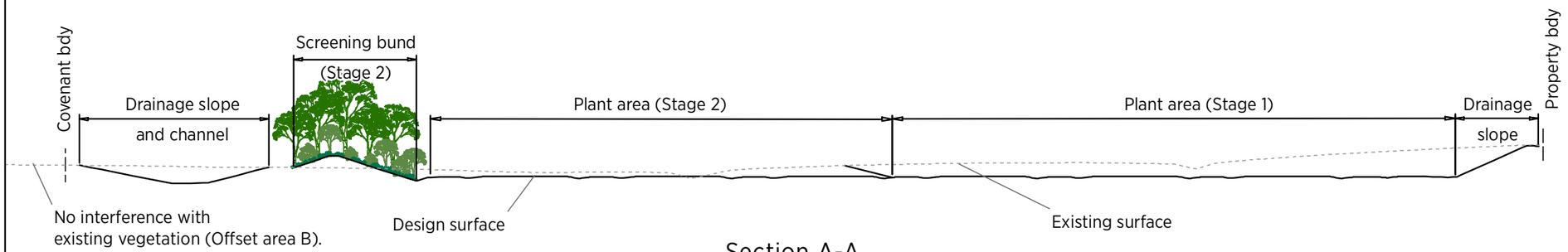
NOT FOR CONSTRUCTION

Drawing Scale	1:2000 @ A3
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP04
Date Created	26/02/2021

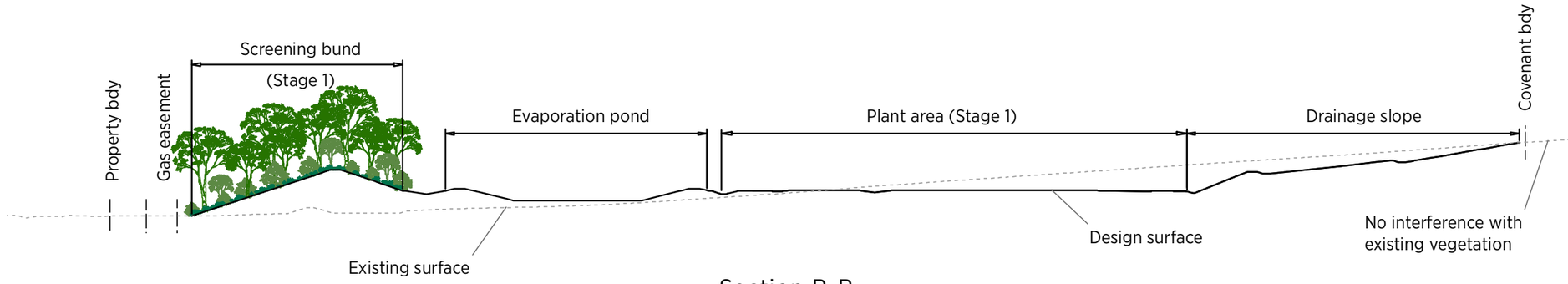
ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au

LRP05: Sections

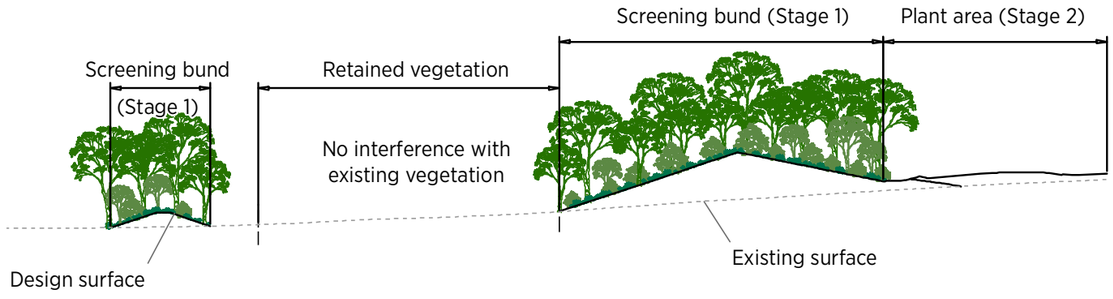
Notes:
1. Refer to drawings LRP03 and LRP04 for relevant details of the sections shown on this plan.
2. Vegetation shown on this plan is indicative only. It is shown to demonstrate the potential vegetation structure at full maturity.
3. Existing vegetation and plant treatments not shown for clarity.



Section A-A



Section B-B



Section C-C

Legend

- Existing surface
- Design surface

NOT FOR CONSTRUCTION

Drawing Scale	1:2000 @ A3
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP05
Date Created	26/02/2021

ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au

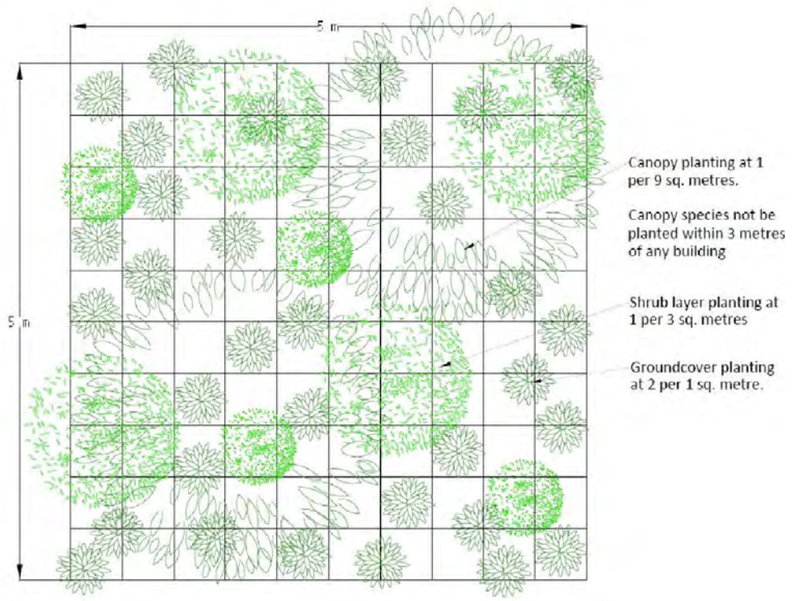
LRP06: Planting details

Table 1: Screening Amenity bund treatment

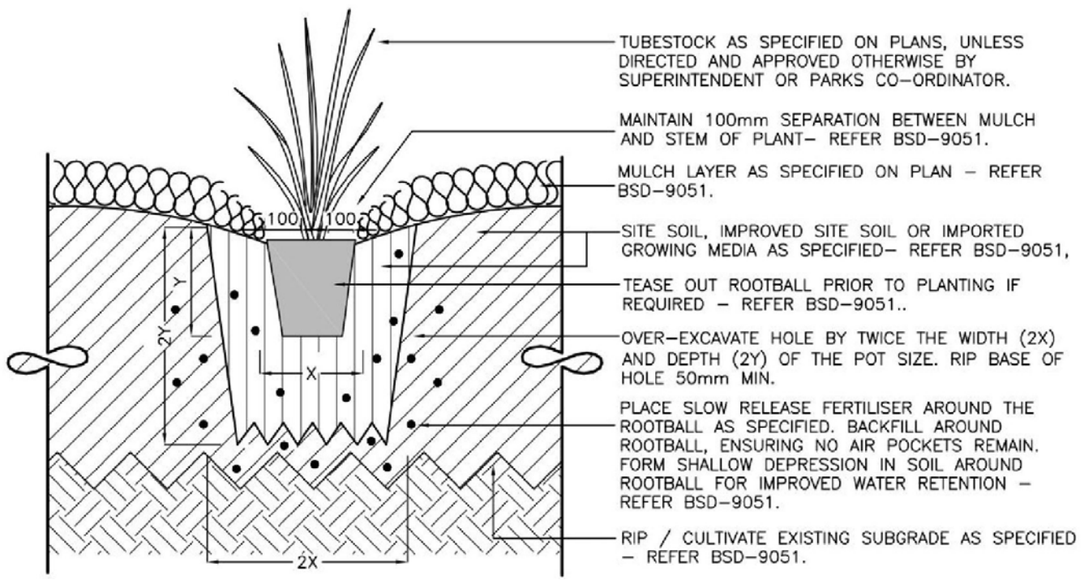
Botanical Name	Common Name	Planted Size	Planted density
Canopy			
Angophora leiocarpa	Smooth-barked Apple	75mm	1/9m2
Corymbia citriodora subsp. *variegata*	Spotted Gum	75mm	
Corymbia intermedia	Pink Bloodwood	75mm	
Eucalyptus creba	Narrow-leaved Ironbark	75mm	
Eucalyptus tessellaris	Moreton Bay Ash	75mm	
Eucalyptus tereticornis	Queensland Blue Gum	75mm	
Mid-storey			
Acacia disparrima subsp. *disparrima*	Hickory Wattle	75mm	1/3m2
Acacia leiocalyx	Early Black Wattle	75mm	
Allocasuarina luehmannii	Bull Oak	75mm	
Allocasuarina torulosa	Forest Oak	75mm	
Alphitonia excelsa	Soap Tree	75mm	
Brachychiton populneus	Kurrajong	75mm	
Hovea acutifolia	Purple Pea Bush	75mm	
Jacksonia scoparia	Dogwood	75mm	
Pittosporum angustifolium	Weeping Pittosporum	75mm	
Groundcovers			
Aristrida vagans	Threeawn Speargrass	75mm	2/1m2
Cymbopogon refractus	Barbed Wire Grass	75mm	
Dianella revoluta	Blue Flax-lily	75mm	
Entolasia stricta	Wiry Panic	75mm	
Eremochloa bimaculata	Poverty Grass	75mm	
Eremophola debilis	Winter Apple	75mm	
Imperata cylindrica	Blady Grass	75mm	
Hardenbergia violacea	Native Sarsaparilla	75mm	
Lomandra longifolia	Mat Rush	75mm	
Themeda triandra	Kangaroo Grass	75mm	

Table 2: Native grass seed mix

Botanical Name	Common Name	Application
Groundcovers		
Aristrida vagans	Threeawn Speargrass	To be included in hydromulch mix
Cymbopogon refractus	Barbed Wire Grass	
Entolasia stricta	Wiry Panic	
Eremochloa bimaculata	Poverty Grass	
Imperata cylindrica	Blady Grass	
Lomandra longifolia	Mat Rush	
Themeda triandra	Kangaroo Grass	



Sample Planting Layout
(to be acheived by off-maintenance).



Tubestock Planting Detail (BSD-9053)

NOT FOR CONSTRUCTION

Drawing Scale	NA
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP06
Date Created	26/02/2021

ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au

Table 3: Revegetation Procedures

Activity		Management Response	Responsible Party
Appointment of contractor	1	Appointment of contractor with demonstrated experience in bushland rehabilitation. Relevant qualifications include a certificate in Conservation Land Management - natural Area Restoration or a degree in a related field such as ecology or vegetation management. Contractors must hold applicable licences such as: - Commercial operator's licence (ground application of herbicides) issued under the *Agricultural Chemicals Distribution Control Act 1966* ; - Senior First Aid certificate; - White Card i.e. General Safety Induction (Construction Industry); and, - Relevant Ecoaccess permits issued by the relevant State department.	Project Manager
Review Rehabilitation Plan	1	Rehabilitation Plan must be reviewed by contractor prior to commencement of site work.	Project Manager, Contractor
	2	All relevant personnel sign a register noting that they have reviewed and will comply with the requirements of the Rehabilitation Plan.	Project Manager, Contractor
Rehabilitation staging	1	Staging to be in accordance with LRP03 & LRP04 of this plan.	Contractor
	2	All stages of rehabiliation works are to be completed prior to establishment period. 24 month maintenance period to include all stages of rehabilitation.	Contractor
	3	Prior to commencement of any stage, spotter/catcher is to inspect stage area. Observed fauna is to be relocated outside of the stage boundary into already completed rehabilitation areas or adjcent vegetation.	Contractor / Fauna Spotter Catcher
	4	Any amphibians encountered during inspections, works or monitoring are to be handled in accordance with the *Interim hygiene protocol for handing amphibians* (DEHP).	Fauna Spotter Catcher
Site preparation	1	Bare topsoil in rehabilitation areas will be appropriately prepared prior to planting.	Contractor
	2	Bare soil in rehabilitation areas affected by earthworks is to be tined to a minimum depth of 300mm prior to planting and covered with 200mm reclaimed topsoil.	Contractor
	3	Import topsoil similar to naturally occurring topsoil, suitable for the establishment and on-going viability of the selected vegetation, free of weed propagules and contaminants, and which achieves the requirements of *AS 4419 Soils for landscaping and garden use* .	Contractor
	4	Avoid differential subsidence and excess compaction and produce a finished topsoil surface which has the following characteristics:	Contractor
	a	Finished to design levels.	Contractor
	b	Smooth and free from stones or lumps of soil.	Contractor
	c	Graded to drain freely, without pending, to catchment points.	Contractor
	d	Graded evenly into adjoining ground surfaces.	Contractor
	e	Ready for planting.	Contractor
	5	In areas of exposed soil, install mulch which is free of deleterious and extraneous matter such as soil, weeds and sticks.	Contractor
	6	Mulch is to be from native trees removed from site where possible. Otherwise native organic mulch is to be imported in accordance with *AS 4454-2012 Composts, soil conditioners and mulches* .	Contractor
Erosion and sediment	1	Temporary erosion and sediment control fencing to be installed in accordance with Best Practice Erosion and Sediment Control (IECA Australia, November 2008).	Contractor
Adaptive management, monitoring and compliance	1	Project Ecologist to conduct regular inspections to ensure compliance with procedures outlined in this plan.	Project Ecologist
	2	Project Ecologist to issue notice of compliance to contractor for non-conforming works and any remedial works to ensure compliance.	Project Ecologist
Plant procurement	1	Plant species and sizes to be supplied in accordance with Table 1.	Contractor
	2	Plants will be supplied in weed-free containers of the required size. Open rooted stock is not to be supplied. All plants are to be healthy and vigorous. Root bound, diseased and poor stock will not be accepted.	Contractor
	3	Supply plants with foliage size, texture and colour at time of delivery consistent with the size, texture and colour shown in healthy specimens of the nominated species.	Contractor
	4	Supply plants with extension growth consistent with that exhibited in vigorous specimens of the species nominated.	Contractor
	5	Supply plants free from damage and from restricted habit due to growth in nursery rows.	Contractor
	6	Supply plants free from stress resulting from inadequate watering, excessive shade or excessive sunlight experienced at any time during their development.	Contractor
	7	Supply plants that have been grown and hardened off to suit the conditions that could reasonably be anticipated to exist on site at the time of delivery.	Contractor
	8	Supply plants with foliage free from attack by pests or disease.	Contractor
	9	No single species shall constitute more than 30% of the total individuals planted.	Contractor
	10	All plant material is to be sourced from local provenance stock.	Contractor
	11	Plant substitution is not permitted and alternative species must be confirmed with Litoria Consulting and/or Council prior to planting.	Contractor

Activity		Management Response	Responsible Party
Planting	1	Do not plant in unsuitable weather conditions such as extreme heat, cold, wind or rain. In other than sandy soils, suspend excavation when the soil is wet, or during frost periods.	Contractor
	2	Planting of designated areas in accordance with the planting schedule, densities and planting detail described in this Rehabilitation Plan.	Contractor
	3	Planting layout of designated areas requires a random planting layout, in accordance with the *Sample Planting Layout, Tubestock Planting Detail* shown in this Rehabilitation Plan.	
	4	Generally planting holes for trees are to be a minimum of 1.5 times the diameter of the rootball and twice the depth of the rootball.	Contractor
	5	Planting pit is to have roughened sides and decompacted base.	Contractor
	6	Install water retention crystals to manufacturer's specifications (approximately 5 grams per plant).	Contractor
	7	Remove the plant from the container with minimum disturbance to the root ball, ensure that the root ball is moist and place it in its final position, in the centre of the hole and plumb, and with the top soil level of the plant root ball level with the finished surface of the surrounding soil.	Contractor
	8	Backfill with topsoil mixture. Lightly tamp and water to eliminate air pockets. Ensure that topsoil is not placed over the top of the root ball, so that the plant stem remains the same height above ground as it was in the container.	Contractor
Weed control	1	Prior to the commencement of weed removal / control, contractor to inspect site to confirm weed species and/or extents for control.	Contractor
	2	Weed species / extents are flagged on-site (as required).	Contractor
	3	Weed control, subject to site monitoring, undertaken every 3 months following planting and carried out in accordance with requirements listed in this Rehabilitation Plan.	Contractor
	4	During the establishment and 12 month maintenance period all rehabilitation treatments shall be maintained in a weed free condition.	Contractor
	5	Weed control is carried out in accordance with best practice methods according to the requirements of individual species and/or environmental conditions as specified in Table 4 and Table 5.	Contractor
	6	Weed control will be undertaken in a manner which does not promote erosion or instability of soil, especially in waterways or high velocity flow zones.	Contractor
	7	Avoid application of herbicides on windy days or if rain is likely to follow within 12 hours.	Contractor
	8	Apply herbicides:	Contractor
	a	To the manufacturer's instructions and material data and safety sheets.	Contractor
	b	When the weather is humid with moderate temperatures and maximum sunlight.	Contractor
	c	When the ground has adequate soil moisture.	Contractor
	d	Where in close proximity to waterways, undertake weed control in accordance with the following guidelines: 1. Do not spray herbicides over waterbody. 2. Direct spray away from waterbody where possible. 3. Spray only to the extent of covering foliage with droplets. 4. Spray when weather is calm. 5. Use a flat fan nozzle and low pump pressure to reduce likelihood of spray drift. 6. Do not spray when rain is forecast within 6 hours.	Contractor
	9	Undertake any 'make good' works arising from meetings with either Council or Litoria Consulting, resulting in no declared plant pests or environmental weeds (i.e. 0%).	Contractor
Establishment	1	Ensure the general appearance and presentation of the landscape and the quality of plant material at date of practical completion is maintained for the full planting establishment period.	Contractor
	2	Replace failed, dead and/or damaged plants at maximum 3 week intervals as necessary throughout the full plant establishment period.	Contractor
Watering	1	Thoroughly water the plants before planting, immediately after planting, and as required to maintain growth rates free of stress.	Contractor
	2	Subject to prevailing weather conditions, watering to occur:	Contractor
	a	Daily for first week (5 waterings)	Contractor
	b	3/week for weeks 2-4 (9 waterings)	Contractor
	c	2/week for weeks 5-8 (8 waterings)	Contractor
	3	Manually water all planting areas, soaking to a depth of 300 mm. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings.	Contractor
	4	Water at times of day to minimise water evaporation loss. Do not water during the hottest period of Summer days.	Contractor

LRP07a: Revegetation procedures

NOT FOR CONSTRUCTION

Drawing Scale	NA
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP07a
Date Created	26/02/2021

ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au

Table 3: Revegetation Procedures (cont)

Activity		Management Response	Responsible Party
Maintenance	1	Maintain appropriate planting densities and replace dead / dying / diseased stock every 3 months.	Contractor
	2	Provide replacement plants as follows:	Contractor
	a	Of the same species and size listed in Table 1 & Table 2.	Contractor
	b	Of uniformly high quality stock equal to the best commercially available.	Contractor
	c	Representative of optimum growth for the species as restricted by the container size.	Contractor
	d	With a balanced root system in relation to the size of the plant and conducive to successful transpiration. Inspect the root conditions of plants by knocking plants from their containers.	Contractor
	e	Without signs of having been stressed at any stage during their development due to inadequate watering, excessive shade/sunlight, suffered physical damage or have restricted habit due to growth in nursery rows.	Contractor
	f	Healthy, well grown, hardened off specimens of good shape and free from pests and disease.	Contractor
	g	Well rooted and without any indication of having been restricted (pot bound) or damaged at any time.	Contractor
	h	Been grown in their final containers for not less than twelve (12) weeks.	Contractor
	3	Water to a depth of 300 mm. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings. Water at times of day to minimise water evaporation loss. Do not water during the hottest period of Summer days.	Contractor
	4	Provide progress report to Council at minimum 12 months after acceptance on-maintenance.	Contractor

Table 4: Maintenance and Monitoring Procedures

Task	Objective	Action	Timing	Maintenance frequency	Responsible Party
Weed control in rehabilitation areas	No declared plant pests within restoration areas (Council/State) (i.e. 0%).	Supplementary weed removal in accordance with this Landscape & Rehabilitation Plan.	Prior to completion of maintenance period	Every 3 months during maintenance period	Current owners / proprietors of the land
	No environmental weeds within restoration areas (i.e. 0%).	Supplementary weed removal in accordance with this Landscape & Rehabilitation Plan.	Prior to completion of maintenance period	Every 3 months during maintenance period	Current owners / proprietors of the land
Establishment and survival of all plants	90% survivorship of plants.	Replacement or supplementary planting in accordance with this Landscape & Rehabilitation Plan.	Prior to completion of maintenance period	Every 3 months during maintenance period	Current owners / proprietors of the land
Maintain appropriate planting densities	Planting densities are in accordance with this Landscape & Rehabilitation Plan.	Replacement or supplementary planting in accordance with this Landscape & Rehabilitation Plan.	Prior to completion of maintenance period	Every 3 months during maintenance period	Current owners / proprietors of the land
Rubbish removal	No rubbish within restoration areas	Remove rubbish and dispose off-site.	Prior to on-maintenance inspection.	-	Contractor / current owners / proprietors of the land

Table 5: Performance Outcomes

Period	Weed content	Planting densities	Structure, growth & health	Diversity
On-maintenance inspection	<20%	~80% (±5%) of target density	Species from canopy, shrub and understorey present.	Planted species in accordance with LRP06, with no species to constitute more than 30% of planted individuals.
Off-maintenance inspection	<10%	~90% (±5%) of target density	Species from canopy, shrub and understorey present, exhibiting healthy plant growth typical for 24 month for each species.	Planted species in accordance with LRP06, with no species to constitute more than 30% of planted individuals.

LRP07b: Revegetation procedures

NOT FOR CONSTRUCTION

Drawing Scale	NA
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP07b
Date Created	26/02/2021

ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au

Table 6: Weed Control Procedures

Method	Details
Complete removal	This technique is used for plants which regrow from bulbs, tubers or other plant parts, such as runners. Remove all plant parts, including roots by hand pulling. Plant parts should be removed from the site and disposed of via landfill or composting.
Stem scraping	This method is suitable for treating small shrubs and vines with thin and relatively soft bark tissue, which are actively growing and not stressed. Stem scraping or scrape and paint is perfect for treating vine species, especially Madeira Vine. The aim of this technique is to remove a small portion of the bark. This will allow the herbicide to penetrate into the plant's sapwood travelling to the tubers and effectively destroying the plant.
	Using the knife, scrape away 100 millimetres to expose the sap wood. Immediately (within 15 seconds) apply the herbicide to the exposed stem. Failure to apply the herbicide immediately will result in the plant sealing itself off and not all the herbicide to effectively penetrate into it.
Cut stump	This method is a quick and effective way of treating small shrubs, large trees, woody plants and vines without aerial tubers. This method allows accurate placement of the herbicide with minimal hazard to the environment and the operator. The intention of this method is to apply the herbicide to the actively growing plant sapwood. The herbicide will move through the plant into its roots and effectively kill it.
	Using the saw, machete, cane knife or secateurs, cut the plant at least 150mm above the ground. Immediately (within 15 seconds) apply the herbicide to the base of the stump. Failure to apply the herbicide immediately will result in the plant sealing itself off and not allow the herbicide to effectively penetrate into it.
Overall wet spray	This technique is suitable for treating grasses, herbs and shrubs up to 6 metres tall and involves spraying individual and small clumps of weeds with diluted herbicide.
	Avoid spraying on rainy or windy days and make sure the plants are actively growing. Ideal conditions for spraying are immediately after rain and once all the dew has evaporated.
	In terms of application technique:
	1. Spray close to the target plants to avoid spray drift onto other valuable (i.e. native) plants.
	2. Spray to cover all leaves and stems to the point of visible wetness.
	3. Use short sweeping strokes.
	4. Start from the far corner of the infestation working away from sprayed areas.
	5. Be systematic to avoid spraying the same area twice.

Table 7: Weeds & Recommended Control

Scientific Name	Common Name	Control Method
Bidens pilosa	Cobbler's Pegs	Complete removal
Cirsium vulgare	Spear Thistle	Overall wet spray
Conyza bonariensis	Flaxleaf Fleabane	Overall wet spray
Gomphocarpus physocarpus	Balloon Cotton Bush	Overall wet spray
Gomphrena celosioides	Gomphrena Weed	Overall wet spray
Lantana camara	Lantana	Cut stump, stem scraping
Lantana montevidensis	Creeping Lantana	Cut stump, stem scraping
Melinis repens	Red Natal Grass	Overall wet spray
Optunia stricta	Prickly Pear	Complete removal
Paspalum dilatatum	Paspalum	Overall wet spray, slashing and mowing
Verbena bonariensis	Purpletop	Overall wet spray

LRP08: Weed control procedures

NOT FOR CONSTRUCTION

Drawing Scale	NA
Drawn By	JA
Issue	B
DWG Ref.	20076 LRP08
Date Created	26/02/2021

ABN: 75 100 511 689
lvl 3 22 wandoo st fortitude valley
po box 461 paddington qld 4064
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au

APPENDIX 10: EROSION MANAGEMENT PLAN

Westlink Pty Ltd

Report for Westlink Power Project

Erosion Management Plan

February 2010

Contents

Table Index

1. Introduction

1.1 The Project

In response to rapidly growing demand for electricity, Westlink Pty Ltd (Westlink) is proposing a staged development of a natural gas-fired power station at a site north of Gatton in South-East Queensland, referred to as the Westlink Power Project (WPP).

The proposed WPP is to be located on a parcel of land near the township of Gatton; approximately 90 km west of Brisbane and approximately two kilometres north of Gatton, immediately north of the Warrego Highway on Fords Rd, Adare.

On the 4th of September 2009, Westlink lodged with the Lockyer Valley Regional Council (LVRC) a Development Application (DA) complete with a detailed Review of Environmental Factors (REF) for the WPP. Specifically, the DA is over Lot 191 on Crown Plan CSH2361 situated in the County of Cavendish, Parish of Lockyer contained in Certificate of Title, Title Reference 17000028 and is seeking a:

- Development Permit for a Material Change of Use (MCU) for the Electricity Generation Infrastructure;
- Development Permit for Environmentally Relevant Activity (ERA) No.14; and
- Development Permit for Operational Work (OW) for Vegetation Clearing.

The proposed use is more specifically defined as a natural gas-fired power station, consisting of the following elements:

- Staged installation of six open-cycle gas turbines;
- An electrical switchyard;
- A gas receiving unit;
- An operations building, workshop, administration building and car park; and
- Associated safety and monitoring equipment.

The proposed WPP is to be built in stages, in line with growing demand for electricity. Subject to development approval, the first stage of the project is expected to consist of 200 to 300 MW of generating capacity, with future expansion leading to a total project comprising up to 1,000 MW of open cycle gas turbines.

1.2 Purpose

The purpose of this Erosion Management Plan (EMP) is to provide a response to Lockyer Valley Regional Council (LVRC) and the Department of Environment and Resource Management (DERM) with information requested as part of this application process. This Report/Management Plan specifically addresses request item/s no. PR P.5 of the DERM information request outlined in correspondence dated 22 October 2009.

1.3 Information Requested

The following requests for information relating to erosion and sediment management are as follows:

DERM Information Request - Vegetation Management Group (Item 3)

Prepare a Soil Erosion, Sediment and Drainage Control Plan which demonstrates how the applicant intends to reduce the impacts of land degradation or promote further evidence indicating how the application will meet PR. P.5 of the Regional Vegetation Management Code.

Response:

This EMP demonstrates a range of mitigation measures and devices which will assist in minimising land degradation on site and therefore meets the requirements of this request.

The performance requirement of PR. P.5 is as follows:

> *"To regulate the clearing of vegetation in a way that does not cause land degradation and maintains ecological processes—the effect of clearing does not result in—*
>
> *a) mass movement, gully erosion, rill erosion, sheet erosion, tunnel erosion, stream bank erosion, wind erosion, or scalding; and*
>
> *b) any associated loss of chemical, physical or biological fertility—including, but not limited to water holding capacity, soil structure, organic matter, soil biology, and nutrients, within and/or outside the lot(s) that are the subject of the application."*

Specific mitigation measures are described in detail in Sections 4, 5 and 6 of this EMP. The existing ground cover and vegetation will be preserved for the balance of the development site.

DERM Information Request - EPA (Project Reference Number 341117) Item 1(c)

Provide an Erosion Management Plan prepared in accordance with the DERM information sheet: "Information to be provided with an application for an environmentally relevant activity (ERA)".

Response:

This Erosion Management Plan has been prepared in generally in accordance with the aforementioned factsheet.

LVRC Information Request – Item 3 Geotechnical Investigation

Advise proposed options to ensure slope stability and erosion protection on the steep and high batters.

Response:

Sections 4, 5, and 6 of this Erosion Management Plan outline specific mitigation measures to minimise erosion and promote slope stability for the development.

2. Regulatory Framework

Erosion and sediment control is regulated at both local and state levels of government. The key legal references and documents are:

- *Environmental Protection Act 1994*
- *Environmental Protection Regulation 2009*
- *Environment Protection (Water) Policy 2009*
- Queensland Water Quality Guidelines 2006
- IECA Australasia (IECA, November 2008). *Best Practice Erosion and Sediment Control*.

This EMP has been developed with reference to the above documentation.

3. Environmental Factors

3.1 Rainfall

Annual rainfall in Gatton is in the order of 760 mm (BOM, 2009). The months of October to March typically experience the heaviest rainfall followed by a noticeable decline of rainfall between April and September.

3.2 Geology

Reference to the 1:500 000 Moreton Geological Sheet indicates that Gatton is underlain by Quaternary Age flood plain and river terrace deposits, and is close to the boundary with Jurassic age, Marburg Formation deposits of sandstone, siltstone, shale, conglomerate, coal and oolitic ironstone.

The regional hydrogeology of the area has been deduced from the 1:2,500,000 map of Groundwater Resources of Queensland. According to the Queensland Department of Natural Resources and Water (DNR&W) Groundwater Database (2007), there are twelve registered bores within one kilometre of the site boundary. Limited stratigraphic records from these bores indicate that the majority of the site is underlain by residual soils of the Woogaroo Subgroup. According to historical records from DNR&W, groundwater has been encountered in the Woogaroo subgroup at depths of around 32m below ground level (BGL) and 114m BGL.

3.3 Topography

The site has varied topography with significant contour changes occurring on the north to south transect. The southern section of the site is relatively flat and rises gradually towards a NW-SE orientated ridge in the north. The southern extent of the site comprises gentle gradients climbing from the Warrego Highway and Fords Road. The south-western corner of the site forms a local depression and can become inundated, with saturated soils remaining for considerable periods of time.

A major gully system dissects the ridge and channels south towards the largest dam. A second smaller gully also extends from the ridgeline and joins with the larger gully system. The gullies range from 0.5m to 1.5m in depth. Minor erosion has occurred along creek beds but has been reduced by dense vegetation.

The northern portion of the site is situated on the opposite side of the central ridge and does not have significant bearing on the area in which the development is proposed. The southern catchment is approximately 30 ha. A small portion of the proposed development footprint has a gradient of greater than 10% (refer to Appendix A for further detail).

3.4 Soils

Geotechnical investigations indicate the soil comprises approximately 0.6 m of organic rich Clayey Sand/Sandy Clay overlying completely weathered sandstone. The soil layer is thinner (0.2 m thick) towards the north-eastern side of the proposed powerplant site.

3.5 Vegetation

The southern third of the site fronting Fords Road has been cleared and is covered with grass, with the northern portion of the property under vegetation. The primary vegetation type comprises open eucalypt woodland of various eucalypt species. The regional ecosystem remnant vegetation mapping prepared by the Queensland Herbarium describes the vegetation as a mix of RE 12.9-10.2 which is described as *Corymbia citriodora*, *Eucalyptus crebra* open forest on sedimentary rocks, and is classed as least concern under the VMA and accounts for 70% of the area, with the balance of the vegetation largely comprising RE 12.9-10.5 which is described as *Corymbia trachyphloia*, *C. citriodora*, *Eucalyptus crebra*, *E. fibrosa* subsp. *fibrosa* open forest on quartzose sandstone, and is classed as least concern under the VMA. The site also contains a small patch of 'High value regrowth vegetation that is a Least Concern regional ecosystem'.

The area to be affected by the proposed development will be completely cleared of all vegetation and the top soil will be stripped and removed from the area of disturbance.

3.6 Extent of Works

The proposed development will involve considerable reshaping of the land in the south east corner of the site, with six gas-fired turbines proposed in this area together with various support and ancillary infrastructure. The area of disturbance accounts for some seven hectares of the overall 70.151 ha contained within the parent parcel. The extent of works will involve significant cut and fill to create a relatively level platform on which the infrastructure is to be constructed.

4. Design Considerations

A number of design considerations have been proposed to minimise the risks associated with erosion on the site. Key design aspects are as follows:

- The area of disturbance on site will be limited to the footprint required to support the gas-fired turbines and necessary infrastructure and landscaping. Existing ground cover and vegetation will be preserved for the balance of the area.
- A relatively level platform is to be created using cut and fill techniques to enable the infrastructure to be constructed in a functional manner.
- Stormwater drainage systems will be established to manage stormwater runoff and to minimise velocity across open areas. Roofwater will be collected and discharged away from disturbed areas to minimise the risk of sediment entering the stormwater system.
- Vehicular access, manoeuvring and parking areas will be sealed to reduce the risk of erosion occurring within high traffic routes.
- Cut batters will be steepened toward the rear of the site where exposure of subsurface sandstone is likely. Weathered sandstone may be subject to the development of dispersive soils and therefore minimisation of exposure to rainfall is desirable.
- Diversion drains and bunding will be put in place upslope of the cut batters to divert all stormwater from upslope in the undisturbed portions of the catchment away from the construction area and the location of the new development. Diversion drains will be grass lined for the upper reaches where stormwater velocities are low and be rock lined at lower reaches as velocities and flow volumes increase. Specific design details will be provided at detailed design phase.
- Stormwater management will be achieved in the south western extent of the site through a series of large bunds that will be stabilised through revegetation as shown in Appendix A of this report.
- Progressive landscaping of all disturbed areas will be undertaken in accordance with the landscaping plans provided with this application. Jute matting and hydromulching will be installed in areas supporting batters steeper than 1 on 2 grades. Other areas are to be rehabilitated through a mixture of geofabric protection, mulch, hydromulching and the planting of shrubs and trees as shown in the landscape plan.
- The layout will assist in allowing efficient drainage of the site without resulting in high velocity flows being diverted over areas that may be subject to erosion.

5. Erosion & Sediment Control Strategy - Construction Phase

5.1 Planning

The following steps will be taken to prevent erosion and sedimentation, prior to commencement of works:

- All reasonable and practicable measures shall be taken to minimise changes to the volume, frequency, duration and velocity of stormwater runoff such that accelerated erosion within downstream waterways is minimised. This will be achieved in part through the installation of diversion drains and the detention bunds in the south west corner. Progressive rehabilitation of this area will be necessary to stabilise soils in the area.
- The location and design of works shall take appropriate consideration of the need to minimise potential erosion problems. This shall extend to include the location of access roads, temporary storage areas, stockpiles and site offices.
- To the maximum degree reasonable and practical, development layouts shall aim to minimise the duration that any, and all, areas of soil need to be exposed to other erosive effects of wind and rain during the construction of the proposed works.
- The staging and/or layout of works shall not cause unnecessary soil disturbance if an acceptable alternative layout is available that achieves the same, or equivalent, project outcomes.
- The Contractor shall be familiar with the preliminary geotechnical report prepared for the site as well as any additional geotechnical investigations and design plans. Adequate soil data shall be obtained for the site to:
  - Identify potential dispersive soils if present (dispersive soil risks may be associated with the weathering of the sandstone in areas of cut);
  - Maximise the erosion control benefits of the proposed site revegetation/stabilisation works; and
  - To allow the appropriate selection, design and specification of Erosion and Sediment Control (ESC) measures.

5.2 Site Preparation

The expansion area will be cleared and established, and site access points determined, in accordance with the following:

5.2.1 Site Clearing

- Land clearing shall be delayed as long as practical and shall be undertaken in conjunction with development of each stage of works, unless otherwise approved.
- All reasonable and practicable efforts shall be taken to delay the removal of, or disturbance to, existing ground cover prior to land-disturbing activities.
- No clearing shall be undertaken unless preceded or accompanied by installation of adequate drainage and sediment control measures.

- Prior to site clearing, areas of protected vegetation, and significant areas of retained vegetation shall be clearly identified for the purposes of minimising the risk of unnecessary land clearing.
- All reasonable measures shall be undertaken to protect “retained” vegetation from damage.

5.2.2 Site Establishment

- Development conditions shall be conveyed to the principal contractor prior to construction commencing.
- Prior to construction commencing, a site representative shall be nominated to undertake regular EMP audits of the site.
- Land disturbing activities shall be undertaken in such a manner that allows all reasonable and practicable measures to be undertaken to:
  - Permit stormwater to pass through or around the disturbance area in a controlled manner, and at non-erosive flow velocities;
  - Minimise soil erosion resulting from rain, water flow, and wind;
  - Minimise adverse effects of sediment runoff (including safety issues);
  - Minimise environmental harm resulting from work-related soil erosion and sediment runoff; and
  - Ensure that the value and use of land/properties adjacent to the development (including roads) are not diminished as a result of the adopted erosion and sediment control measures.
- All office facilities and operational activities shall be located such that any effluent, including wash-down water, can be totally contained, and treated, within the site.

5.2.3 Site Access

- Site access shall be stabilised and confined to the minimum practical number of locations.
- Vehicular access into the site shall be controlled so as to prevent tracking of sediment onto adjoining sealed roadways.
- Stormwater runoff from access roads and stabilised entry/exit systems shall drain to an appropriate sediment control device.

5.3 Site Management

The site will be managed in accordance with the following:

- All land-disturbing activities shall be conducted in accordance with the requirements of relevant environmental legislation.
- Construction schedules shall aim to minimise the duration that any and all areas of soil are exposed to the erosive effects of wind and rain.
- All land-disturbing activities shall be undertaken in accordance with the EMP and the conditions of development approval.
- All erosion and sediment control measures shall conform to the standards and specifications either contained in:
  - The approved EMP and supporting documentation; or

  - The latest version of the IECA Guidelines if such standards and specifications are not contained in the approved EMP.
- Any works that cause significant soil disturbance that is ancillary to any purpose for which external approval is required, will not commence before the issue of that approval.
- Land disturbing activities shall not cause unnecessary soil disturbance if an acceptable alternative construction process is available that achieves the same or equivalent outcomes at equivalent cost.
- Sediment deposited off the site as a direct result of on-site activities, including sand, silt, soil, mud, gravel, cement, and ceramic waste shall be collected, and the area rehabilitated as soon as practical, with appropriate consideration given to both the safety, and environmental risk, associated with the sediment deposition.
- Adequate waste collection bins shall be provided on-site, and maintained such that potential and actual environmental harm is minimised.
- Concrete waste and chemical products, including petroleum and oil-based products, shall be prevented from entering an internal body, or an external drain, or piped stormwater system.
- All stormwater, sewer line, and services trenches not in streets, shall be mulched and seeded within seven days after backfill. No more than 150 m shall be open at any one time.
- Site spoil shall be disposed of in a manner that does not result in ongoing soil erosion or environmental harm.

5.4 Erosion and Sediment Control Treatments

This section of the EMP identifies the most appropriate erosion and sediment controls for the project. In addition, monitoring requirements are outlined. The selection of appropriate control measures is based on information provided in earlier sections of this EMP. Standard drawings and construction notes can be found in the relevant guideline.

5.4.1 Erosion Control

The following erosion control measures will be used to minimise the generation of sediment laden runoff during construction:

- Wherever practical, priority shall be given to the prevention, and minimisation, of soil erosion, rather than the trapping of displaced sediment.
- Within the limits of technology, erosion control measures used to control wind-borne erosion shall be designed to adequately manage a typical seasonal wind event in terms of wind direction and strength.
- Dust suppression activities shall ensure that sediment-laden runoff resulting from these measures is controlled and does not create a traffic hazard.
- All temporary earth banks, flow diversion systems and sediment dam embankments are to be seeded and mulched for temporary vegetative cover within 10 days after grading.
- Exposed earth surfaces are to be loosened, mulched, and seeded to maximise infiltration, minimise runoff, and promote revegetation.
- Unprotected slope lengths shall not exceed 80 m, or an equivalent vertical fall of 3 m prior to shutdown periods, or anticipated significant rainfall.

- Unprotected slopes exceeding 30 m are to be ripped across the slope at 10 m intervals to a depth of at least 0.2 m, or to contour furrows/banks.
- Construction and stabilisation of earth batters, steeper than 6:1 slope (horizontal:vertical), are staged such that no more than three vertical metres of batter is exposed to rainfall at any point in time.
- Steep slopes will require careful management and additional inspections of site performance at these locations should be considered during periods of higher risk.

Table 1 outlines some erosion controls recommended for use during construction, and their application.

Table 1 Erosion controls to be implemented during construction

ESC Measure	Application
Outlet protection	Placed at the outlet of temporary chutes to reduce discharge velocity and thus potential erosion.
Mulching	Applied on batters as soon as practicable and used to stabilise decommissioned access tracks. Erosion and sediment controls such as catch drains and sediment fences should be maintained until rehabilitated areas are stabilised.
Geofabric	Used as underlining for rock pads and channels to avoid soil exposure.
Rock Check Dams	Placed at regular intervals along catch drains to slow channelled runoff to non-erosive velocities.
Sediment Fences	These should be installed along down slope perimeter boundaries and other nominated areas to reduce the amount of material entering the floodway and existing pipe culverts. These fences will also allow runoff to pond and filter through the fence prior to entering these drainage lines and culverts.

5.4.2 Sediment Control

The following sediment control measures and procedures address treatment of sediment laden runoff during construction:

- All reasonable and practicable measures shall be taken to prevent or minimise the release of sediment from the site.
- All reasonable and practicable measures shall be taken to prevent the discharge to stormwater drains or waterways, any sediment-laden runoff resulting from the formation of exposed aggregate surfaces.
- Suitable all-weather access shall be provided to all sediment control devices.
- Sediment control devices shall be de-silted and made fully operational as soon as practical after a sediment-runoff event if their sediment retention capacity falls below 75% of the required capacity.
- Solid materials removed from sediment control devices shall be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

- Sediment basins shall be maintained and fully operational throughout the construction period and until the respective sediment basin's design catchment achieves the required ground vegetation coverage.
- Settled sediment shall be removed from sediment basins when its volume exceeds the nominated storage volume.
- Sediment-laden run-off from the site shall be directed to the designated sediment control device(s), which depending on the situation may include:
  - Rock check dams;
  - Vegetated channels;
  - Vegetated buffer strips;
  - Sediment fences;
  - Sediment basin (sized to the appropriate soil retainment characteristics, catchment area, and design rainfall event).

Suitable applications for the above sediment control devices are detailed in Table 2.

Table 2 Sediment control devices to use during the construction phase

ESC Measure	Application
Entry Points / Washdown Area	To assist in removing the soil from vehicles as they enter and exit the construction site. This will minimise the amount of sediment tracked onto Fords Road.
Sediment Trap	To trap sediment where concentrated flow is to be intercepted. These structures may be constructed from a number of materials including rock, sediment fence, geofabric, haybales or a combination of all.
Sediment Basin	A sediment basin has been designed for the site conditions and located within the floodway channel. This basin will capture runoff from the site, allowing the fine sediment to settle, thus reducing the amount to turbidity prior to downstream discharge.
Sediment Fences	These should be installed along down slope perimeter boundaries and other nominated areas to reduce the amount of material entering the floodway and existing pipe culverts. These fences will also allow runoff to pond and filter through the fence prior to entering these drainage lines and culverts.

5.4.3 Velocity Control

The velocity controls recommended for use during construction are detailed in Table 3.

Table 3 Velocity control measures

ESC Measure	Application
Rock / Sandbag Check Dams	Placed at regular intervals along catch drains to slow channelled runoff to non-erosive velocities.

5.5 Monitoring Requirements

The following monitoring regime will be used during the construction phase of the project:

- End of day inspection of erosion and sediment control devices and rectification where required.
- Daily following a rainfall event – inspection and sediment removal where required as soon as practicable.

6. Post Construction Measures

This section details site rehabilitation, monitoring, and maintenance procedures to be carried out post construction.

6.1 Site Rehabilitation

To rehabilitate the site following construction, the following measures will be taken:

- All disturbed areas shall be rendered erosion resistant by turfing, seeding, mulching, paving or otherwise suitably stabilised within 14 days of completion.
- The pH of topsoil shall be adequate to enable growth of vegetation.
- Inspection of revegetation zones will be undertaken to assess vegetation condition, and to identify if any erosion, channelling, or weed problems are occurring.

6.2 Site Monitoring

Site monitoring will be achieved through the following:

- Sediment basin water quality samples must be taken at a depth no greater than 200mm above the base/invert of the basin.
- All environmental incidents shall be recorded in a field log, which shall remain accessible to the various regulating authorities.

6.3 Site Maintenance

To ensure the site is maintained, the following procedures are to be followed:

- All ESC measures shall be maintained in good working order during their operational life.
- All temporary ESC measures to be maintained and fully operation during the maintenance period.
- The capacity and effectiveness of all ESC measures shall be implemented and maintained at all times.
- Where it is necessary to clear excess vegetation in order to restore the water carrying capacity of open drains, the vegetation shall be selectively cut and trimmed so as to leave a short, dense, live ground cover, for the purpose of minimising soil erosion.
- Maintenance of road shoulders, table drains, batters and other surfaces likely to erode shall aim to leave the grass length no shorter than 50 mm where practical.
- An emergency supply of repair materials such as wires, stakes, and filter cloths should be readily accessible and restocked after use.
- Post remediation, the site should be in a stable and non-erodible form.

Appendix A

Sediment Control Plan

SILT AND EROSION CONTROL

1. GENERAL

1.1 TAKE ALL REASONABLE AND PRACTICAL MEASURES TO PREVENT OR REDUCE HARM TO THE ENVIRONMENT AS SET OUT IN THE ENVIRONMENTAL PROTECTION ACT (1994). THE MANAGEMENT OF EROSION OF THE SITE AND ITS SURROUNDS AND THE TRANSPORTATION AND DEPOSITION OF SILT IS THE RESPONSIBILITY OF THE CONSTRUCTOR AND ALL INVOLVED WITH THE PROJECT.

1.2 NO SITE WORKS TO COMMENCE UNTIL APPROPRIATE EROSION AND SEDIMENT CONTROL HAS BEEN PROVIDED AND INSTALLED.

1.3 THE WORKS SHOWN ON THIS PLAN ARE FOR THE TEMPORARY CONTROL OF EROSION DURING THE CONSTRUCTION AND ESTABLISHMENT OF ACCEPTED GRASS COVER. THE REVEGETATION AND REHABILITATION WORKS ARE TO BE UNDERTAKEN AS SOON AS PRACTICALLY POSSIBLE.

THIS MANAGEMENT TO BE ADDRESSED THUS:

A) DURING CONSTRUCTION
PROVIDE AND MAINTAIN TEMPORARY CONTROLS FOR ALL ACTIVITIES WHICH POTENTIALLY COULD RESULT IN EROSION OR SEDIMENTATION - DEPENDING ON WEATHER CONDITIONS.

B) PRIOR TO PRACTICAL COMPLETION
PROVIDE AND MAINTAIN LONGER-TERM MEASURES TO MINIMISE EROSION AND SEDIMENTATION, TO AND FROM, THE COMPLETED WORKS. THE FINAL NATURE AND EXTENT OF THESE CONTROLS WILL BE AGREED WITH THE SUPERINTENDENT.

C) SILT AND EROSION CONTROL DEVICES ARE TO BE REMOVED WHEN SATISFACTORY GRASS COVER (8m² in 10m²) HAS BEEN ACHIEVED AND SITE IS STABLE.

1.4 CLEARING OF VEGETATION TO BE KEPT TO A MINIMUM AND LIMITS OF CLEARING TO BE VISIBLY DEFINED.

1.5 REFER TO IECA, BEST PRACTISE EROSION AND SEDIMENT CONTROL, NOV 2008 FOR GUIDLINES ON REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL ON THIS SITE.

1.6 PROVIDE SILT FENCE DOWN GRADIENT OF ALL STOCK PILES.

1.7 CONSTRUCTION WORK TO BE STAGED TO MINIMISE EXPOSURE OF DISTURBED AREAS AND EROSION AND SEDIMENT CONTROL PLAN TO BE AMENDED ACCORDINGLY.

1.8 STOCKPILE SITES TO BE LOCATED A MINIMUM OF 50m FROM WATERCOURSES.

1.9 WITHIN 50m OF WATERCOURSES, TRENCH EXCAVATION MATERIAL TO BE PLACED UPSTREAM OF TRENCH.

1.10 WORKS ON SLOPES GREATER THAN 10% SHALL HAVE SPECIAL MEASURES TAKEN TO MINIMISE EROSION RISKS (e.g. EROSION CONTROL BLANKETS, MULCH, TURF etc.)

1.11 ALL SURPLUS WASTE TO BE REMOVED FROM SITE AND DISPOSED OF ACCORDINGLY.

1.12 REGULAR MAINTENANCE OF STRUCTURES IS AN ESSENTIAL PART OF EFFECTIVE EROSION AND SEDIMENT CONTROL. THESE STRUCTURES SHOULD BE INSPECTED AT LEAST DAILY DURING DRY WEATHER AND AFTER EVERY STORM EVENT THAT CAUSES RUNOFF.

1.13 LANDSCAPING TO BE IN ACCORDANCE WITH THE LVRC TREE PLANTING AND LANDSCAPE GUIDELINES, IF APPLICABLE.(LVRC PLANNING SCHEME. SECTION 8.12 PSP No 11)

2. DUST SUPPRESSION

2.1 THE CONSTRUCTOR IS TO ENSURE THE SUPPRESSION OF DUST AT ALL TIMES DURING CONSTRUCTION. ACCEPTABLE METHODS OF DUST SUPPRESSION INCLUDE:-

- WATERING
- REVEGETATE DISTURBED AREA
- MULCHING

VEGETATION MANAGEMENT NOTES

1. GENERAL

1.1 NO CLEARING OF THE SITE IS TO COMMENCE UNTIL APPROVAL TO PROCEED HAS BEEN GIVEN BY THE SUPERINTENDENT.

1.2 ALL TREES TO BE REMOVED SHALL BE TAGGED AND INSPECTED FOR ANY SIGNS OF WILDLIFE. SHOULD ANY WILDLIFE BE IDENTIFIED THEN THE PROPONENT SHALL ORGANISE THE SAFE REMOVAL AND RELOCATION OF SUCH SPECIES TO AN APPROPRIATE LOCATION.

1.3 CARE IS TO BE TAKEN TO ENSURE THE OPERATION OF CONSTRUCTION EQUIPMENT DOES NOT DAMAGE TREES BEYOND THE LIMIT OF CLEARING. IF NECESSARY, TREE GUARDS ARE TO BE PLACED AROUND THE TREES TO PROTECT THEM. TUNNEL UNDER TREE ROOTS WHEREVER POSSIBLE DURING TRENCHING OPERATIONS. IN THE EVENT OF ROOT DAMAGE, MAKE A CLEAN CUT ABOVE THE SEVERED ROOT AND TREAT THE ROOT WITH A SUITABLE FUNGICIDE.

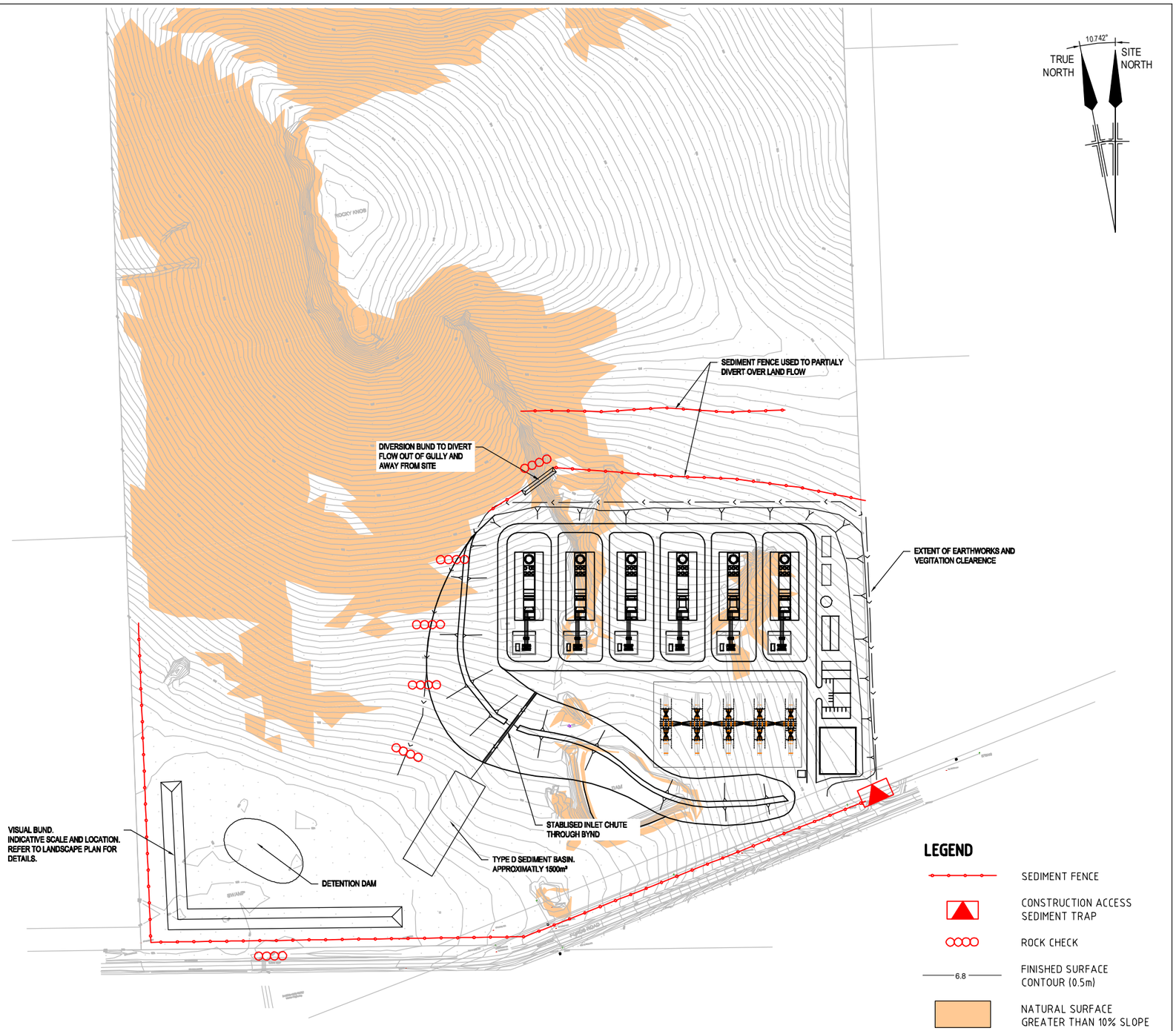
1.4 ALL SUITABLE VEGETATION MATERIAL SHALL BE PROCESSED THROUGH A MILLING MACHINE TO PRODUCE CHIP MULCH. UNSUITABLE MATERIAL SUCH AS ROOTS AND STUMPS SHALL BE DISPOSED OFF SITE. NO BURNING OF CLEARED MATERIAL IS ALLOWED. CHIP MULCH PRODUCED ON-SITE SHALL BE AGED AND LEACHED IN THE OPEN FOR AT LEAST ONE MONTH AFTER MILLING. CHIP MULCH SHALL BE FREE FROM WEEDS, STONES, SOIL AND OTHER CONTAMINATES. THE MAXIMUM SIZE OF CHIP SHALL FIT WITHIN A PRISM MEASURING 150mm x 100mm x 20mm.

OR

ALL VEGETATION IS TO BE DISPOSED OF IN A MANNER APPROVED BY THE SUPERINTENDENT.

2. REVEGETATION

2.1 REHABILITATION REQURIED OF ALL DISTURBED AREAS. NOTE THAT AREAS OF EARTHWORKS AND TRENCHING ARE TO BE DECOMPACTED TO A DEPTH OF 250mm BY SCARIFYING.



PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	ISSUED FOR CLIENT REVIEW		GHD			

GHD CLIENTS | PEOPLE | PERFORMANCE
4-6 Innovation Parkway
Kawana Business Village, Birtinya QLD 4575 Australia
PO Box 1540 Buddina QLD 4575
T 61 7 5413 8100 F 61 7 5413 8199
E bta1mail@ghd.com W www.ghd.com

Drawn	GHD	Designed	
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client WESTLINK PTY. LTD.
Project WESTLINK POWERSTATION DEVELOPMENT ASSISTANCE
Title EROSION AND SEDIMENT CONTROL PLAN

Original Size A1
Drawing No: 41-21379-SK005
Rev: A

Plot Date: 15 February 2010 - 1:48 PM Plotted by: Christopher D. Schnitzerling Cad File No: G:\41\22282\CADD\Drawings\41-21379-SEDIMENT PLAN.dwg

GHD

201 Charlotte Street Brisbane QLD 4000
GPO Box 668 Brisbane QLD 4001
T: (07) 3316 3000 F: (07) 3316 3333 E: bnemail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	B. Anderson	D. Willis		P Wootton		17/12/09
1	B. Anderson	D. Willis		P. Wootton		20/01/10

APPENDIX 11: WESTLINK POWER PROJECT LANDSCAPE MANAGEMENT AND REVEGETATION PLAN

Attachment C

Landscape Management and Revegetation Plan

CLIENTS | PEOPLE | PERFORMANCE

Westlink Pty Ltd

Report for Westlink Power Station Development

Landscape Management and Revegetation Plan

February 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

1. Introduction

1.1 Scope of Works

The Landscape Management and Revegetation Plan (LMRP) has been produced to manage and reinstate vegetation throughout the operation, construction and maintenance phases of specified areas of Westlink Power Project (WPP) site. Refer to Landscape Detail Design Planting Layout 1, Dwg 41-22282-L001, L002, L003 and L004, Rev A, located in Appendix A of this document. A Detailed Landscape Specification document has also been prepared which sets out the procedures to be followed fro implementation of the soft landscape components of the project. Please Refer to Appendix D of the Visual Impact and Landscape Assessment Addendum Report for details. Additionally, a Detailed Ecological Assessment, dated 21st April 2009, has been prepared by Conics and relevant information on existing vegetation, fauna, weed species has been referred to in this LMRP.

1.2 Aims and Objectives of Revegetation

The LMRP aims to provide a clear, concise and practical framework for the management and revegetation of the areas outlined in 41-22282-L001 to L004 Planting Layout Plan for the WPP located in Appendix A of this document. The objectives of the LMRP are described in Table 1 below.

Table 1 Aims and Objectives of Rehabilitation Works

Components	Objective	Management Response
Project Management	To formulate and implement vegetation management actions; To clearly identify, methods and reporting lines; To inform all relevant players of their responsibilities; To promote and maintain stable vegetation cover.	Project management will incorporate LMRP as an integral part of the construction and operational phase. Nominate the person with responsibility for overseeing development works (e.g. the site supervisor or works supervisor) to be responsible for implementing vegetation management actions on site, and for point-of-contact for local Council or other agencies. Advise all contractors as to their role in vegetation management. Supply an action plan outlining timeframes for the implementation of each phase, and monitoring and reporting activities.

Catchment Management and Action	To protect catchments during construction and operational phases of development.	Implement catchment protection measures prior to construction works commencing. Ensure that short (construction phase) impacts on water quality are minimized. Ensure that hydrology quality of runoff is restored in the long-term.

Components	Objective	Management Responses
Clearing and Disposal of Vegetation	To minimise the adverse impacts of vegetation clearance; To maximise recycling or reuse of cleared vegetation; To minimise the impacts of habitat loss due to the removal of vegetation or hollow bearing trees; To minimise impacts to native flora and fauna; To minimise soil erosion and sedimentation; To minimise the introduction and/or spread of weeds; To promptly identify and control weeds and to eliminate noxious weed species; To maintain existing floristic characteristics of the region throughout the proposed developed landscape; To minimise the negative impacts of pest plant and animal species within and adjoining the power station footprint, during construction of the project; To ensure the most appropriate measures are implemented to mitigate potential negative impacts of infestation by pest plant & animal species, caused before, prior to, during construction and throughout the maintenance period of the project; To ensure no negative impacts in water quality resulting from pathogens, bacteria, and nutrients; and To define the roles, responsibilities and the tasks to be performed, in regard to the control and monitoring of weed infestations.	Clearly identify areas of vegetation to be cleared or retained, and areas containing hollow bearing trees. Relocate wildlife including possums, sugar gliders, and native beehives prior to the removal of habitat trees. Ensure appropriate permits have been obtained prior to these actions. Use clearing methods that will not damage adjacent protected vegetation and will minimise soil profile disturbance. Recycle cleared vegetation for reuse on or off site such as mulch. Trees with identified hollows should have the hollow section preserved and this section should be suitably mounted on nearby or adjacent suitable trees, subject to Council approval. Establish an inventory of both native and exotic species on the site. Identify any species listed under the *Nature Conservation Act 1992 (Qld)*, and the *Environmental Protection and Biodiversity Conservation Act 2000 (Commonwealth)* which are to be protected under this legislation. Implement vegetation protection measures prior to construction works commencing. These commonly include designating vehicle access ways and work areas, signage, barrier fences, and tree guards, to minimize compaction of the remaining vegetation's root zone. Protect the root zones of individual trees or clumps of trees from compaction, filling, stockpiling or excavation, by excluding such activities to a location outside the vegetation canopy drip-line.

Revegetation and Maintenance	To restore and enhance disturbed areas in the post construction phase; To maximise survival opportunities for areas of retained vegetation and newly rehabilitated areas; To protect vegetation and catchments during construction and operational phases of development; To restore and enhance disturbed areas in the post construction phase; To maximise survival opportunities for areas of retained vegetation and newly rehabilitated areas; To improve the ecological values by providing a naturally vegetated weed-free area with habitat complexity, food resources and linkages to other areas; and To prevent existing and new weeds from restabilising within the rehabilitated areas.	Determine the revegetation techniques suitable for the site taking into account the topography, soils, and ecological processes (i.e. natural regeneration, direct seeding, and soil seed-bank translocation techniques). Provide planting densities and techniques as required. Provide recommended native species lists for revegetation, as well as priority weed species recommended for control. Ensure recommended native plant species will not aggressively compete or displace existing native species. Specify a maintenance program in the LMRP to ensure the long-term health and vigour of retained vegetation and the healthy growth of new plantings and/or direct seeded areas. Give details on mulching, watering and fertiliser regimes, regular inspection schedules for damage or disease, replacement planting criteria and weed eradication measures in this program. Implement a monitoring program to measure the effectiveness of adopted measures. Provide for monitoring of any adjacent waterways for sedimentation and erosion with an action plan to remediate as necessary. Weed management and control methods should be applied in dry weather conditions only throughout the year. Chemical control of weeds should have a minimum of 4 – 24 hrs of non-contact exposure to heavy rain. All exposed soil surfaces are to be rehabilitated within 24 hrs of construction or landscaping completion and where necessary have temporary or permanent sediment control devices in place prior or during construction phase.

2. Existing Vegetation to be Retained

A field assessment was conducted to establish existing conditions on site in the vicinity of the proposed power station and screen/buffer mound areas. Trees at the southern bank of the existing dam and to the south west of the dam will be retained where possible. A variety of eucalypt species have been identified, refer to Landscape Detail Design Planting Layout 1, Dwg 41-22282-L001, L002, L003 and L004, Rev A, prepared by GHD and the Detailed Ecological Assessment, Lot 191 CSH2361, Ford's Road Gatton, dated 21st April 2009, prepared by Conics. Existing vegetation will provide an amount of instant screening of the proposed power station stacks. This has been documented on Landscape Detail Design Planting Layout 1, Dwg 41-22282-L001, L002, L003 and L004, Rev A, prepared by GHD

Mistletoe Infestation

There was a visible infestation of mistletoe (*Amyema miquelii*) on the forest red gums (*Eucalyptus tereticornis*) present on site around the largest dam. Mistletoe is a native epiphytic parasitic shrub that, if occurring in high enough densities may kill its host tree. Mistletoe also provides a potential food source for birds, particularly mistletoebird (*Dicaeum hirundinaceum*) and provides roosting opportunities for other species. Although mistletoe was present in quite a few trees located around the dam, it does not appear to be having a detrimental effect on the host trees. Retained trees should be routinely inspected by a suitably qualified arborist to make an assessment and perform any treatment required.

3. Roles and Responsibility for Revegetation Works

All personnel are responsible for the environmental performance of their activities and for complying with their General Environmental Duty as outlined in the *Environmental Protection Act 1994* (EP Act).

Section 36 (1) on the EP Act states that "a person must not carry out any activity that causes, or is likely to cause, environmental harm, unless the person takes all reasonable and practicable measures to minimise that harm". The following roles and responsibilities relates to their obligations under the EP Act.

General Manager

The General Manager (GM) is responsible for the overall management of the project. This includes Environmental, Health and Safety management.

Project Manager

The Project Manager (PM), (Revegetation Contractor) is responsible for all project works and implementation of the work on location. This person reports to the GM.

The PM is also responsible for developing and maintaining a Compliance Register for the project. This includes managing compliance audits (environmental and safety) to ensure compliance.

Project Supervisor/s

The Supervisor is responsible for directing work in the field in compliance with the specifications documented in the specification for the Site Landscape and Revegetation Works. The Project Supervisors have the authority to 'stop the work' if, in their opinion, the work has the potential to harm people or damage the environment. This includes the incorporation of LMRP mitigation measures into work procedures, Job Hazard Analysis and Toolbox Meetings. The supervisor/s report to the PM.

The supervisor/s are also responsible for the implementation, monitoring and reporting in compliance with the LMRP. This includes the continuous improvement of environmental performance of people and equipment. The Project Supervisor is responsible for implementing all deliverables of the weed management plan outlined in the LMRP. This includes identification and control of all weeds species on site with a priority focus on declared weeds species using appropriate control techniques. The site supervisor is also required to prepare regular reports and records of all work activities. This person is responsible to the Project Manager.

Revegetation Contractor - Project Manager Role

- Supply of skilled and qualified Project Overseer to manage the project;
- Provision of providing site assessment of projects being undertaken;
- Overseeing staff/employees conducting labour intensive project and on site supervision/onsite training in general hand tools and small engine equipment;
- Setting daily tasks and meeting goals or work objectives;

- Community liaison;
- On site /council representation;
- Preparing or daily work reports/feedback to project coordinator;
- Project Design, planning and budgeting; and
- Meetings/presentations;
- Recruitment of employees/training;
- Provision of vehicle;
- All work cover/insurance wages and administration costs incurred by Revegetation Contractor; and
- Travelling expenses covered by Revegetation Contractor.

Revegetation Contractor - Project Supervisor Role

- Supply of skilled and qualified site supervisor to oversee project;
- Provision of providing site assessment of projects being undertaken;
- Overseeing staff/contractors intensive labour project;
- On site supervision/onsite training in general hand tools and small engine equipment;
- Setting daily tasks and meeting goals or work objectives;
- Community liaison / on site /council representation;
- Preparing or daily work reports/feedback to project coordinator; and
- Provision of vehicle and all work cover/insurance wages, travelling expenses and administration costs incurred by Rehabilitation contractor.

Weed Contractor

The Weed Contractor is responsible for implementing all deliverables in the weed management plan outlined in the LMRP. This includes identification and control of all weeds species on site with a priority focus on declared weed species using appropriate control techniques. The weed contractor is also required to prepare regular reports and records of all work activities. This person is responsible to the Environmental Site Manager.

Landscape Contractor

The landscape contractor is responsible for the implementation of all deliverables outlined in this LMRP. This includes identification and control of all weeds species on site, with a priority focus on declared weed species, using appropriate control techniques. The landscape contractor is also required to prepare regular reports and records of all work activities. This person is responsible to Environmental Site Manager.

Important: Roles of the weed and landscape contractor need to be determined as there is potential for one or the other to overlap in terms of their roles and responsibilities for project deliverables. For example, the weed contractor can maintain revegetation areas, which would relieve the landscape contractor of their maintenance duties. Preferably an organisation that can achieve and deliver all outcomes can alleviate this issue. Otherwise, clear and concise site specific work plans for the project

will have to be produced for the contractors to delineate work activities.

4. Management of Risks for Flora and Fauna Revegetation Works

The revegetation works will be developed to effectively implement the following:

- Effective management of vegetation within the work area;
- Control and prevent re-establishment of weeds in the proposed restoration, revegetation areas and natural areas of the site;
- Maintain, enhance and promote the rejuvenation of native species on the site and surrounding areas; and
- Establish a monitoring program to effectively manage adverse weed infestation and its impact on the environmental values of the area.

Table 2 below outlines all management requirements for the operational and maintenance phase of the project and the responsibility for managing fauna, flora, monitoring and reporting requirements.

Table 2 Flora and Fauna Management – Operational & Maintenance of Rehabilitation Works

Flora and Fauna Management Operational & Maintenance Phase	
Objective	To minimise known and potential fauna and flora impacts in areas of high environmental sensitivity
Issues and Impacts	Minimisation of tree clearing (weed treatment) particularly in high value riparian habitat areas; Disturbance of ground cover vegetation; Destruction of fauna habitat Rehabilitation.

Control Measures	**Vegetation Treatment** In the event vegetation is required to be cleared a spotter/catcher is to inspect for and appropriately remove any fauna immediately prior to works. A Vegetation Management Indicator Code should be adopted to mark all individual trees on site. This is to be marked on trees (degradable paint or tie) to inform all operators on site the status of the trees. The following codes should be used: ◗ Red tape to indicate removal; ◗ Yellow and black tape to indicate significant tree; and ◗ Blue tape to indicate vegetation to be pruned. The extent or partial vegetation treatment within the site is to be clearly marked in each restoration zone (Monitoring Photographic Data Points are to be pegged and GPS for delineation). Tree protection devices or protection zones are to be used to minimise disturbance to existing vegetation on site that is to remain. These can vary from timber deflection braces attached to trees themselves in confined working spaces to wire strand star picket fences to protection tree root areas or groups of trees. In the event individual trees are to be removed from site they are to have mature seed collected (if in season) for direct seeding of disturbed areas and be mulched on site. Mechanical vegetation (hand) removal methods shall be favored over the use of herbicides where possible.
Control Measures	Where required by the landowner or relevant statutory authority, strips of vegetation or individual trees should remain to allow passage for animals between revegetation planting plots. Dead/injured wildlife during works or found on site shall be reported to the GM. Logs occurring in the proposed revegetation zones should be examined and their importance in terms of habitat value determined and assessed. Where they provide significant habitat values, logs should be left in their place of origin or relocated near or reinstated once weed removal treatment is completed. **Rehabilitation** Avoid the need for revegetation as much as possible by limiting vegetation clearing and/or site disturbance. Revegetation should only be considered where natural regeneration appears to have failed despite a period of suitable weather for colonisation and growth of vegetation. The site will be monitored during the works to ensure that the conservation and aesthetic value of the site are maintained. Areas proposed for rehabilitation will be supplemented with replacement plantings if any losses occur in the first 24-month period.
Monitoring	Maintenance personnel to monitor site during works and monthly through monthly maintenance inspections.

Reporting	Monthly monitoring operational works sheet are to be recorded and submitted to the general manager. Regular random on-site surveillance of tree and vegetation operational works to be conducted and onsite weed management surveillance report to recorded and submitted to site officer. Monthly progress rejuvenation monitoring records to be maintained on file by site officer. Monthly rejuvenation operational works sheet are to be recorded and submitted to site officer. Regular random on site surveillance of rejuvenation operational works to be conducted and onsite surveillance recorded and submitted to site officer. Annual rejuvenation management review including monitoring results of planting plots to be undertaken and submitted in an annual report.
Corrective Action	Areas undergoing rehabilitation shall be maintained as required. If soil erosion is still occurring in rejuvenation areas: ◗ review rejuvenation techniques conducted by project manager; ◗ assess the potential for disturbance to occur; and ◗ implement erosion and sediment control actions. If there is poor re-growth or regeneration of native plants occurring in rejuvenation, conservation and operational works zones: ◗ review rejuvenation and direct seeding management techniques conducted by project manager; ◗ assess the appropriate use and amounts of herbicides are being used in rejuvenation areas; ◗ assess the potential for weeds to occur in rejuvenation areas; and ◗ assess other potential sources or causes of weeds or limited re-growth of native plants to occur .i.e. plant pests and disease monitoring.
Responsibility	Revegetation Contractor

5. Management of Risks for Weed Management

Poor weed control accounts for most tree-planting failures, due to competition for light, moisture and nutrients. Weeds can reduce a planted species' early growth rates by up to 70% compared to weed free sites, and can decrease survival from an expected 90% of trees planted to as little as 10% survival rate. It is therefore vital that weed control is undertaken prior to planting.

The area around the footprint of the stacks and bunds has been diminished in the past due to historic landuses such as farming. Initial site investigations found tree species around the proposed power station site are largely made up of immature trees. The vegetation on site is presently providing habitat to native fauna species. For a list of fauna species recorded on Lot 191 CSH2361, refer to Detailed Ecological Assessment report, Appendix 4 of the original REF, Fauna Species Recorded on Lot 191 CSH2361 dated 21st April by Conics. Weed control activities and revegetation of the site should be staged such that suitable habitat for fauna species is maintained throughout the revegetation process and are afforded a degree of protection for as long as practicable.

Native plant species should be used in all landscaping or revegetation to provide habitat for native fauna.

Weed management requirements for operational works and maintenance for the re-vegetation works has been identified and listed in Table 2 below.

Table 2 Weed Management – Operation and Maintenance Rehabilitation Works

Weed Management and Maintenance	
Objective	To ensure that no existing weeds are spread or introduced during Project and ongoing maintenance.
Issues and Impacts	Ground disturbance, transfer and spreading of weeds.

Operational and Maintenance	
Control Measures	All weed technicians on site must be an accredited AC/DC Licensed operator. A pre-project weed audit and chemical treatment is to be undertaken before commencing works. All declared weeds (P1 -Priority 1 weeds) within the site are to be treated first before (P2 – Priority 2 weeds) before any revegetation works are to commence and are to continue throughout the duration of the 12 months maintenance project. All weed species located on site are to be identified and recorded. When applying weed management methods all due diligence will be used to maintain and preserve surrounding or existing native vegetation or communities. Woody weed species should have there stem cut close to ground level (50 mm) and be sprayed or swabbed with an approved herbicide e.g Roundup bioactive 20 ml/1 litre or concentrate, to prevent regrowth of unwanted weed species. The application of herbicidal dye should be used with the constituent herbicide to monitor the application kill rates of weed species. All broadleaf weeds in open space pasture areas are to be sprayed with Amicide 625 at a rate of 3 litres/400 litres of water. It is intended that any regrowth of weed seeds that may occur on site will be successfully controlled in the proposed maintenance program. Weekly, biweekly and monthly weed management practices will be applied to suppress and prevent re-growth of weeds species in all areas of the work site. Regularly monitoring and declared weed surveillance is to be conducted on a monthly basis of all areas. All weed removal techniques and chemicals used on site will be recorded and filed and made readily available to all relevant government agencies on request. Conduct follow up weed inspection during the growing season one year after hand over and arrange for the chemical eradication of any perceived weed occurrence. This will be outside existing contract conditions and will incur additional fees and services charges if required.
Monitoring	Weeds are to be visually monitored during routine monthly site inspections and maintenance visits. Technicians are to provide reports after maintenance patrols outlining the presence of weed infestations. Daily weed operational works sheet are to be recorded and submitted during operational works to Project Manager daily. Monthly site surveillance and maintenance report is to be submitted to the GM.

Corrective Action	Destroy localised infestations of weeds and conduct follow-up inspection to ensure that weed control has been effective. Train maintenance staff in weed identification and control measures. If weed infestations are still occurring in rejuvenation, conservation and operational works zones: ◗ review weed removal and weed management techniques conducted by technicians; ◗ assess the appropriate use and amounts of herbicides are being used; ◗ assess the potential for weeds to occur; ◗ assess other potential sources or causes of weeds to occur. Weeds to be sprayed by project manager using herbicides (approved low toxicity herbicides). Manual removal must be used adjacent to watercourses. Plant pathogens to be notified to DERM and QPI as appropriate and treated with approved chemicals in consultation with relevant statutory authority.
Reporting	Weeds and other pests shall be included in monthly maintenance reports.

6. Revegetation Techniques

- All species to be sourced from local seed provenance where possible;
- All schedule species to be provided in standard native tube plant sizes;
- All planting stock shall be true to schedule nomenclature, well formed and hardened off to suit their final location, disease free nursery stock. The root system should be firmly established without large roots extruded from the container tube; and
- Tube stock shall not be root bound.

Appropriate species that are to be reinstated in the re-vegetation program are to be species already existing on site. Canopy trees, small trees and shrubs, sedges and rushes should be planted where possible. A list of re-vegetation species to be considered when regenerating disturbed areas is provided in Table 4. All tube stock is to be inspected prior to planting out with any unacceptable or diseased stock is to be returned by the contractor.

6.1 Revegetation Techniques

Depending on site conditions and availability of resources, it is recommended that a combination of revegetation techniques be used to restore functioning vegetation throughout the site.

Plant Propagation

Plant propagation shall be handled by an appropriate wholesale nursery facility with experience in the propagation of native plants from provenance seed. Plants purchased on 'spec' should also be of provenance material only.

Hand Installation

For hand installation the planting hole will be a minimum of 25% larger than the planting container and its edges will be suitably 'roughed' prior to plant installation. The hole shall be excavated using a 'hamilton planter' or petrol auger, if ground conditions allow, or 'potti putki' if planting occurs in rip lines. The planting hole will then be backfilled with soil and firmly tamped down by hand and foot.

Hand Broadcasting / Natural Recruitment

To supplement the establishment of tube stock native trees, shrubs and lower storey species in restoration zones, it is suggested that during on-going maintenance if any existing native species on site is producing seed these adjacent species should be encouraged to self seed into the surrounding area or the seed should be collected and broad casted across the site. This will add further diversity to the site, particularly ground covers.

Direct seeding is a very 'cost effective' method of revegetation for species that are suitable for this kind of application. This includes local provenance seed such as wattles collected prior to construction. Wattles and other legumes fix nitrogen in the soil while growing and can therefore greatly improve soil condition. Many of these plants also flower heavily and are therefore very attractive to birds and insects. The addition of these pollinators into the revegetation work adds diversity and brings opportunities for natural regeneration.

6.2 Timing of Revegetation

In general, autumn and early winter are the best seasons for planting as summer temperatures can be too high for young plants to establish and impede survival rates. Planting in all seasons can be effective as long as a suitable watering regime is implemented.

6.3 Topsoil/ Mulching requirements

Imported top soil in accordance with AS4419 is recommended for the site as per landscape drawing package 41-22282-L001- RA, ; 41-22282-L002- RA, 41-22282-L003- RA, 41-22282-L004- RA, 41-22282-L005- RA, and Soft Landscape Specification reference 400159, mulched material should be applied particularly to degraded open areas to aid in soil stabilising, weed control, moisture retention and nutrient sources. Mulch depth is to be inspected prior to planting out can commence and should be consistently 100 mm across the site.

6.4 Fertiliser Requirements

Planting areas should be fertilised with Terracottem with approximately 5-10 grams per native tube stock. Terracottem should be placed directly in the hole as composition allows for minerals to transverse downward to the bottom of the hole to encourage root growth away from the planting hole. All sections should be mulched. Fertilser is to be inspected during application and rates monitored.

6.5 Tree Guards

All plants installed manually will be suitably guarded with a protective sleeve 750 mm high with bamboo stakes.

6.6 Watering Requirements

To assist in the establishment of the rehabilitated areas, tube stock should receive a minimum of 5 litres of water per tree 3 times per week for 2 weeks during the initial planting period. Watering should occur once a week for the 12 week maintenance period. Ongoing watering should occur once a month at the same individual tree rate thereafter. Any tube stock replaced should be continually watered until it is established.

6.7 On-going Weed Management

An active weed control program should be maintained throughout all of the rehabilitated sections. The definition of a “weed” for the purposes of management is based on that of ‘environmental weed,’ namely a species that by virtue of fecundity and growth habit has the potential to establish large infestations without disturbances that dominate and eventually exclude the native vegetation.

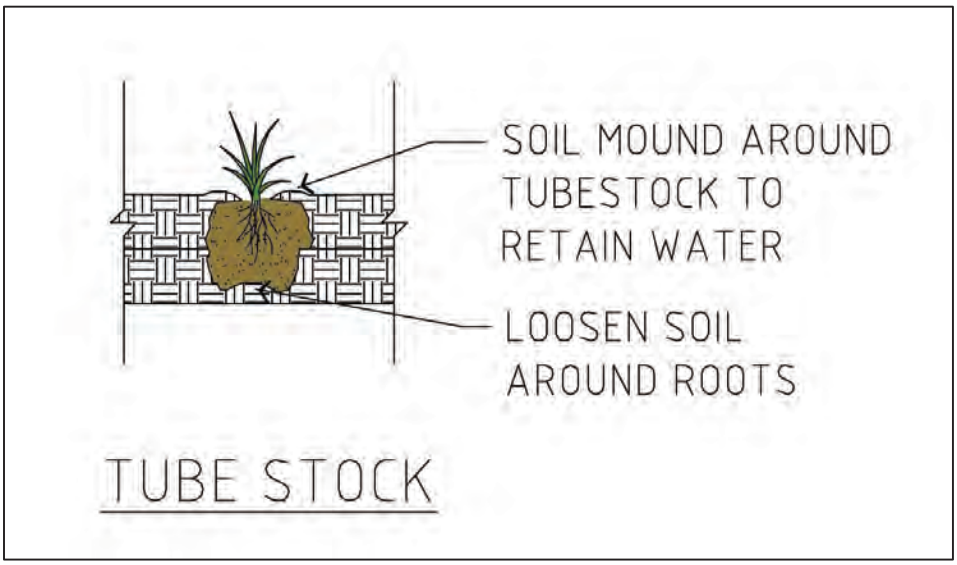
- Control programs to be carried out by personnel qualified in the recognition of target weeds and potential weed species; and
- Where possible maintain weed control within one metre of each plant to reduce competition to new revegetation for approximately 24 months.

7. Planting Techniques

The following techniques should be employed for revegetation of the site:

- Figure 1 and Figure 2 illustrate the recommended planting out techniques of nursery tube stock and mature plants that should be utilised.
- Where possible planting of tube stock should commence immediately after weed management activities, preferably the two activities should be concurrent within a management section.
- Plants should be obtained from local nurseries that specialise in endemic or provincial species.
- If plants are not available seed can be collected from appropriate species of trees, shrubs and groundcover from local provenances such as other reaches of the site. These can then be established as tube stock for planting.
- Drainage lines that follow the natural contours of the site should be included within the rehabilitation works.

Figure 1 Planting diagram for tube stock



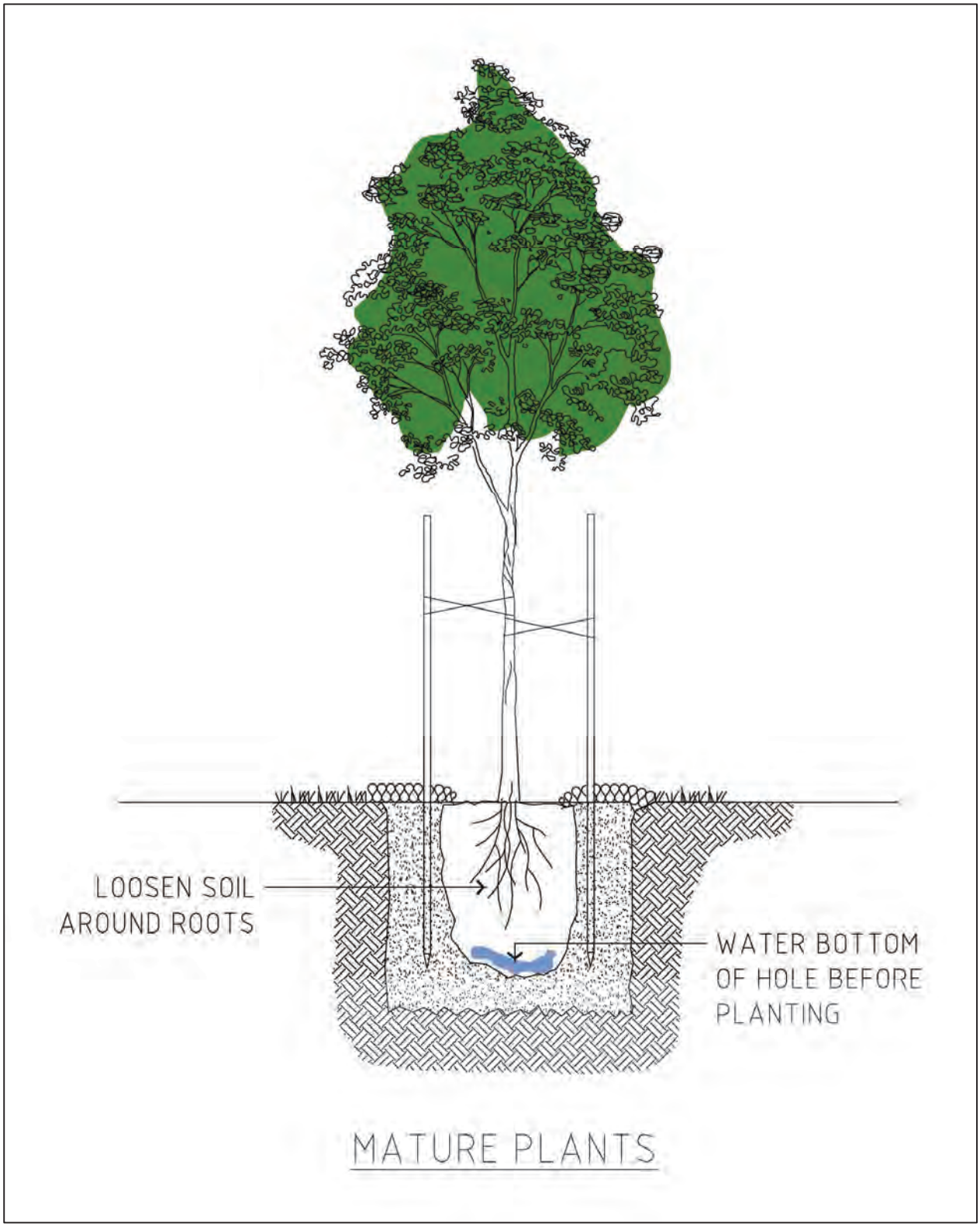


Figure 2 Planting diagrams for trees

7.1 Revegetation Areas

A cross-sectional view of a typical screen/buffer mound where the groups of trees are to be positioned within the site is provided in Figure 3. The planting structure includes a canopy layer; the local native species selected are estimated to reach a height of 25-30 m at maturity. The mid-story and understorey will assist in screening the power station from various viewpoints. Plant species used in the revegetation areas will provide habitats for local fauna and avifauna species.

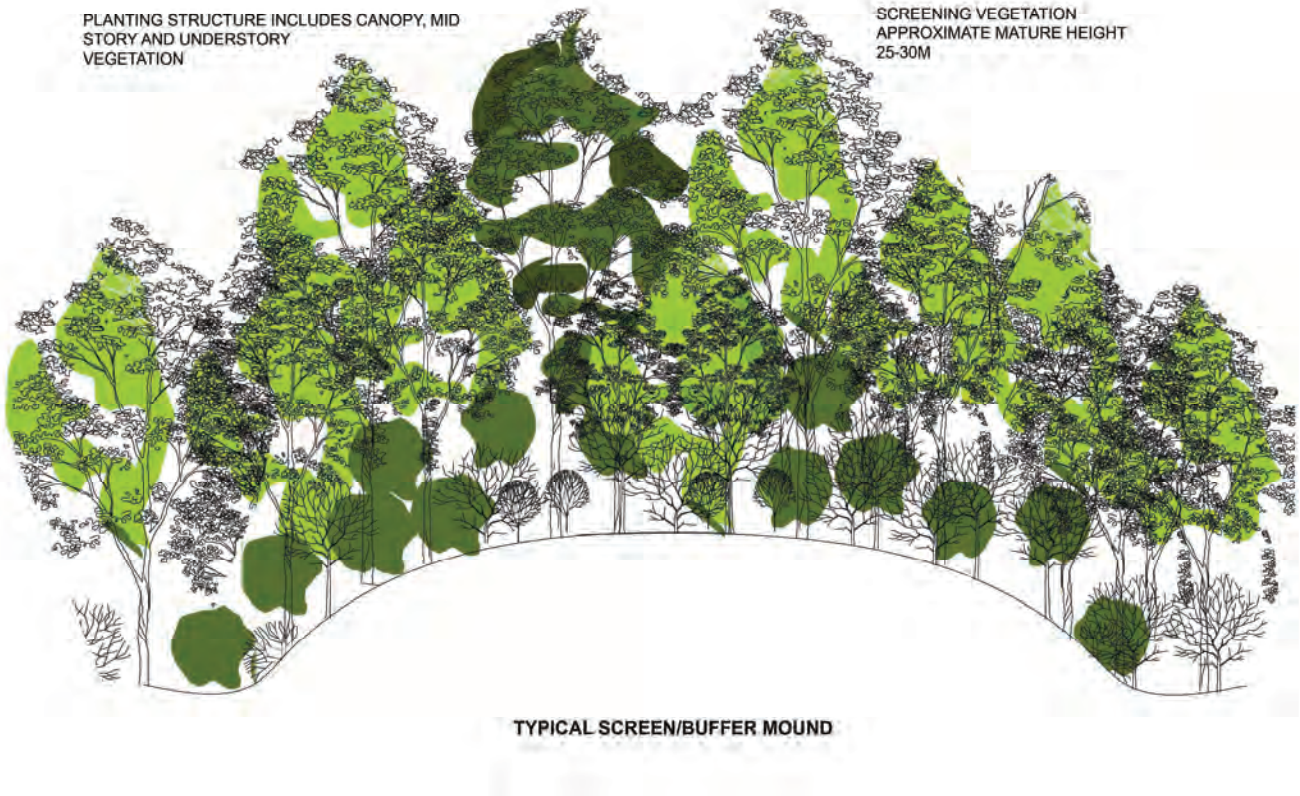


Figure 3 Cross sectional view of Typical Screen/Buffer Mound

7.2 Planting Densities

Planting densities for each tree size is provided in Table 3. A diversity of species in each habitat category should be planted out in accordance with the densities below.

Table 3 Planting Densities

Tree Form	Density
Large tree	1 tree every 10 m
Medium tree	1 tree every 7-8 m
Small tree	1 tree every 3-5m
Shrub	1 shrub every 2-3 m
Ground cover	Clumps every 1-2 m

7.3 Species list for rehabilitation

A list of species is to be used during the rehabilitation are those plants identified from onsite investigations of natural vegetation. Refer to 41-22282-L001 to L004 Landscape Planting Layout for placement of selected species.

Table 4 Species list for Revegetation Areas

Species	Type	Areas
ALLOCASUARINA inophloia	Tree	In both dam locations
CORYMBIA maculata	Tree	In both dam locations
CORYMBIA tessellaris	Tree	In both dam locations
EUCALYPTUS tereticornis	Tree	In both dam locations
LOPHOSTEMON suaveolens	Tree	In both dam locations
ACACIA juncifolia	Shrub	In both dam locations
DODONAEA viscosa	Shrub	In both dam locations
HOVEA acutifolia	Shrub	In both dam locations
JACKSONIA scoparia	Shrub	In both dam locations

PULTENAEA villosa	Shrub	In both dam locations
CYMBOPOGON refractus	Grass/Groundcover/ Native Grass Mix 1	In both dam locations
DIANELLA revoluta	Grass/Groundcover/ Native Grass Mix 1	In both dam locations
HARDENBERGIA violacea	Grass/Groundcover/ Native Grass Mix 1	In both dam locations

Species	**Type**	**Areas**
LOMANDRA longifolia	Grass/Groundcover/ Native Grass Mix 1	In both dam locations
THEMEDA australis	Grass/Groundcover/ Native Grass Mix 1	In both dam locations
DIANELLA caerulea	Grass/Groundcover/ Native Grass Mix 2	In both dam locations
ISOLEPIS nodosa	Grass/Groundcover/ Native Grass Mix 2	In both dam locations
LOMANDRA longifolia	Grass/Groundcover/ Native Grass Mix 2	In both dam locations
THEMEDA australis	Grass/Groundcover/ Native Grass Mix 2	In both dam locations
HARDENBERGIA violacea	Hydromulch Mix with Macmat Jute Matting	In both dam locations
LOMANDRA longifolia	Hydromulch Mix with Macmat Jute Matting	In both dam locations
MYOPORUM ellipticum	Hydromulch Mix with Macmat Jute Matting	In both dam locations
CYNODON dactylon	Hydromulch Grass Mix	In both dam locations

8. Maintenance Program for Revegetation Works

8.1 Revegetation Maintenance Actions

Table 5 Revegetation Maintenance Actions

	Time	Maintenance Action
Presence of Weeds	Fortnightly (12 weeks) Monthly (12 weeks) Quarterly (18 months)	Remove weed regrowth to ensure dominance of regenerating native plants. A weed exclusion zone of at least 2 m should be maintained around each revegetated area. Replenish mulch / weed matting where necessary. Problematic weeds listed in table 10 will be a specific focus for ongoing management.
Health of Plants	Fortnightly (12 weeks) Monthly (12 weeks) Quarterly (18 months)	Replace dead or dying plants. Sick plants may be an indication of stress or poor soil conditions. This may be a result of low nutrient levels or lack of water, it is imperative that a stringent watering regime is maintained.
Signs of Regeneration	Fortnightly (12 weeks) Monthly (12 weeks) Biennially (24 months)	Natural regeneration and new growth in previously weed infested areas is a good sign of recovery and indicates a healthy ecosystem.
Signs of Disturbance	Fortnightly (12 weeks) Monthly (12 weeks) Biennially (24 months)	If a disturbance (e.g. foraging by wildlife or insects, erosion, nutrient influx etc) is affecting >10% of a revegetation area it is considered a major threat and should be mitigated.
Habitat Values	12 months (annually for 2 years)	The site should be developing food sources, (e.g. nectar and seed) and habitat (e.g. leaf litter, nesting sites) for native fauna. Logs, rocks and nest boxes can be utilised to enhance fauna habitat.
Diversity & Structures	12 months (annually for 2 years)	The site should begin to represent a natural system. It should display a diversity of native species and a natural structure incorporating canopy, mid-layer and groundcover.

Density	24 months	A stem density of no greater than one (1) m centre between any two (2) plants to be achieved by end of maintenance period.

8.2 Proposed Maintenance Schedule

Table 6 Proposed Maintenance Schedule

MAINTENANCE SCHEDULE	
Responsibility	PM (Rehabilitation Contractor)
Maintenance Actions and Methodologies	**Initial Establishment** Initial 12-week establishment period applies to all vegetation works. During this period weekly maintenance is to occur that involves the following: ◗ watering; ◗ ongoing weeding; ◗ fertilising; and ◗ replacement of dead or damaged stock. **Ongoing Maintenance** After this period, it is recommended that the site be maintained on a monthly basis over a 24 month period to ensure that the revegetation has been successful. The following is to occur: ◗ Conduct weed spraying, tree watering, tree replacement of losses as necessary to maintain >90% survival rate. ◗ All proposed natural/conservation or landscape areas that are disturbed, will be revegetated at module planting rates. ◗ All revegetation species will be disease free and supplied from an accredited nursery supplier. **Long-term Maintenance** Annual report is required to determine the success of rehabilitation against the floristic and structural criteria provided above and contain recommendations by the PM to the GM in regard to issues affecting the ongoing success of the restoration works, and the possible need for additional activities that may be required outside the normal maintenance program.
Management Intervals	Weekly for first 12 weeks; Monthly for after 24 months; and Review with Biannual report.

Monitoring Program	The monitoring should address the following issues: ◗ Plant growth, percentage cover and survival rates; ◗ Plant losses through herbivores, disease, vandalism, storm damage or other factors; ◗ Weed re-growth and control measures; ◗ Plant replacement; ◗ Guard repair and weeding inside guards; and ◗ Maintenance watering regime. It is also essential to keep an accurate photo-record of the progress of the restoration works by setting up an appropriate number of representative fixed photo-points across the site. Photos should be taken by digital camera and recorded in the project file by date and discrete photo-point number. Photo-point locations should be clearly marked on site and mapped by a surveyor or by GPS. The site should be monitored on a monthly basis over 24 months

Corrective Actions	If soil erosion is still occurring in planting zones the following is to occur: ◗ review rehabilitation techniques conducted by project manager; ◗ review erosion and sediment control; ◗ assess the potential for disturbance to occur; ◗ assess other potential sources or causes of disturbance to occur; and ◗ maintain planting regimes to a minimum of >90% survival rate. If weed infestations are still occurring in planting zones the following is to occur: ◗ review weed removal and weed management techniques conducted by project manager; ◗ assess the appropriate use and amounts of herbicides are being used; ◗ assess the potential for weeds to occur; and ◗ assess other potential sources or causes of weeds to occur. If there is poor re-growth or regeneration of native plants occurring in rejuvenation areas zones, the following is to occur: ◗ review re-vegetation and direct seeding management techniques conducted by project manager; ◗ assess the appropriate use and amounts of herbicides are being used in rejuvenation areas; ◗ assess the potential for weeds to occur in rehabilitated areas; and ◗ assess other potential sources or causes of weeds or limited re-growth of native plants to occur.i.e. plant pests and disease monitoring.

Reporting	Report prepared after each maintenance and monitoring visit documenting the following: ◗ plant growth rate; ◗ plant survival rate in each monitoring zone; ◗ photos from monitoring zones; ◗ areas of weed establishment including species; and ◗ weed spraying, tree watering or tree replacement of losses completed. Annual report is required to determine success of rehabilitation against the floristic and structural criteria provided above and is to outline recommendations by the PM to the GM in regard to issues affecting the ongoing success of the restoration works, and the possible need for additional activities that may be required outside the normal maintenance program.

8.3 Photographic Monitoring Data Points

To aid in evaluating the success of the weed management and rehabilitation a number of photo points will be established along the restoration management area. Posts (timber) will be used to delineate the extent of the planting plot and each post will have a GPS coordinated for each post. Photographs will be taken at a post indicating a southern and northern aspect view of each planting plots. On a monthly basis, the same GPS posts will be used as a reference point to take photographs of the revegetation plots to monitor site establishment, tree growth and weed suppression. Periodic inspections are to be conducted every month for 24 months. Photographs are to be taken and included in the annual report to provide an indication of the survival and growth of vegetation and establishment of weeds over the maintenance period.

8.4 Preparation and submission follow up Monitoring Report

The objectives of the follow up report will be through site analysis and correlation of preliminary work activity reports will be to provide a maintenance report outlining:

- a comprehensive description of the existing environment after restoration works and mapping;
- establish plant identification of species located on site and a vegetation management plan;
- photographic record of site before and after of designated areas for revegetation/planting techniques to be applied;
- assessment of the potential impacts of weeds within the site and appropriate weed management practices to be implemented;
- review of vegetation management plan monitoring and maintenance program;
- review of description of project deliverables to meet guidelines;
- review of preparation of project schedule;
- description of safety measures used;

- review of methodologies; and
- conclusion and recommendation on long term maintenance of the revegetation works.

The Landscape Management and Revegetation Plan produced should establish a maintenance benchmark for the site. The revegetation areas would be required to be watered and weed free to maintain a planting threshold of 90% over a 24-month period. Any plant losses over this period of time should be replaced to maintain required planting regimes and to meet the 24-month maintenance conditions criteria outlined in Table 7 below.

Table 7 Site specific floristic and structural criteria – 24 month maintenance period

Criterion	24 Months	Comments
Plant survival (%)	90%	Provided follow-up maintenance is provided (i.e. watering, weeding and replacement planting). If maintenance is not provided then survival rate will be lower which is not acceptable. Failures must be replaced during maintenance and prior to handover. Failed hydro seeding areas are to be reapplied.
Diversity of species (% original planting ratio)	80%	A diversity of native species for each plant type (edge, pioneer, shrub, tree) should be present and one or two species should not dominate (i.e. wattle species). 80% must be achieved in the first 12 months.
Plant growth (cm)	> 1.00m growth	Average Height of tree to be >1 m.
Mean cover (%) excluding weeds	80%	Include trees, shrubs and ground covers must achieve 80% Hydro seeded areas must achieve 90%
Mean weed foliage cover (%)	<5%	Must be no greater than 5% in the first 12 months.
Presence of invading environmental weeds (%)	5%	In first 12 months 5% with evidence of dieback/ poisoning.
Evidence of self-generating	Evident	
Fauna habitat developing	Evident	

8.5 Mulching & Erosion Matting

All exposed soil surfaces are to be blanket mulched to a minimum depth of 100 mm mulched with a natural mix blend of organic matter (forest mulch) to aid in the retention of moisture and the reduction of weeds for the initial planting. In the event that mulch quantities are insufficient on site, mulch maybe

required to be imported to site. All organic products delivered to site are required to be supplied by a quality supplier and be QPI certified red imported fire ant free.

In areas where embankment gradients are steep or the area shows signs of potential erosion, control devices such as coil logs or a bio degradable matting (Jute Matting Grade 3) should be used to line exposed areas batters/slopes.

Native seed can be hand sown under the matting if available or it can be planted into with tube stock. The matting should be positioned parallel to the embankment gradient and be partially submerged into the soil at its highest and lowest point (both ends) and pinned at 1.5 m spacing over the matting coverage. Where matting is required to join another piece the matting should be slightly rolled so the joining mats are overlaid and then pinned through the centre at 1 m spacings. This will prevent slippage from water runoff and mats being dislodged from strong winds.

Once matting is in place, planting into the Jute mating is to be at 1 plant per 1 m^2, the matting is to cut using Jute matting scissors. The cut is to be made as an upside v pattern with the cut portion turned into and under the mat. This allows access to plant into the soil and acts as a device to catch and hold water to the new plant.

Re-vegetated areas are to be designated as lawn free maintenance zones. The combination of natural re-growth and leaf litter from plants will eventually allow the natural vegetation to maintain itself.

8.5.1 Stockpiling Areas for Mulch

It is recommended to establish any mulch stock piles at a distance of 40 m from a major watercourse and preferably on flat land. The stock pile is to have a sediment fence installed around its entire perimeter. It is best practice to ensure that any exposed surfaces should be covered within a 48 hour period after being cleared. Where blanket mulch meets embankments with steep slopes. Sediment fencing should be installed along the top of the embankment at 1.5 m from the edge of the slope to prevent mulch being potentially washed down embankments during heavy rainfall periods.

If embankments are mulched, sediment fences should be installed to run parallel along the embankment slope at top and toe of batter to prevent mulch slipping in heavy rainfall periods until plantings have stablised the slope.

9. Erosion and Sediment Control

Erosion and sediment requirements have been identified and listed in Table 8 below:

Table 8 Erosion and Sediment Control Plan

Erosion and Sediment Control	
Objective	To rehabilitate the site using all reasonable and practicable measures to minimise erosion and sedimentation.
Issues and Impacts	Locating structures, existing erosion problems, extensions/upgrade of access tracks Traffic movement on access tracks, vegetation clearing
Planning and design	
Control Measures	Locate structures in areas of low erosion potential, where possible. Where any widening of existing tracks or structures are to be located in areas of high erosion risk, design erosion control measures in accordance with Institute of *Engineers Australia Queensland Division (1996) Soil Erosion and Sediment Control – Guidelines for Queensland Construction Sites*. Utilise existing access tracks where possible. Design/schedule ameliorative measures for existing erosion areas including: ◗ Installation of whoa boys on access tracks if required; ◗ Backfill, resurface and install contour banks for existing rill and gully erosion, to provide erosion resistance and reduce overland flow velocity. ◗ Planning and design are to consider erosion and sediment control impacts and include into budgets
Monitoring	Not applicable to this stage of project
Reporting	Not applicable to this stage of project
Corrective Action	Review design of erosion and sediment control measures
Responsibility	Westlink

Construction	
Control Measures	***Access Tracks*** Limit construction of new access tracks by utilising existing tracks where possible. Limit construction of new access tracks where existing surface remains suitable for construction traffic and longer term 4WD maintenance vehicles. All access tracks to be located by GPS and shown on site route plans to avoid misunderstandings prior to detailed construction commencing.
Control Measures	No clearing of riparian vegetation or in any areas vulnerable to erosion unless at structure sites. Access tracks through easily erodable ground shall have endemic grass (or with a mixture of sterile annuals) seeds hand spread across the majority of the track on a regular basis to facilitate native grass germination and soil retention, even though the track may remain under irregular traffic use. Where access tracks become heavily disturbed, restrict movement by cordoning off with survey tape. Install additional drainage control measures (such as table drains, rock check dams and whoa boys) if required. Access tracks not required: to be cordoned off, re-profiled and rehabilitated, as such areas become available. Erosion controls shall remain in place and maintained until such time as a stable landform (>70% groundcover) has been achieved.

Control Measures	Any new access tracks or extensions to existing access tracks shall be constructed to control drainage and minimise erosion. Erosion and sediment control shall be undertaken in accordance with *Institute of Engineers Australia Queensland Division (1996) Soil Erosion and Sediment Control – Guidelines for Queensland Construction Sites*, a copy of which is with each Construction Manager and Project Environmental Officer. Where new or extended access tracks are required across creeks and gullies, earthworks should be minimised as far as practicable to minimise soil disturbance. Crossings should be constructed at right angles to the stream flow, if possible. Approaches to creeks may need stone lining to provide stable access and access clearings should be minimised to retain riparian vegetation. Whoa-boys should be constructed immediately upslope to prevent up-gradient runoff from causing rill erosion. The surface of the crossing should be finished at the original creek bed level. Streambeds may require stone lining for protection. New or extended access tracks shall be constructed at grades of less than 20%, as far as possible. Where previously constructed tracks traverse directly up steep ridge lines that are causing significant erosion, alternative flatter alignments should be investigated and the existing track rehabilitated. Erosion protection of access track lead off drains from whoa boys, dams or other drains shall be extended until a non-scourable 2% grade or less is achieved. Rehabilitate temporary access roads by deep ripping, replacing displaced topsoil and revegetating with endemic vegetation. ***Traffic Movement*** In the event of saturated soil conditions, works may be postponed until further notice to prevent disturbance and damage to access roads.

Control Measures	Structure footings and infrastructure within site. Disturbances associated with constructing structure footings require strategies to minimise the release of sediment to waters. These strategies shall include but not be limited to the construction of diversion banks/drains, where necessary, along the elevated perimeter of the works to prevent uncontaminated stormwater from contacting areas of disturbance and installation of temporary sediment fences below areas of earthworks. Erosion and sediment control measures at disturbed areas and on the approach corridors shall be implemented as per (Institute of Engineers Australia Queensland Division (1996) Soil Erosion and Sediment Control – Guidelines for Queensland Construction Sites).
Control Measures	Cleared vegetation should be windrowed on the low side of the clearing. Broad-scale clearing shall be undertaken with blades at least 100mm above ground level to minimise topsoil disturbance, unless earthworks are required. Deep rip and revegetate disturbed areas once construction has been completed and lay down areas or access tracks no longer required.
Monitoring	Regular inspections of all stormwater drains and erosion control measures for discharges of suspended solids to waters daily in response to significant rainfall events (>50 mm in 24 hours). The Contractors Site Foreperson or delegate shall immediately undertake any necessary maintenance works to prevent or minimise the release of contaminated runoff to any waterways. Such actions are to be audited by the Project Environmental Officer for compliance.
Reporting	Erosion and sediment control shall be included in monthly reports prepared by the Project Environmental Officer. The reports are to recommend appropriate controls to minimise erosion on site.

Corrective Action	The Construction Manager and the Project Environmental Officer are to be notified in the event of non-compliance. Corrective actions in the event of non-compliance include inspection of maintenance and erosion control measures and identification of sediment control deficiencies. Sediment fences and additional whoa boys (or rock check dams on drainage lines) may be installed to prevent transport of sediment to any waterway. Undertake revegetation works in areas of likely erosion. Some tracks may have to be temporarily closed to repair erosion damage and to prevent further sediment transport off site.
Responsibility	Construction Manager and Project Environmental Officer
Operation and Maintenance	
Control Measures	Access roads and structure sites will be regularly monitored (minimum annually) for evidence of erosion and sedimentation of gullies and creeks. Grading of tracks should be limited to those sections where erosion damage has occurred. Where ground cover exists and no erosion is occurring, access should be maintained by slashing with grading limited to clean-up of drainage control structures to allow dry weather 4WD vehicle drive access. The success of rehabilitation should determine the need for additional erosion control works.
Monitoring	Regular monitoring for erosion along the corridor during routine inspections.
Reporting	Corridor Maintenance to include erosion in reporting requirements.
Corrective Action	Where erosion has occurred, stabilise the area and implement appropriate controls (drainage, bunds, sediment devices etc) to prevent erosion from occurring again.
Responsibility	Environmental Officer and Maintenance Contractor

10. Weed Control and Management

Identification of Weeds on Site

During the field visit to the area proposed for the power station and buffer mound, one declared weed, listed under the *Land Protection (Pest and Stock Route Management) Act 2002* (LPA), was identified.

This was:

- *Optunia stricta* (prickly pear) – Class 2 Declared Plant.

For general site information on declared weeds, refer to section 3.4.1 of the Detailed Ecological Assessment, Lot 191 CHS2361, Ford's Road, Gatton, dated 21st April 2009 prepared by Conics.

Environmental Weeds

Table 10 contains species that are considered environmental weeds in South East Queensland. These species were identified during the site visit on 14/12/09 and located in the southeast corner of the site, in open grassland areas.

Table 9

Species Name	Common Name
Cirsium vulgare	spear thistle
Gomphocarpus physocarpus	Balloon cotton bush

Environmental weeds identified generally on the site by ecologist are listed in Table 10. Refer to section 3.4.1 Environmental Weeds of the Detailed Ecological Assessment, Lot 191 CHS2361, Ford's Road, Gatton, dated 21st April 2009 prepared by Conics.

Table 10

Species Name	Common Name
Paspalum dilatatum	paspalumgrass
Plantago lanceolata	lamb's tongue
Conyza bonariensis	flaxleaf fleabane
Melinis repens	red natal grass
Gomphrena celosioides	gomphrena weed
Bidens pilosa	cobbler's pegs
Lantana montevidensis	creeping lantana (Class 3 weed)
Verbena bonariensis	purple topped verbana

10.1 Control Methods and Species List

Weed Removal Methods

The following methods are the most common and user-friendly methods of applying appropriate weed management techniques to contain weeds on the property. The following types of weed management techniques are recommended to eradicate different types of weed species, and promote the regeneration of native species in the area.

Although weeds will be removed via machinery as part of the engineering works for the construction of the access track, certain responsibilities in maintaining this zone are required. Weeds reproduce in great numbers by effective methods of vegetative propagation or by setting great numbers of seeds. Seeds and other propagules are spread around by localised environmental elements and machinery. Most soils contain large numbers of dormant weed seeds that readily germinate when exposed to light and moisture. Bare and disturbed soil will be readily colonised by weeds and regular maintenance will be required.

The following methods are to be applied in managing weeds on site:

- direct contact spray; and
- cut stump method.

Direct Contact Spray

This method involves direct spraying of herbicide to the leaf surface of classified weed species. This method is particularly user friendly and time efficient if it is implemented on targeting weed species, which are of a herbaceous/succulent or young nature. The plant usually dies on site and will not require removal using this method. This will minimise the impact on the environment.

This method is excellent for targeting more invasive low growth species such as grasses and herbaceous weeds species, which may occur. Invasive weeds of this kind have a short rapid growth cycle producing regular flowers and seeds, and short reproduction cycles.

Timely direct spraying of these weeds can effectively minimise the reoccurrence of these weeds, disturbing the lifecycle by preventing the plant from producing seed.

Cut stump method

The cut stump method is applied to semi-hardwood species. This involves mechanically cutting the plants stem and then directly applying the herbicide to the cut stem. It recommended that a dye be added to the herbicide to assist in the application as a visual aid to monitor the use and success of the herbicide. For optimum results herbicide should be applied to the stem immediately to prevent plant cells from sealing and preventing herbicide from entering the plant. Mechanical treatment of woody weeds, such as lantana by reducing plant to 50 mm above ground is the most appropriate method. The cut stump method involves applying undiluted Glyphosate directly to the cut stem.

Type of herbicide

When applying weed control methods near waterways that require the use of chemical herbicides it is a

requirement to use herbicide of a low residual composition. This will minimise the build up of herbicide levels in the surface soil and ecosystem. Roundup biactive is the preferred use herbicide as it has a low residual nature and is also effective in the control of weed species. The type of herbicide is preferred when in close proximity of waterways. Coloured dye should be added to chemical control of weeds to provide visual identification of herbicide application and the monitoring of success rates. In areas of intense weed infestation, particularly near creeks), removal of vegetation encourages erosion and further opportunistic weed species. Revegetation of these areas is a priority.

Timing

The weed management techniques are to be applied in the early morning and/or late afternoon. If the herbicide is mixed with water and used in the direct contract spray, the herbicide may evaporate before it is absorbed into the plant tissue. It is a legal requirement that any department or contractor must be an approved licensed herbicide operator (AC/DC Applicators License) when using herbicide on state, commercial or public lands. It is a requirement to record and file a materials/herbicide spray checklist nominating Time/Date/weather conditions/ litres used (application rates) on every application and be made available to any government official if requested. Chemical control of weeds should have a minimum of 4 – 24 hrs of non-contact exposure to heavy rain.

All exposed soil surfaces are to be rehabilitated within 24 hrs of construction or landscaping completion and where necessary have temporary or permanent sediment control devices in place prior or during construction phase

Declared Plant Surveillance

When monitoring declared weeds it is a requirement to undertake monthly and annual site surveillance inspections to monitor weed and re-vegetation areas. This allows consultation between landowners and council to maintain awareness and education in relation to weed management on the site for the potential re-growth and occurrence of new invasive weeds. This surveillance is required to be undertaken by a suitably qualified person. Under the *Queensland Land Protection (Pest and Stock Route Management) Act 2002*, it is a required that the property owner, manage any declared plants on the property.

Table 11 Guide for weed species list and recommended control methods

Species Name	Common Name	Form	Control methods
Lantana camara Class 3	Lantana	Shrub	Refer to P1 General Control Methods
Opuntia stricta Class 2 Declared Pest P1	Prickly Pear	Cactus	Refer to P1 General Control Methods 1

Lantana montevidensis Class 3 Declared Pest P1	Creeping Lantana	Shrub	Refer to P1 General Control Methods
Bidens pilosa P2	Cobbler's Pegs	Annual Herb	P2 Control Method
Melinis repens P2	Red Natal Grass	Perennial grass	P1 Control Method 1
Verbena bonariensis	Purpletop	Perennial herb	P2 Control Method

11. Potential Impacts and Mitigation Measures for Revegetation Works

To ensure the most appropriate measures are implemented to mitigate potential negative impacts from the infestation by pest plants, the management of native vegetation and the stabilisation of a riparian zone, prior to, during construction and throughout the maintenance period of the project needs to be implemented. Site-specific mitigation measures have been developed and are to be applied on site as additional requirements to the standard guidelines of the LMRP.

Potential impacts from the proposed rehabilitation works on the surrounding vegetation communities include but not limited to the following:

- Vegetation loss and habitat fragmentation
- Gully erosion and sediment run-off; and
- Weed invasion.

These impacts are discussed in more detail below.

11.1 Vegetation loss and habitat fragmentation Mitigation Measures

- Vegetation to be retained is to clearly visible by barricade fencing or clearly marked or flagged;
- All appropriate permits and approvals to be gained;
- Prior to clearing vegetation or weeds on site, clearing zones need to be identified to all operational and construction personnel;
- Temporary fencing incorporating safety measures and sediment control devices should be installed to delineate limit of clearing permitted under the development application;
- Utilise existing tracks, disturbed areas and cleared lands for access only;
- Rehabilitate cleared area with appropriate local native species;
- Retain habitat features such as large fallen logs for reinstatement following construction and during rehabilitation;
- Vegetation required to be cleared should be mulched on site. The mulch should be used to assist in stabilising soil batters/disturbed areas or stockpiled to reinstate future proposed re vegetation areas after completion of works;
- Vegetation removed on embankments should be cut no less than 50 mm above ground level to maintain soil/riparian surface stability where possible. This will assist to maintain and improve the potential regeneration of the site from re-growth when construction is completed;
- Logs occurring in the proposed rehabilitation area should be examined and their importance in terms of habitat value determined and assessed. Where they provide significant habitat values, logs should be left in their place of origin or relocated near or reinstated once works are completed.
- A list of species is to be used during the revegetation are those plants identified from on site investigations of natural vegetation Table 4. Species have been grouped into the different categories

based location of planting.

- Planting densities for each tree size is provided (refer to Table 3). A diversity of species in each habitat category should be planted out in accordance with the densities in Table 3. Re-vegetation is required to mitigate against potential adverse impacts on vegetated and or exposed lands of the operation works.

Gully Erosion and Sediment Run-off

The embankments also show evidence of spoil and landfill waste used to stablise the embankments. Further clearing and disturbance to the soil structure and vegetation cover through this area would increase any erosion already present on the gully slopes through exposed soil surfaces, increased water run-off and disturbance to the banks.

Mitigation Measures

- Site is to be assessed prior to works to determine locations of stockpiles, diversion banks and requirements for other sediment retention devices. Appropriate devices to be installed to prevent turbid water from leaving site and entering surrounding surface waters. Water should be ponded until sediment has settled or water has receded.
- Sediment Control Devices to be used:
  - coil logs on formed swales, dry creek beds and slopes;
  - sediment fencing on boundaries and open surface run off areas;
  - silt curtains in water bodies; and
  - jute matting (grade 3) on all exposed slopes/batters greater than 1: 2.
- Revegetation should occur as by applying a direct seed mix of native ground covers, sedges and grasses or tubestock species to achieve a ground cover density of 1 plant 1 m ration. Utilise existing tracks, disturbed and cleared areas for pipeline easement;
- Install sediment fencing to protect surrounding creek lines, gullies and reduce run-off;
- Backfilling and rehabilitation of the alignment within 24 - 48 hrs is to occur immediately after pipe-laying is complete;
- Exposed soil surfaces are to be jute matted (grade 3) on slopes/batters and rehabilitated at 1 native plant per m^2 or direct seeded under matting or exposed surfaces at 7 kg per hectare; and;
- By reducing the need to clear vegetation, it will reduce the area required to regenerate.

11.2 Weed Invasion and Edge Effect

Increased disturbance within the site in time would allow weed species to penetrate further into this area if not managed accordingly. In time this may affect the integrity, biodiversity and habitat value of the native vegetation. Also, weeds may not provide good protection against erosion. Often the removal of one weed species allows another weed species type to takeover. The following mitigation measures are suggested.

Mitigation Measures

In addition to implementing the rehabilitation and revegetation in accordance with the overall VMRP the

following site-specific requirements are to be implemented:

- All weeds throughout the site are to be sprayed and managed a minimum 1-month prior to any clearing or earthworks can commence;
- Direct contact spraying and cut stump method are the preferred weed control methods to be used throughout the proposed rehabilitation site;
- Herbaceous weeds are to be direct contact sprayed and woody weeds are to be cut 50 mm above to ground level and have stumps sprayed or swabbed with an approved herbicid - e.g. Roundup Biactive 20 ml/1 litre with wetting agent, to prevent re-growth of unwanted weed species. The application of an herbicidal application dye should be used and applied with the constituent herbicide to monitor the application kill rates of weed species.
- Clean equipment prior to exiting and arriving on site. A leaf blower is sufficient to prevent the introduction of new weeds on site.
- Roundup bioactive is the preferred herbicide (applied with dye to monitor application) to be used on site;
- Landscape/weed contractor is to be a licensed and accredited commercial operator with approval from QPI;
- Initial 12-week establishment period applies to all vegetation works. During this period weekly weed maintenance is to occur that involves ongoing weeding and spot spraying; and
- Regular monthly ongoing maintenance of the rehabilitation works is to occur for a period of 24 months for weed suppression and re-vegetation areas.

12. Conclusions

As a result of the proposed landscape management and revegetation works the following has been determined:

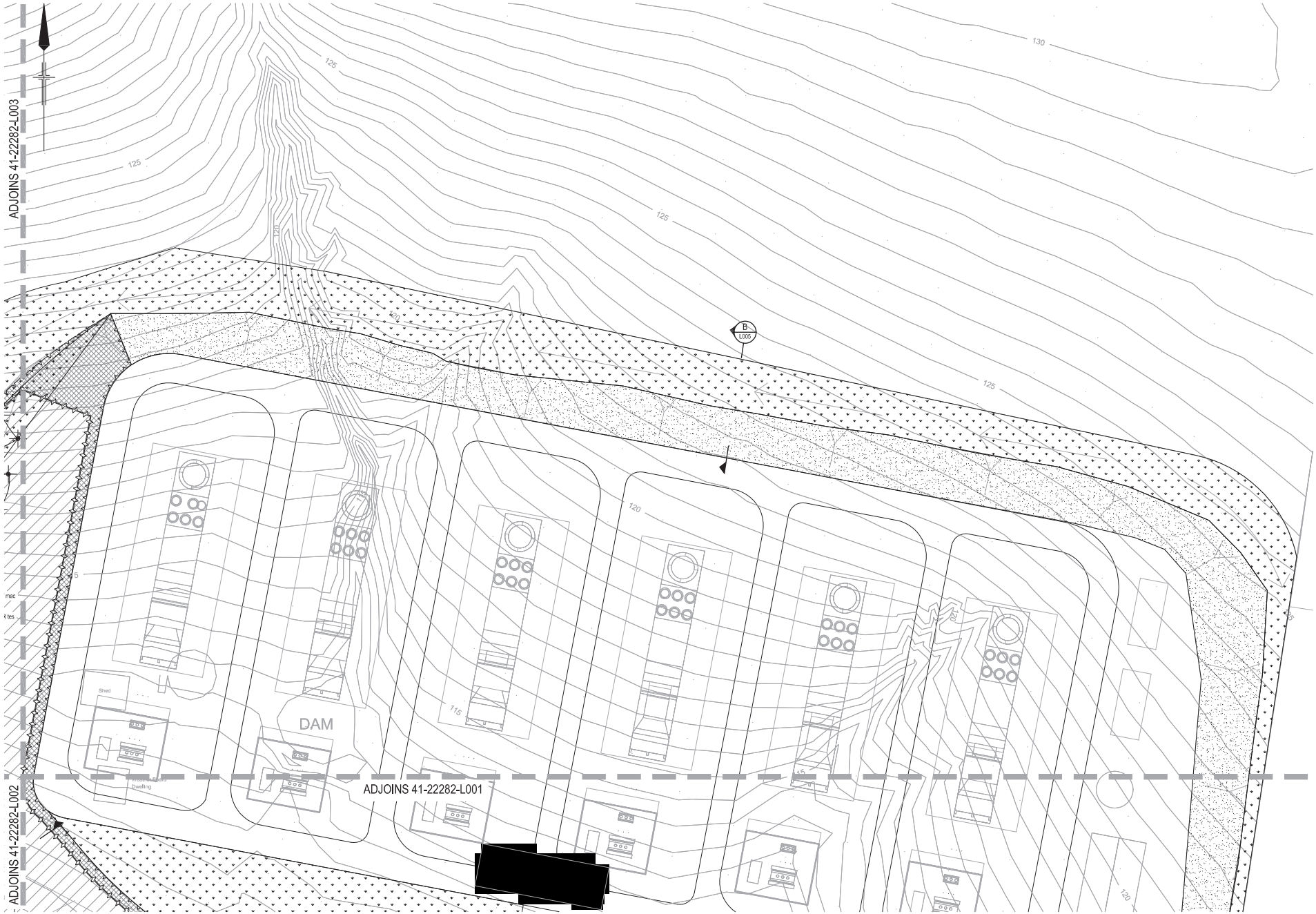
- Selective removal of weeds will occur as a result of the project;
- All environmental weeds throughout the site are to be sprayed and managed in accordance of the LMRP;
- Trees, shrubs and ground covers must planted in accordance with the planting specification as outlined in the 41-22282-L001-L004, Landscape Planting Layout and associated Landscape Specification;
- Mean ground cover of weeds must be no greater than 5% in re-vegetation planting plots in the first 24 months;
- Regular monitoring and reporting is required for clearing, rehabilitation, weed management and re-vegetation of all areas;
- Regular ongoing maintenance of re-vegetation establishment, weed suppression areas, re-vegetation of areas is required to maintain and enhance the visual and dominant landscape in the region;
- Replacement of dead plants is required during the maintenance period.
- Successful survival of all re-vegetated species planted to a minimum of 90% survival rate after 24-month period;
- A follow-up quarterly maintenance program after the initial 12 months is highly recommended;
- The PM is responsible for implementing and achieving the deliverables outlined in Section 11 of this LMP (Weed Control and Management);
- PM is to be a licensed and accredited commercial operator with approval of from QPI;
- All declared weeds (P1 zone) are required to be controlled as a priority over all other weed species;
- Direct contact spraying and cut stump method are the preferred weed control method techniques to be used throughout the site;
- Initial 12-week establishment period applies to all vegetation works. During this period; weekly weed maintenance is to occur that involves ongoing weeding and spot spraying;
- Ongoing maintenance is to continue monthly for the 24 months;
- Roundup bioactive is the preferred herbicide to be used on site;
- PM and the EO are to visually monitor for the presence of weeds during routine patrols PM personnel are to provide reports after maintenance patrols outlining the presence of weed infestations.
- Monthly operational works sheet are to be recorded and submitted to GM monthly.
- An accurate photo-record of the progress of the weed control works and re-vegetation is required by setting up an appropriate number of representative fixed photo-points in the area. Photos should be taken by digital camera and recorded with a GPS coordinate. Photo-point locations should be clearly

marked on site and mapped by a surveyor or by GPS.

- An annual report should be prepared documenting the monthly activities and reporting over the 24 months.
- The report completed by the PM to the GM should contain recommendations in regard to issues affecting the ongoing success of the LMRP works, and the possible need for additional activities that may be required outside the normal maintenance program.

Appendix A

Detailed Landscape Plan

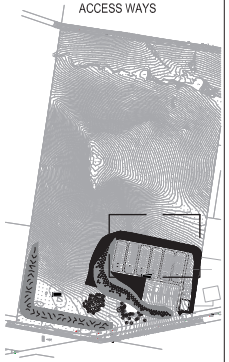


LEGEND

- EXISTING TREE TO BE RETAINED (INDICATIVE LOCATION ONLY)
- PROPOSED TREE
- PROPOSED SHRUB MIX
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 1
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 2
- PROPOSED HYDROMULCH MIX WITH MACMAT JUTE MATTING (REFER TO SPECIFICATION)
- PROPOSED HYDROMULCH GRASS MIX (TO BE APPLIED TO ALL DISTURBED AREAS. REFER SPECIFICATION)

NOTES:

1. REFER TO LMRP FOR WEED REMOVAL INFORMATION, STREAM ORDERS AND RIPARIAN / WILDLIFE CORRIDORS, STOCKPILE LOCATIONS AND DISPOSAL SITES, EROSION CONTROL AND LOCATION OF MACHINE ACCESS WAYS



KEY PLAN
NTS

PRELIMINARY

No	Revision	Note: * Indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

DO NOT SCALE

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
LANDSCAPE PLANTING LAYOUT 4

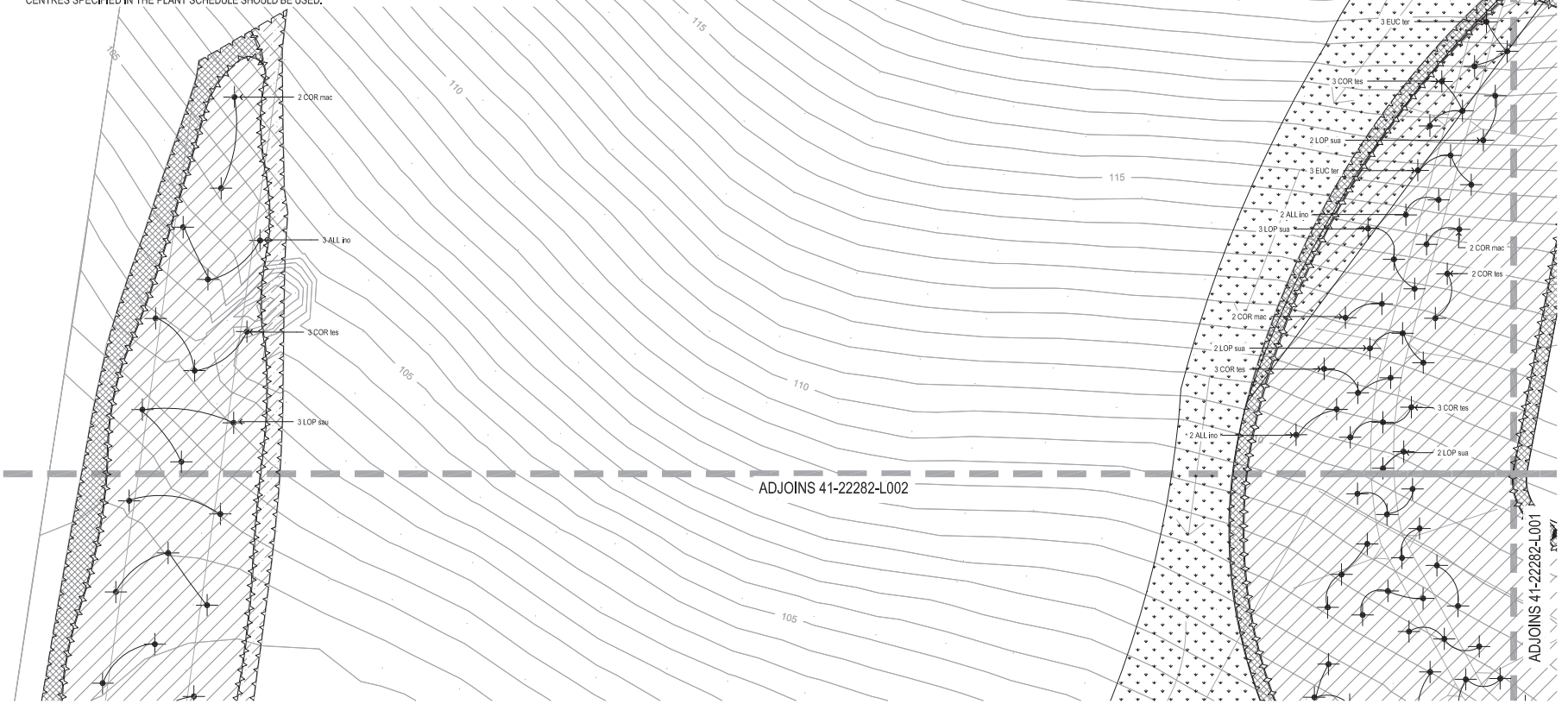
Original Size A1 | Drawing No: 41-22282-L004 | Rev: A

Plot Date: 23 December 2009 - 1:36 PM Plotted by: Claire Humphreys Cad File No: G:\41\22282\CADD\Drawings\41-22282-L004.dwg

MASTER PLANT SCHEDULE								REV A
QUANTITY	CODE	BOTANICAL NAME	COMMON NAME	CENTRES (mm)	POT SIZE	HEIGHT (MATURITY)	SUPPLY HEIGHT	STAKING
TREES								
42	ALL ino	*ALLOCASUARINA inophloia*	Stringybark She Oak	10000	25L	10m	1200mm	Y
52	COR mac	*CORYMBIA maculata*	Spotted Gum	10000	25L	25-30m	1200mm	Y
46	COR tes	*CORYMBIA tessellaris*	Moreton Bay Ash	10000	25L	35m	1200mm	Y
37	EUC ter	*EUCALYPTUS tereticornis*	Forest Red Gum	10000	25L	30m	1200mm	Y
48	LOP sau	*LOPHOSTEMON suaveolens*	Swamp Box	10000	25L	10-25m	1200mm	Y
SHRUB MIX								
13950	ACA jun	ACACIA juncifolia	Rush Leaf Wattle	MIXTURE OF SPECIES AT 2000mm CENTRES	TUBE	1-2.5m	NA	N
13950	DOD vis	*DODONAEA viscosa*	Sticky Hop Bush		TUBE	5-8m	NA	N
13950	HOV vis	*HOVEA acutifolia*	Pointed Leaf Hovea		TUBE	2-4m	NA	N
13950	JAC sco	*JACKSONIA scoparia*	Dogwood		TUBE	4m	NA	N
13950	PUL vil	*PULTENAEA villosa*	Hairy Bush Pea		TUBE	2m	NA	N
GROUNDCOVERS/NATIVE GRASS MIX 1								
2255	CYM ref	*CYMBOPOGON refractus*	Barbed Wire Grass	MIXTURE OF SPECIES AT 750mm CENTRES	TUBE	NA	NA	N
2255	DIA rev	*DIANELLA revoluta*	Blueberry Lily		TUBE	NA	NA	N
2255	HAR vio	*HARDENBERGIA violacea*	Native Sarsaparilla		TUBE	NA	NA	N
2255	LOM lon	*LOMANDRA longifolia*	Mat Rush		TUBE	NA	NA	N
2255	THE aus	*THEMEDA australis*	Kangaroo Grass		TUBE	NA	NA	N
GROUNDCOVERS/NATIVE GRASS MIX 2								
1060	DIA cae	*DIANELLA caerulea*	Blue Flax Lily	MIXTURE OF SPECIES AT 750mm CENTRES	TUBE	NA	NA	N
1060	ISO nod	*ISOLEPIS nodosa*	Knobby Club Rush		TUBE	NA	NA	N
1060	LOM lon	*LOMANDRA longifolia*	Mat Rush		TUBE	NA	NA	N
1060	THE aus	*THEMEDA australis*	Kangaroo Grass		TUBE	NA	NA	N
HDROMULCH MIX WITH MACMAT JUTE MATTING								
NA	1/3	*HARDENBERGIA violacea*	Native Sarsaparilla	NA	NA	NA	NA	N
NA	1/3	*LOMANDRA longifolia*	Mat Rush	NA	NA	NA	NA	N
NA	1/3	*MYOPORUM ellipticum*	Boobila	NA	NA	NA	NA	N
HYRDROMULCH GRASS MIX								
		CYNODON dactylon		NA	NA	NA	NA	N

NOTES:

1. WHERE DISCREPANCIES OCCUR BETWEEN PLANT QUANTITIES SHOWN ON DRAWING AND PLANT SCHEDULE, A QUANTITY DERIVED FROM PLANT CENTRES SPECIFIED IN THE PLANT SCHEDULE SHOULD BE USED.
2. WHERE SITE CONDITIONS DIFFER FROM AREAS SHOWN ON DRAWINGS, A QUANTITY DERIVED FROM PLANT CENTRES SPECIFIED IN THE PLANT SCHEDULE SHOULD BE USED.

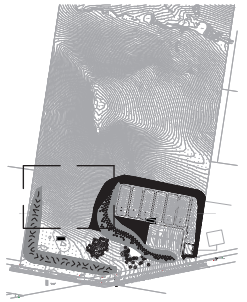


LEGEND

- EXISTING TREE TO BE RETAINED (INDICATIVE LOCATION ONLY)
- PROPOSED TREE
- PROPOSED SHRUB MIX
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 1
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 2
- PROPOSED HYDROMULCH MIX WITH MACMAT JUTE MATTING (REFER TO SPECIFICATION)
- PROPOSED HYDROMULCH GRASS MIX (TO BE APPLIED TO ALL DISTURBED AREAS. REFER SPECIFICATION)

NOTES:

1. REFER TO LMRP FOR WEED REMOVAL INFORMATION, STREAM ORDERS AND RIPARIAN / WILDLIFE CORRIDORS, STOCKPILE LOCATIONS AND DISPOSAL SITES, EROSION CONTROL AND LOCATION OF MACHINE ACCESS WAYS



KEY PLAN
NTS

PRELIMINARY

No	Revision	Note: * Indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

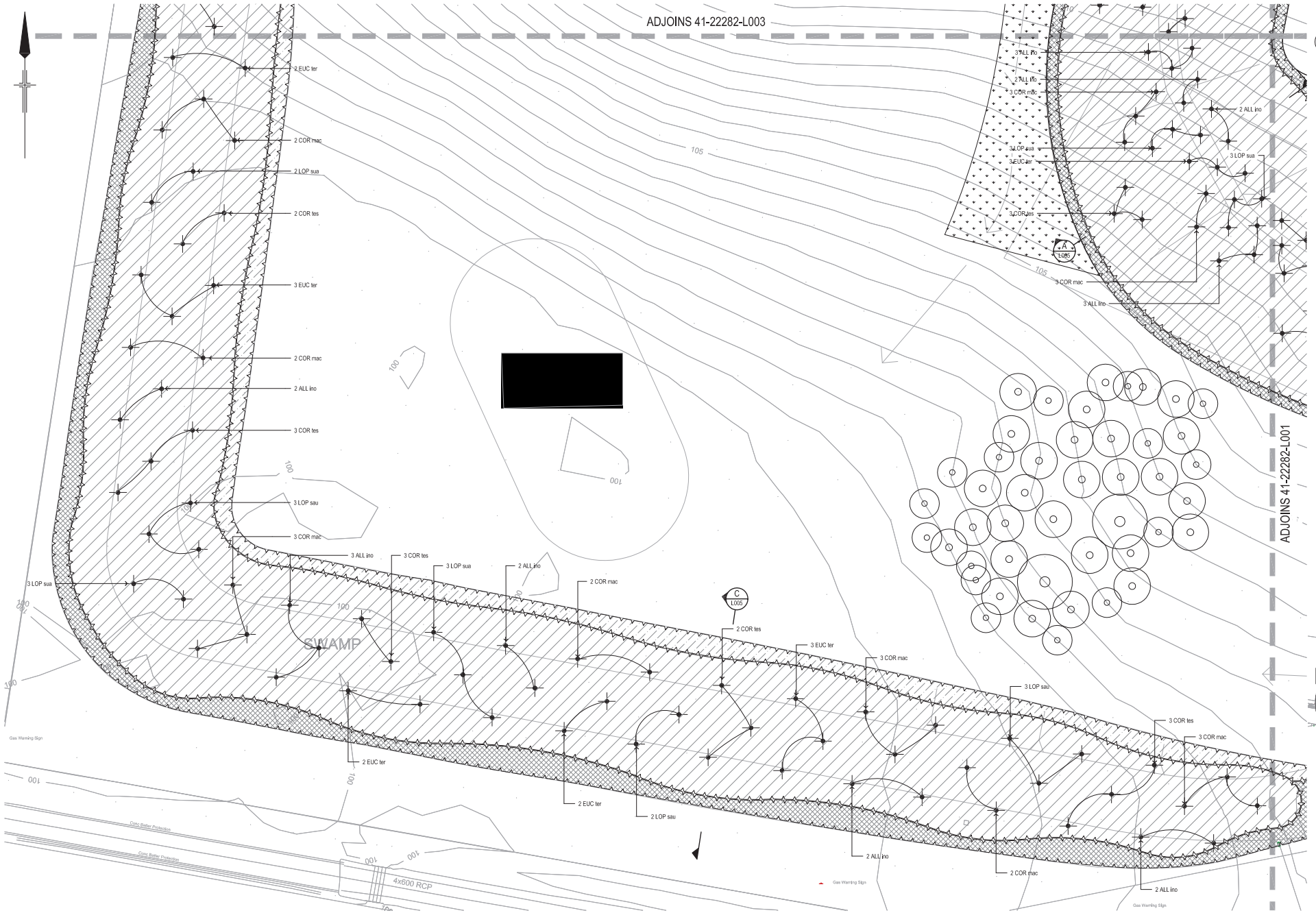
DO NOT SCALE

Drawn C.HUMPHREYS	Designed C.HUMPHREYS	
Drafting Check	Design Check	
Approved		
Date		
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
LANDSCAPE PLANTING LAYOUT 3

Original Size A1 | Drawing No: 41-22282-L003 | Rev: A

Plot Date: 23 December 2009 - 1:36 PM Plotted by: Claire Humphreys Cad File No: G:\41\22282\CADD\Drawings\41-22282-L003.dwg

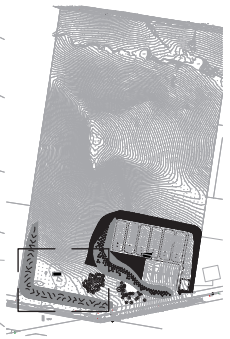


LEGEND

- EXISTING TREE TO BE RETAINED (INDICATIVE LOCATION ONLY)
- PROPOSED TREE
- PROPOSED SHRUB MIX
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 1
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 2
- PROPOSED HYDROMULCH MIX WITH MACMAT JUTE MATTING (REFER TO SPECIFICATION)
- PROPOSED HYDROMULCH GRASS MIX (TO BE APPLIED TO ALL DISTURBED AREAS. REFER SPECIFICATION)

NOTES:

1. REFER TO LMRP FOR WEED REMOVAL INFORMATION, STREAM ORDERS AND RIPARIAN / WILDLIFE CORRIDORS, STOCKPILE LOCATIONS AND DISPOSAL SITES, EROSION CONTROL AND LOCATION OF MACHINE ACCESS WAYS



KEY PLAN
NTS

PRELIMINARY

No	Revision	Note: * Indicates signatures on original Issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

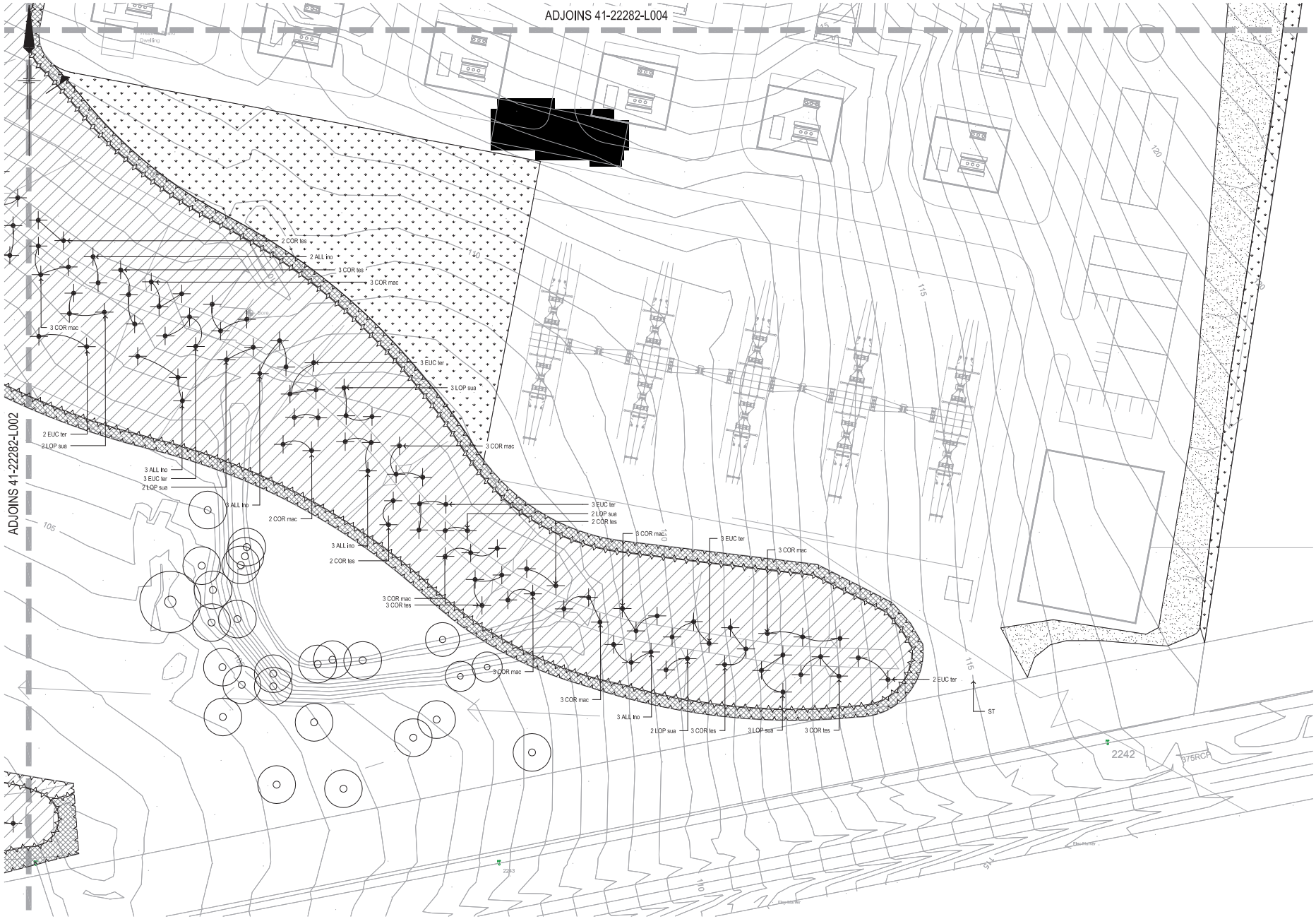
DO NOT SCALE

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
LANDSCAPE PLANTING LAYOUT 2

Original Size A1 | Drawing No: 41-22282-L002 | Rev: A

Plot Date: 23 December 2009 - 1:37 PM Plotted by: Claire Humphreys Cad File No: G:\41\22282\CADD\Drawings\41-22282-L002.dwg

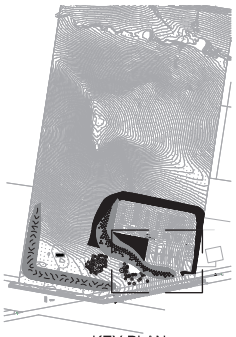


LEGEND

- EXISTING TREE TO BE RETAINED (INDICATIVE LOCATION ONLY)
- PROPOSED TREE
- PROPOSED SHRUB MIX
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 1
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 2
- PROPOSED HYDROMULCH MIX WITH MACMAT JUTE MATTING (REFER TO SPECIFICATION)
- PROPOSED HYDROMULCH GRASS MIX (TO BE APPLIED TO ALL DISTURBED AREAS. REFER SPECIFICATION)

NOTES:

1. REFER TO LMRP FOR WEED REMOVAL INFORMATION, STREAM ORDERS AND RIPARIAN / WILDLIFE CORRIDORS, STOCKPILE LOCATIONS AND DISPOSAL SITES, EROSION CONTROL AND LOCATION OF MACHINE ACCESS WAYS



KEY PLAN
NTS

PRELIMINARY

No	Revision	Note: * Indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

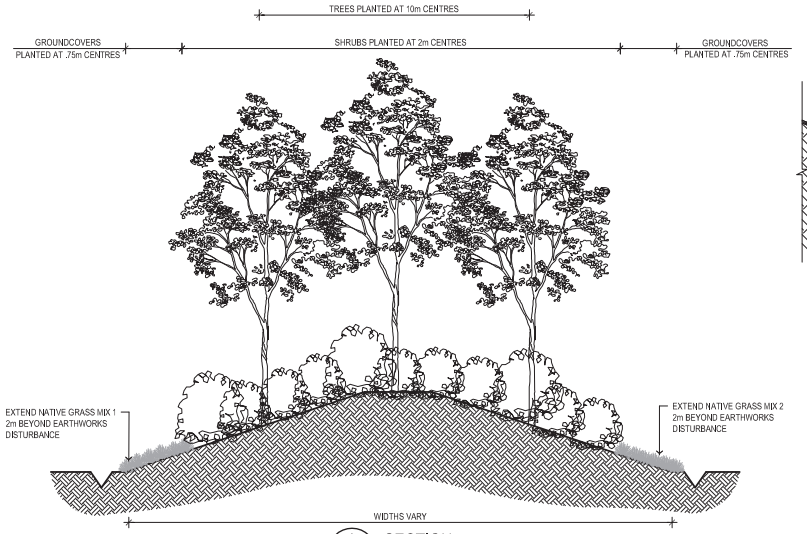
GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

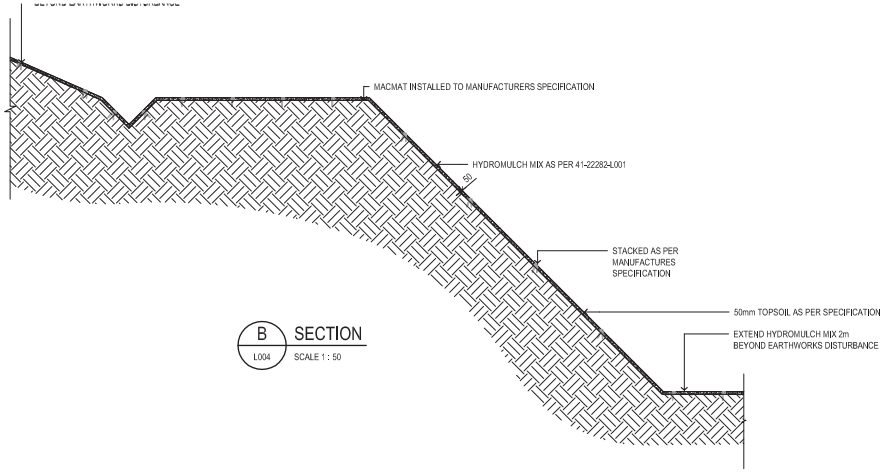
Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
LANDSCAPE PLANTING LAYOUT 1

Original Size A1 | Drawing No: 41-22282-L001 | Rev: A

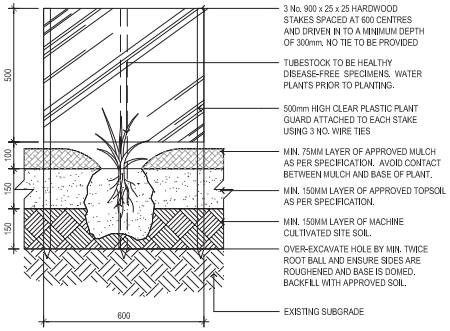
Plot Date: 23 December 2009 - 1:38 PM Plotted by: Claire Humphreys
Cad File No: G:\41\22282\CADD\Drawings\41-22282-L001.dwg



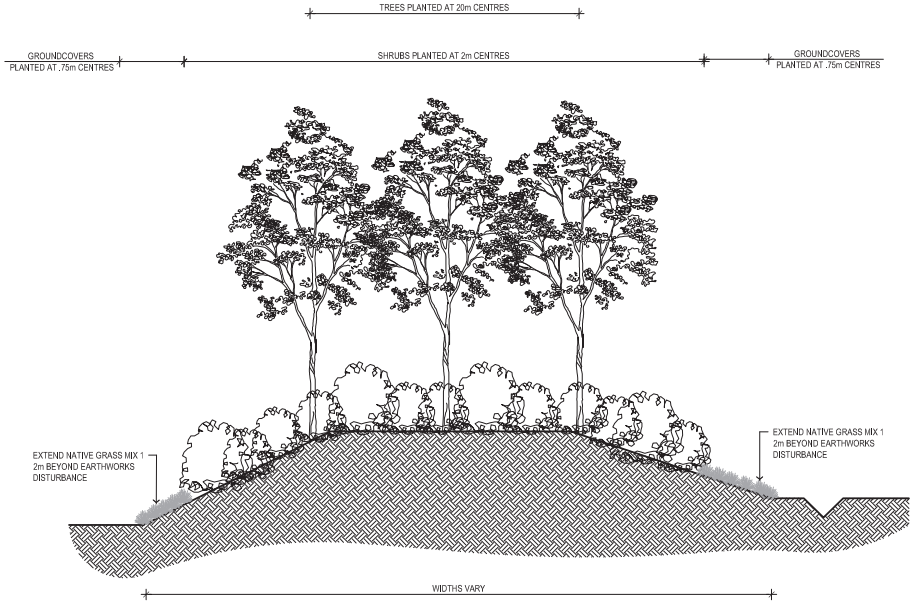
A SECTION
L001 SCALE 1 : 200



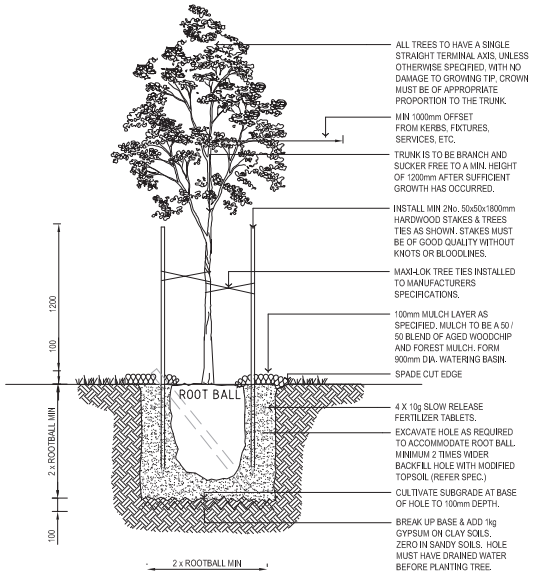
B SECTION
L004 SCALE 1 : 50



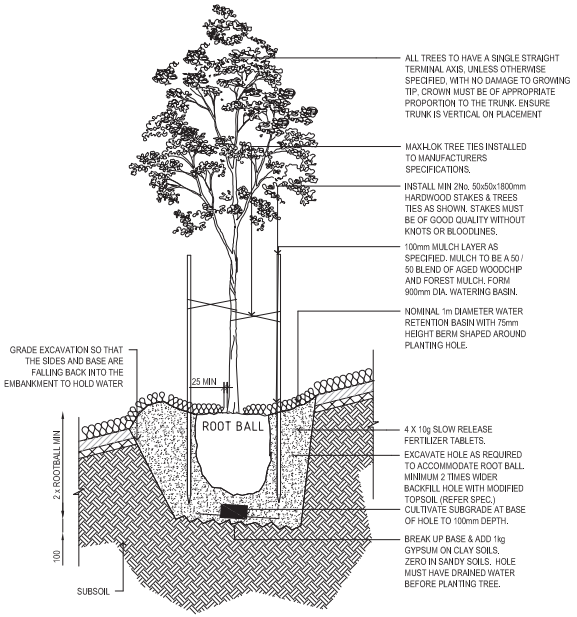
TYPICAL TUBE STOCK PLANTING DETAIL
SCALE 1:10



C SECTION
L002 SCALE 1 : 200



TYPICAL ADVANCED SIZE TREE PLANTING
SCALE 1:20



TYPICAL MATURE TREE PLANTING IN SLOPING GROUND
SCALE 1:20

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

SCALE 1:200 AT ORIGINAL SIZE (0 2 4 6 8 10m)
SCALE 1:20 AT ORIGINAL SIZE (0 0.2 0.4 0.6 0.8 1.0m)
SCALE 1:50 AT ORIGINAL SIZE (0 0.5 1.0 1.5 2.0 2.5m)
SCALE 1:10 AT ORIGINAL SIZE (0 0.1 0.2 0.3 0.4 0.5m)

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

DO NOT SCALE

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: WESTLINK PTY LTD.
Project: WESTLINK POWERSTATION
Title: LANDSCAPE DETAILED DESIGN
TYPICAL SECTIONS AND PLANTING DETAILS

Original Size: A1
Drawing No: 41-22282-L005
Rev: A

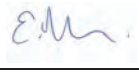
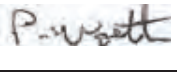
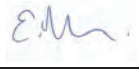
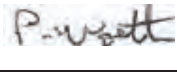
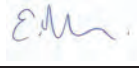
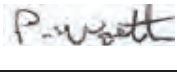
Plot Date: 23 December 2009 - 1:00 PM Plotted by: Claire Humphreys
Cad File No: G:\41\22282\CADD\Drawings\41-22282-L005.dwg

GHD

201 Charlotte Street Brisbane QLD 4000
GPO Box 668 Brisbane QLD 4001
T: (07) 3316 3000 F: (07) 3316 3333 E: bnemail@ghd.com.au

GHD has produced the Report in accordance with the terms of engagement for the commission with WPL.

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	C.O'Neill	E. Nicholoau		P. Wootton		17/12/09
B	C.O'Neill	E. Nichaloau		P. Wootton		01/02/10
0	C. O'Neill	E. Nichaloau		P. Wootton		23/02/10

APPENDIX 12: WESTLINK POWER PROJECT VISUAL IMPACT AND LANDSCAPE ASSESSMENT

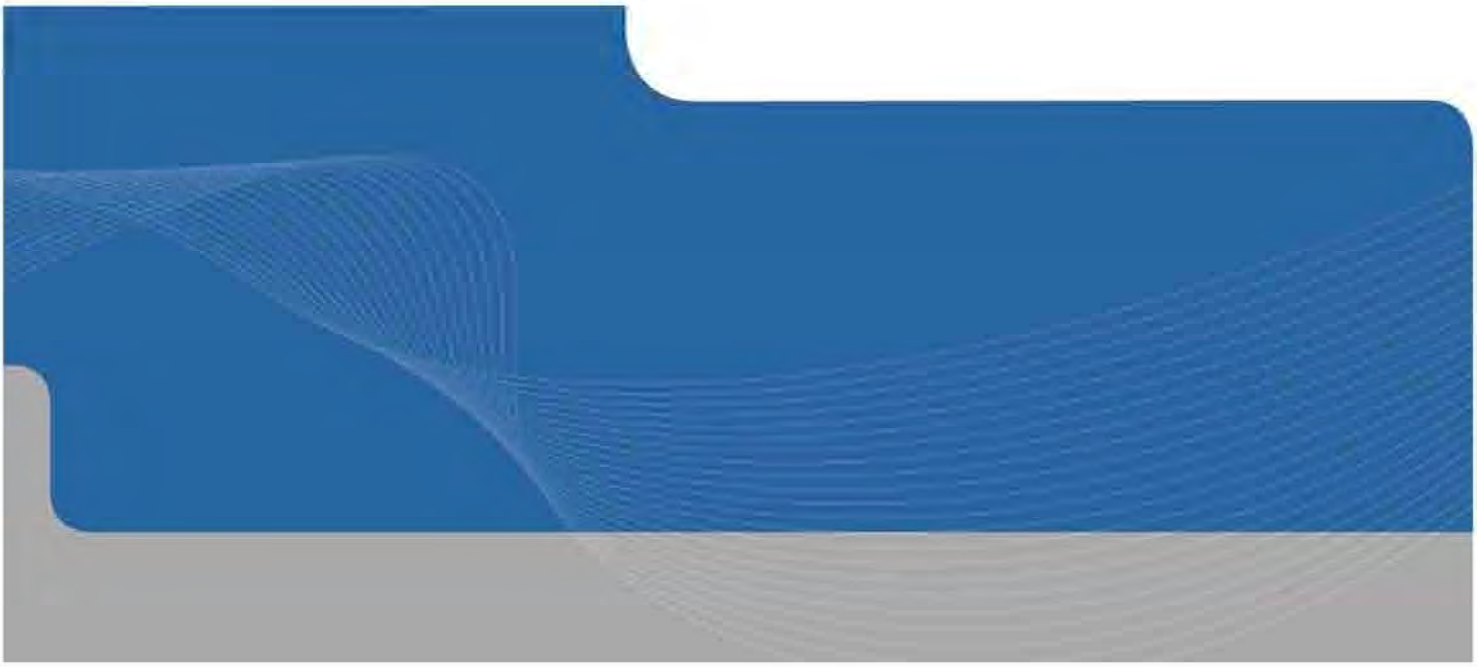
CLIENTS | PEOPLE | PERFORMANCE

Westlink

Westlink Power Project

Visual Impact and Landscape Assessment

August 2009



INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

Figure Index

Appendices

1. Visual Impact and Landscape Assessment

1.1 Introduction

Westlink Pty Ltd (Westlink) is proposing a staged development of a natural gas-fired power station of up to 1,000 megawatts (MW) capacity, at a site north of Gatton in South-East Queensland. This proposed generation development is known as the Westlink Power Project (WPP), and would comprise staged installation of six open-cycle gas turbines. Turbine unit sizes for the project would depend on the outcome of detailed design works, an equipment selection process and negotiations with plant suppliers. Gas turbines with a rated capacity of between 100 and 200 MW would be considered.

The proposed plant would be designed as a standby or "peaking" power station, intended to run when demand for electricity increases rapidly or to provide backup power when other power stations experience outages, are shut down for maintenance or are subject to other power supply constraints. It is envisaged that the plant may be expected to run up to 20 per cent of the time.

GHD Pty Ltd (GHD) was engaged by Westlink to complete a Visual Impact and Landscape (VIL) Assessment for the WPP. GHD has extensive experience in the creation of 3-dimensional (3D) visualisations to communicate siting options and visual impact assessment of new infrastructure, including transmission lines, roads, rail and pipeline corridors, in addition to power stations and treatment plants.

The VIL Assessment concentrated on the proposed WPP, situated approximately two kilometres north of the Gatton Township (refer to Figure 1). The study area is a 70 hectare property located on Fords Road, Adare, described as Lot 191 on plan CSH2361. The VIL Assessment comprises findings from field investigations, Geographic Information System (GIS) viewshed modelling, development of 3D snapshots of the proposed WPP building structures, and review of existing studies and literature.

A number of terms are frequently used in this assessment:

- View – what can be seen;
- Vantage points – a specific location from which a view can be obtained. This term is referred to in the GIS modelling when comparing current views to modelled views; and
- Viewshed – the areas from which a specific location can be seen, for example, surrounding residential dwellings.

Where possible, this assessment has attempted to be objective and to incorporate multiple sources of visual characteristics and values. It is, however, recognised that visual assessment is subjective and individuals may associate different visual experiences to the study area.

A component of the VIL Assessment is a review of landscape character. The assessment of landscape character describes the visual character and history of the site and identifies how it may be affected by the proposed development. The property and its surrounds are described in the context of landscape ecology and incorporate the concepts of patch-corridor-matrix in describing the pattern of existing vegetation. The character of the landscape with respect to physical landform patterns and elements reviewed using the Australian standard definitions and concepts espoused in the "Australian Soil and Survey Field Handbook" (McDonald *et al*. 1990).

Landscape features are determined and/or influenced by physical, biological and cultural factors and may include geology and soils, vegetation and land use. These factors may also influence the visual setting and are discussed throughout the assessment.

1.2 Overview of the Project

Westlink propose to develop the WPP on a 70 hectare site (the Development Site), approximately two kilometres north of Gatton. The proposed footprint for the WPP covers approximately seven hectares in the south-east corner of the site. Figure 1 highlights the overall site boundary and its location relative to the Township of Gatton.

The WPP is proposed to be constructed on a pad established at 114 reduced levels (RL) measured in metres above sea level. The estimated size of the construction pad for six gas turbine generation units of nominal 150 MW is approximately 140 metres by 280 metres. The VIL Assessment focuses on the impact of the tallest structures of the WPP after completion of all development stages, comprising:

- Six exhaust stacks at 30 metres above ground level (AGL); and
- Six air inlet towers at 25 metres AGL.

Concept designs have been completed and an initial layout prepared for the WPP, showing the general equipment location and orientation within the Development Site (refer Figure 2). The main elements and elevation of the proposed WPP infrastructure are shown in Figure 3.

Other infrastructure incorporated in the overall WPP includes a switchyard, maintenance shed, and offices.

When undertaking the concept design a number of mitigation measures were employed to minimise the visual impact of the WPP. These include:

- A detailed site selection to locate the WPP adjacent to infrastructure of a similar nature. The site selected is adjacent to the APA Gatton Compressor Station, opposite the Energex Bulk Supply Sub-station, and near the Gatton Landfill, allowing the WPP to be situated in an area of similar visual context;
- Location of the WPP footprint within the Development Site to minimise vegetation clearing, and utilise topography and existing vegetation as a visual barrier; and
- Sympathetic building design, including using non-reflective building materials and appropriate colour schemes to minimise the extent to which the most prominent features (air intakes and stacks) would be visible within the local area.

The concept design shown in Figures 2 and 3 comprises a “worst-case scenario” by which the largest potential gas turbine units available for the project were selected for assessment. It should be noted that detailed design may result in smaller units ultimately being selected. The VIL Assessment also reviewed the WPP at completion, as opposed to installation in the three stages proposed, meaning this aspect is also assessing the “worst-case scenario”.

1:400,000 (at A3)

0 5 10 15 20

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

N

CLIENTS | PEOPLE | PERFORMANCE

Site Boundary
Water Body
Built-Up Areas
Highway
Major Road

Westlink Pty Ltd
Westlink Power Project Visual Impact Assessment

Job Number 41-21379
Revision B
Date 5 AUG 2009

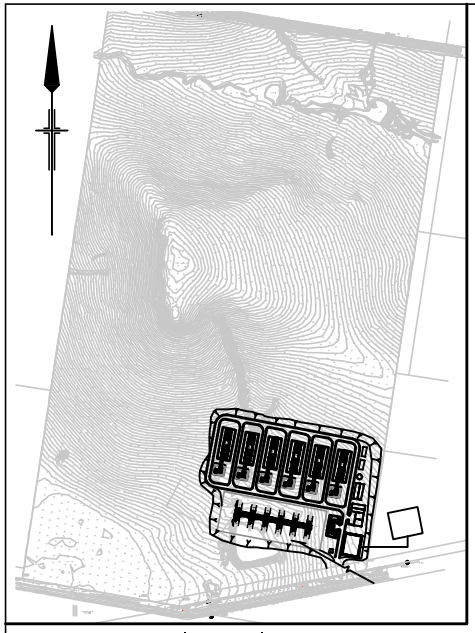
Figure 1

Locality Map

G:\41\21379\CADD\GIS\Arcview\Projects\21379-08a.mxd

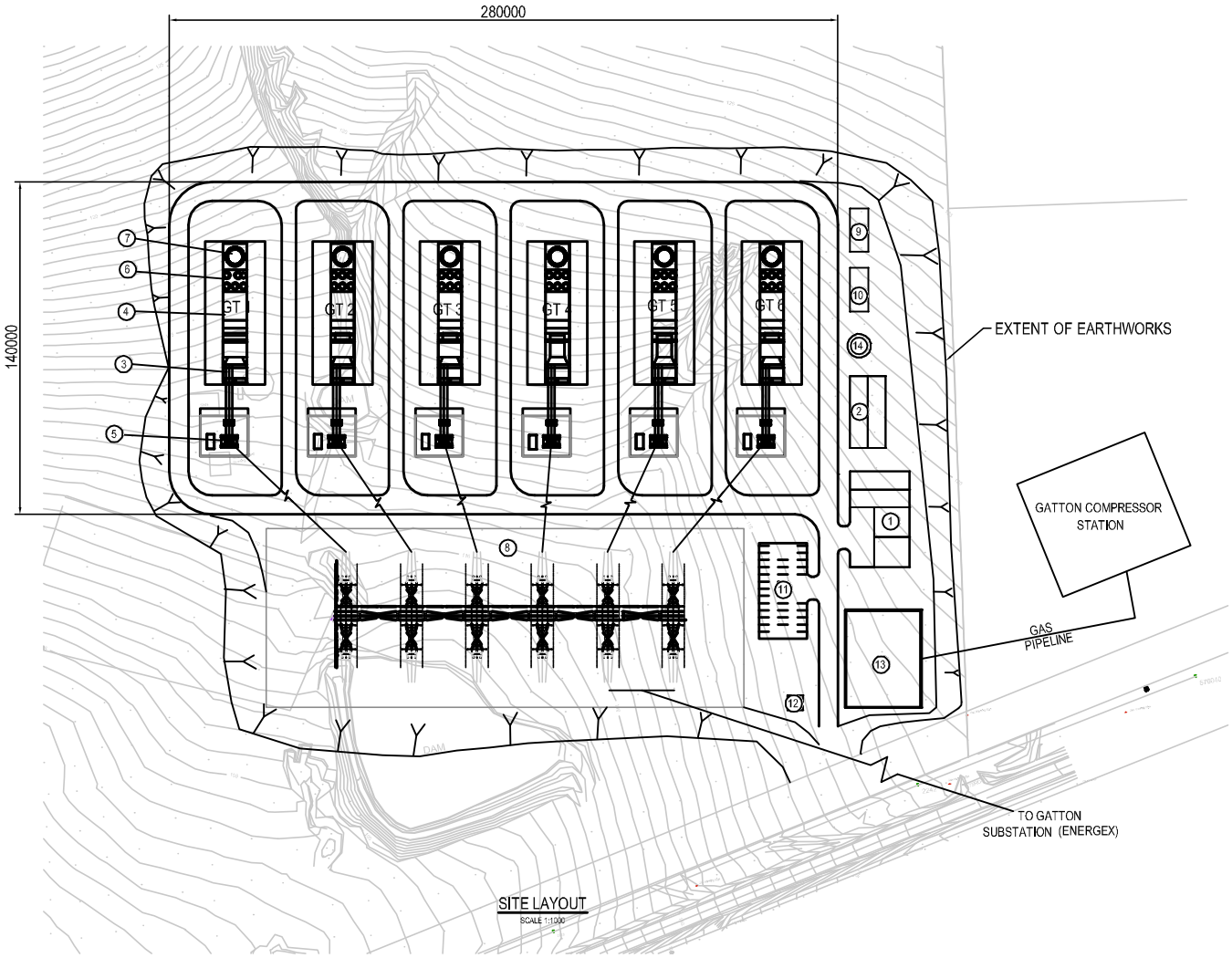
Data source: Roads, Waterbodies and City Boundaries (Navteq, Navigate, Q3, 2008) Imagery (Westlink, 2006), Site Boundary (GHD, 2009). Created by: E Hibberd

1-3 Annand Street Toowoomba QLD 4350 Australia T 61 7 4633 8000 F 61 7 4613 1687 E tbamail@ghd.com.au W www.ghd.com.au



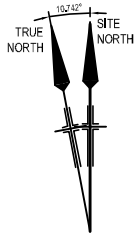
SITE LOCATION

SCALE 1:5000



SITE LAYOUT

SCALE 1:1000



	DESCRIPTION	HEIGHT (m)
1	CONTROL AND ADMIN BUILDING	7.0
2	WAREHOUSE AND WORKSHOP	14.0
3	GAS TURBINE AIR INTAKE	26.0
4	GAS TURBINE ENCLOUSRE	8.5
5	TRANSFORMER	5.0
6	COOLING FANS	13.0
7	EXHAUST STACK	30.0
8	SWITCHYARD	11.0
9	OTHER TANKS & PUMPS	7.0
10	FIRE SYSTEM	4.0
11	CAR PARK	-
12	SECURITY HOUSE	4.0
13	GAS SKID (IF REQUIRED)	6.0
14	FIRE TANK	9.0

NOTES:
1. SITE LOCATION, SIZING AND LAYOUT INDICITIVE ONLY.
2. EXISTING DAM TO BE FILLED IN.

PRELIMINARY

No	Revision	Drawn	Checked	Approved	Date
C	EXTERNAL INFRASTRUCTURE INCLUDED	GHD			25/08/09
B	CLIENT COMMENTS INCORPORATED	GHD			17/07/09
A	ISSUED FOR CLIENT REVIEW	GHD			

Note: * Indicates signatures on original issue of drawing or last revision of drawing

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E brsmail@ghd.com.au W www.ghd.com.au

Drawn GHD	Designed
Drafting Check	Design Check
Approved	
Date	
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved

Client: WESTLINK PTY. LTD.
Project: WESTLINK POWERSTATION DEVELOPMENT ASSISTANCE
Title: PLANT LAYOUT OPTION 1
PLAN VIEW

Original Size A1 | Drawing No: 41-21379-SK004 | Rev: C

Plot Date: 25 August 2009 - 10:15 AM Plotted by: Brynn De Goeyer, Brisbane Cad File No: G:\41\21379\CADD\Drawings\41-21379-SK004_ALT_R.dwg

EAST ELEVATION

SCALE 1:250

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
B	CLIENT COMMENTS INCORPORATED		GHD			17/07/09
A	ISSUED FOR CLIENT REVIEW		GHD			

GHD CLIENTS | PEOPLE | PERFORMANCE

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com.au W www.ghd.com.au

DO NOT SCALE

Drawn	GHD	Designed	
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client **WESTLINK PTY. LTD.**
Project **WESTLINK POWERSTATION DEVELOPMENT ASSISTANCE**
Title **PLANT LAYOUT OPRION 2**
EAST ELEVATION

Original Size **A1**
Drawing No: 41-21379-SK005 **Rev: B**

Plot Date: 3 August 2009 - 2:49 PM Plotted by: Bryn De Gooyer, Brisbane Cad File No: G:\41\21379\CAD\Drawings\41-21379-SK005_ALT_B.dwg

1.3 Site Context

1.3.1 Visual Factors

The visual characteristics of the Development Site and the surrounding area are:

- Warrego Highway to the south;
- Fords Road (which provides vehicular access to the site) to the south;
- The Township of Gatton approximately two kilometres to the south;
- Industrial uses adjacent and to the south-east of the site incorporating the:
    - Gatton Gas Compressor Station and associated above ground pipelines and valves (refer Figure 4);
    - Energex Bulk Supply Substation (refer Figure 5); and
    - Gatton Landfill Facility (refer Figure 6).
- Infrastructure, including adjacent high voltage electricity transmission lines; and
- The cleared high-pressure gas pipeline easement running adjacent to Fords Road in both an easterly and westerly direction from the Gatton Gas Compressor Station.

A site visit of the Development Site and surrounding area identified a large number of structures between 15 and 30 metres of height in and around the Township of Gatton, most prominent (excluding infrastructure discussed above) were water towers, grain silos, telecommunication towers and further electricity transmission infrastructure.

Figures 4 to 6 depict the existing visual amenity of the area and demonstrate the visual context of placing power generation infrastructure in this area.

Figure 4 Gatton Gas Compressor Station

Figure 5 Energex Bulk Supply Substation

Figure 6 Gatton Landfill Facility

1.4 Landform

The surrounding landform between the Development Site and the Township of Gatton is predominantly flat with a slight hill to the south of the overall site. Significant landform changes occur to the north of the site, where the terrain begins to rise gradually into ranges branching off the Great Dividing Range.

The southwest corner of the Development Site is situated within a local depression, and is prone to flooding after significant rain events. The slope profile is flat in the southwest corner and gradually rises from the lower slopes through to mid-slopes. From the western and northern edges of the high point, the upper slopes become steeper in profile. Figure 7 shows landform slope analysis of the overall site.

The landform character of the site is generally defined by an irregular shaped hill, located northwest from the centre of the property. A crest line divides the site from northwest to southeast, creating two large simple slopes, giving variations in relief across the whole site of approximately 50 metres. The largest of four dams on site, found in the southeast corner, is fed by a long open depression running from the high point on the crest of the hill towards the southeast corner. A second long open depression traverses the northern boundary feeding two smaller dams and continues beyond the eastern boundary. Figure 8 shows landform element analysis of the site.

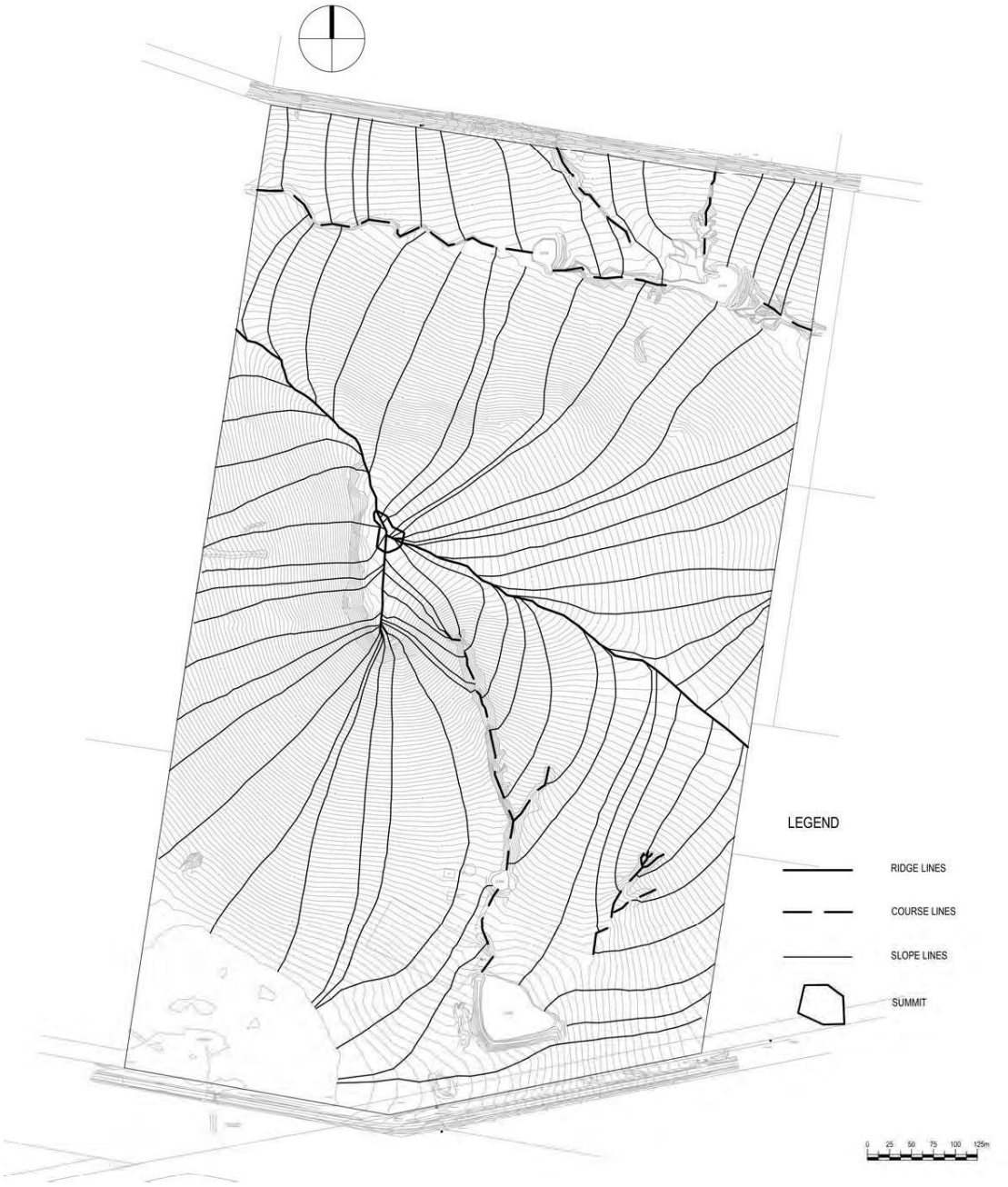


Figure 7 Landform Slope Analysis

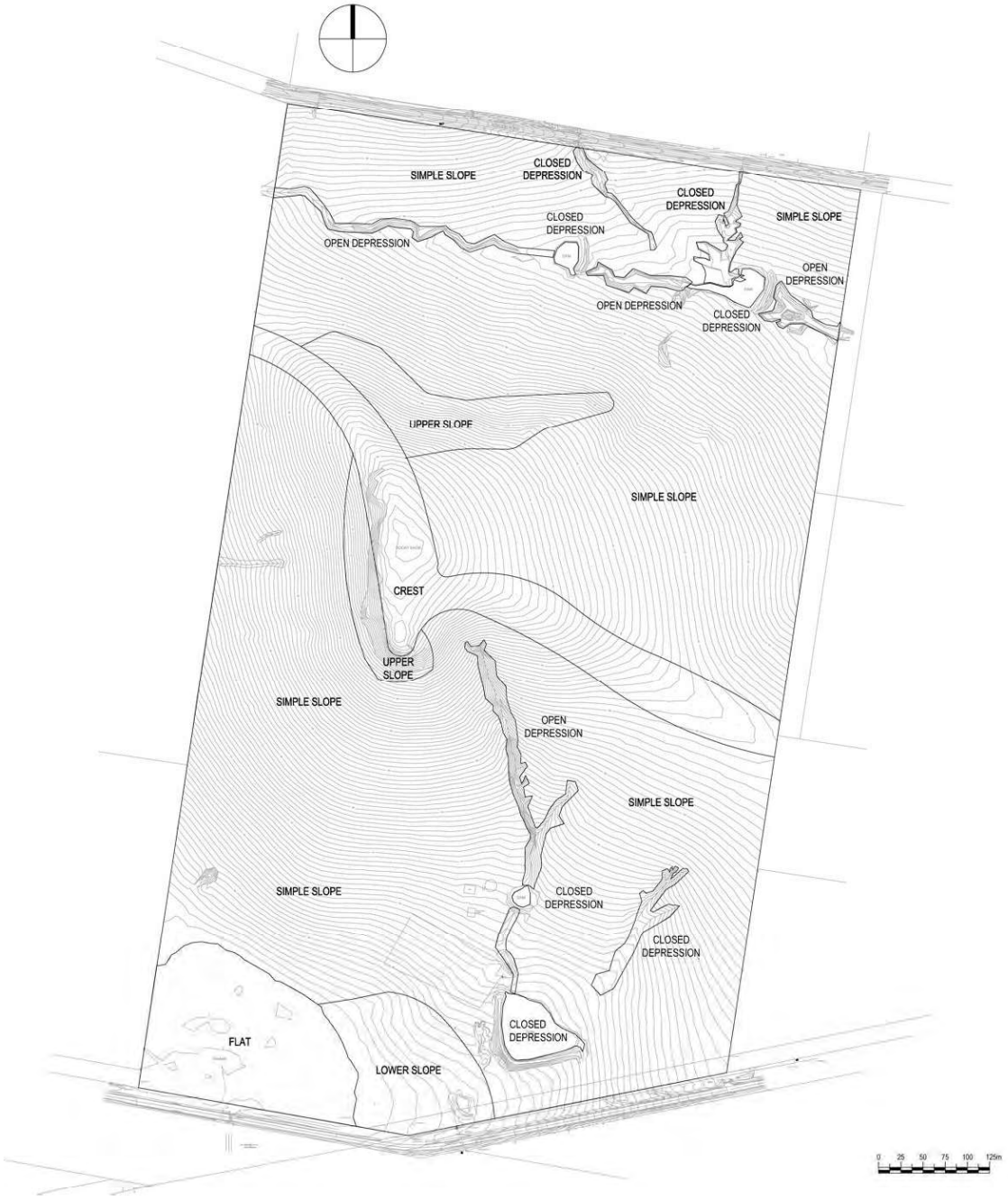


Figure 8 Landform Element Analysis

1.5 Vegetation

The 70 hectare site comprises approximately 55 hectares of remnant vegetation, predominantly in the northern section and outside the WPP footprint. This vegetation is classified as 'Remnant not of concern regional ecosystem' (*Vegetation Management Act 1999*). The overall site represents approximately one quarter of a larger area of remnant vegetation that extends across adjoining properties in an east-west direction (Conics, 2009).

A firebreak with a width of approximately 50 metres exists within the site from the fence line on the northern, western and eastern boundaries. The majority of the property has been mapped as a medium to low risk area under the Lockyer Valley Regional Council's Potential Bushfire Risk Mapping plan (June 2008).

Vegetation forms identified on site are described as:

- *Trees* – Woody plant more than two metres tall with a single stem or branches well above the base;
- *Shrubs* – Woody plant multi-stemmed at the base or if single stemmed less than two metres tall;
- *Tussock Grasses* – Forms discrete but open tussocks usually with distinct open shoots, or if not, then forming a hummock; and
- *Sod Grasses* – Grass of short to medium height forming compact tussocks in close contact at their base and uniting as a densely interfacing leaf canopy.

Growth height classes are a measurement of indicative plant heights for various growth forms found on the property. Table 1 provides the plant relative heights for the different vegetation forms.

Table 1 Vegetation Growth Height Classes

Vegetation Type	Vegetation Height	Height Classification
Trees	12.01m-20m	Tall
	6.01m-12m	Mid-High
Shrubs	1.01m-3m	Tall
	0.51m-1m	Mid-High
Grasses	0.51m-1m	Extremely Tall
	0.26m-0.5m	Mid-High
	<0.25m	Low

1.5.1 Vegetation Formation Classes

Structural formation classes are derived from vegetation canopy separation or foliage cover, relative to how dense or sparse those areas are. Structural formation classes and the differing densities of vegetation found on the WPP site are described in Table 2 and have been spatially located in Figure 9.

Table 2 Vegetation Structural Formation Classes

Vegetation Type	Formation Class	Crown Cover Class/Foliage Cover	Field Criteria to Estimate Cover Class
Trees	Woodland	Sparse	Crowns clearly separated
	Open Woodland	Very Sparse	Crowns well separated
	Isolated Trees	Isolated Plants	Trees about or greater than 100m apart
	Isolated Clumps of Trees	Isolated Clumps of Plants	Clumps of two to five woody plants 200m or further apart
Shrubs	Isolated Shrubs	Isolated Plants	Shrubs about or greater than 25m apart
	Isolated Clumps of Shrubs	Isolated Clumps of Plants	Clumps of two to five woody plants 50m or further apart
Grasses	Closed Grassland	>70%	Crowns touching to overlapping
	Mid-Dense Grassland	30-70%	Crowns touching or slightly separated
	Open Grassland	10-30%	Crowns clearly separated

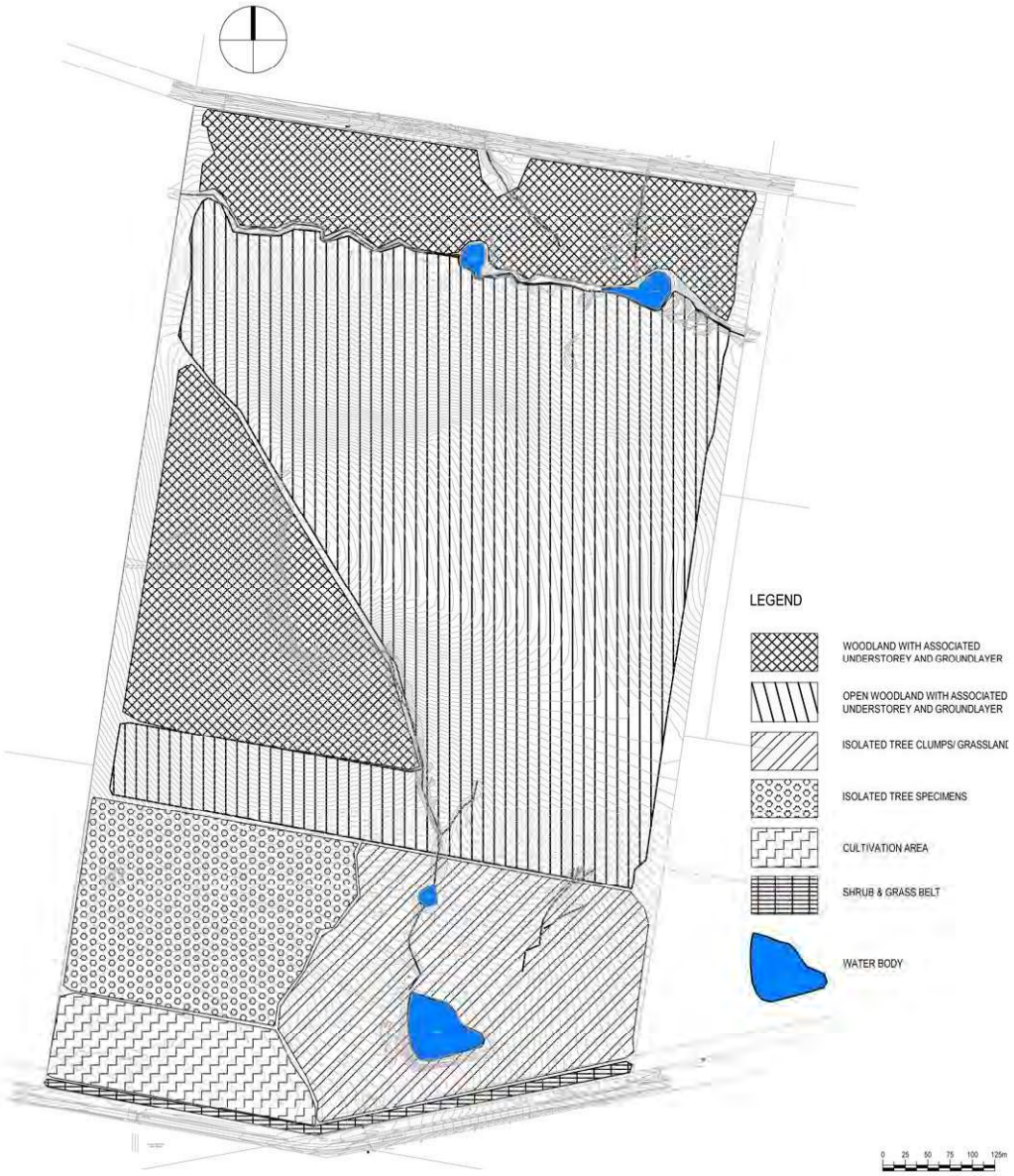


Figure 9 Location of Vegetation Structural Formation Classes

Examples of vegetation formation classes at the WPP site are shown in Figures 10 to 13, depicting a variety of classes. Overall the ground layer presents as a mixture of Mid-dense Tussock and Sod grasses, tending to become denser towards the boundaries.

Understorey and ground layer conditions appear to vary across the property, possibly due to previous fire events (Conics, 2009). Fire events affecting the canopy condition along the ridge through the centre of the site are evident and a large proportion of older trees have been killed by fire during the past five or ten years (Conics, 2009).

Figure 10 Site Photograph 1 – Existing Dam on the southeast Corner of Site

The native vegetation is at its lowest density along the southern boundary, with clearance of native forests leaving mostly isolated specimens and clumps of trees. The largest of four dams, visible in Figure 10, located in the southeast corner has isolated clumps of trees adjacent and around the bunding of the dam.

Figure 11 Site Photograph 2 – Northern Boundary

Denser areas of tall woodland can be found on the northern and western parts of the property. These areas appear to have also been previously subject to logging, leading to relatively immature trees being present. The proposed WPP will be located on a footprint of approximately seven hectares in the south-eastern corner; meaning most of the vegetation located on site will remain undisturbed.

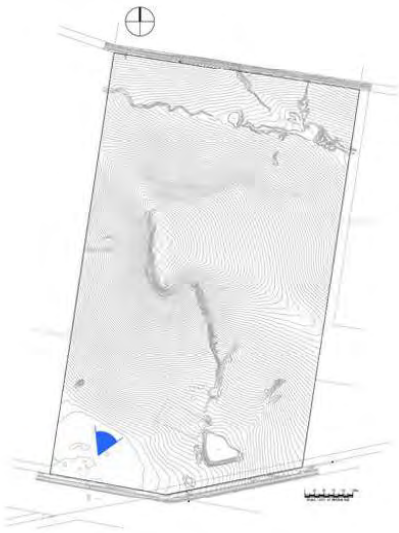


Figure 12 Site Photograph 3 – Southern Depression

The upper stratum on site predominantly comprises tall open woodland, interspersed with pockets of denser tall woodland. The dominant species include *Corymbia maculate, Coymbia henryi, Eucalyptus crebra* and *Eucalyptus fibrosa subsp. Fibrosa* (Conics, 2009). The complexity of the upper stratum appears to have been affected by timber harvesting, resulting in relatively immature trees present, with older growth “habitat” trees less predominant throughout the site.

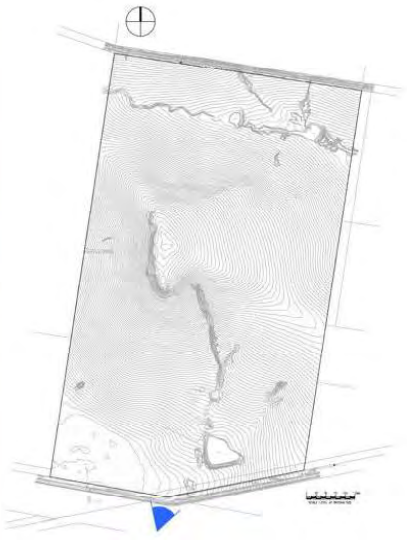


Figure 13 Site Photograph 4 – Fords Road Boundary

In the south-east corner of the site the understorey is less frequent across the site and is predominantly comprised of mid to high trees. Shrubs vary in height and are located infrequently across the whole site. Figure 9 shows a location where shrubs are more prevalent towards property boundaries, until reaching the boundary fire break clearance. Overall the understorey comprises a small amount of the total stratum. A broken belt of shrubs present along the southern boundary acts as a vegetation buffer between the WPP and Fords Road (demonstrated in Figure 13).

1.5.2 Significant Species

Conics (2009) conducted a search of wildlife online and the Environmental Protection and Biodiversity Conservation (EPBC) databases. Two significant species were identified as having potential to occur at the site, *Cryptostylis hunteriana* (Leafless Tongue-orchid) and *Thesium australe* (Austral Toadflax). Leafless Tongue-orchid is found within rainforest environments and no such habitat is present on site to support this species. Potential habitat does exist for *Thesium australe (*Austral Toadflax), however site investigations did not locate any of this species (Conics, 2009).

2. Methodology

2.1 Overview

The nature of a visibility analysis is subjective and dependent on a number of factors, which can include:

- The relationship of the viewer to the visibility (i.e. whether the person is a permanent resident, traveller, worker);
- Exposure to the view (i.e. whether it is a brief glimpse or an outlook from a house);
- Distance from a particular vantage point;
- The sensitivity of the view;
- The degree of human modification (i.e. naturalness);
- Consistency with surrounding landscape;
- The number of viewers;
- Vegetation cover;
- Topography;
- Existence of other similar height and style structures within the region; and
- Orientation of views (i.e. from houses or open space).

To reduce the reliance on subjective criteria, this assessment has utilised objective methodology where appropriate, including the use of computer generated images to convey the nature and context of the project in the receiving landscape. Regardless of the approaches used, a significant subjective element is required to undertake the assessment, whether in the methodologies used, selection of the assessment criteria or by assigning values to each criteria. Consequently, the assessment process has been clearly documented to allow the reader to understand the process undertaken and the justification for the decisions reached.

The images used in the computer modelling have been based on the current concept design available at the time of the assessment. It must also be recognised that these images are not intended to be accurate down to minor details but rather have been developed to show the scale and form of potential visual impacts. The concept design represented in this assessment is the “worst-case scenario” (i.e. the largest possible infrastructure when all stages of the project have been completed) and are subject to change during the detailed design, and as such may be of a smaller nature to infrastructure presented.

2.2 Assessment Methodology

The assessment of the visual impacts has included the following:

- Identification of the potential landscape alterations;
- GIS viewshed analysis to identify those areas where the WPP can be seen from;
- Development of photomontages for the WPP from various vantage points; and
- A visual impact assessment based on visual modification and viewer sensitivity.

The following assessment primarily addresses fixed structures (stacks and air intakes) as they will be the permanent and consistent visual element of the project.

2.2.1 Geographic Information System Viewshed Analysis

The WPP would be partially visible from a number of local vantage points. A significant number of views are shielded by local topography and will also be removed or minimised by screening vegetation. This further limits the extent to which the WPP will be seen. To account for topography and vegetation screening, GIS assessment has been undertaken to model the viewshed of the WPP. Topographic screening is addressed utilising contour data for the region. Screening vegetation has been conservatively modelling by assigning an average tree height to more significant vegetation strands close to the WPP that are likely to offer screening to sensitive areas. Screening impacts from scattered or landscaped vegetation has not been included due to the complexity of such an assessment, so the analysis underestimates the level of screening in many areas.

GIS software ArcView was used to undertake a viewshed analysis to determine from where the WPP will be visible. This was prepared using the following approach:

- Deriving a digital elevation model (DEM) from five (5) metre contour data for the region;
- Incorporating concept design drawings of the WPP pad into the DEM;
- The larger remnants of existing vegetation, external to the site, were given a height value of 15 metres (based on an average vegetation height assessed during the site visit), and added to the DEM to take into account potential vegetation screening; and
- Running a viewshed model (a standard functionality within ArcView) with the approximate standing height of an observer set at 1.5 metres above ground level.

2.2.2 Photomontages

From the viewshed analysis potential areas from which the proposed WPP may be seen were identified and a site visit completed to obtain photos. The vantage points were marked in the field using a hand-held Global Positioning System (GPS), and the photos taken at these points.

Photomontages were developed to demonstrate the visual impact from various vantage points within these regions. Photomontages depict the modification to views as a result of the proposed WPP, and aid in the assessment of overall visual impacts.

The 3D modelling was utilised to create the photomontages and consisted of:

- Using ERDAS Imagine Virtual GIS (a 3D modelling software program), the DEM was overlaid with colour aerial photography;
- A two dimensional “Autocad” drawing of the proposed WPP was imported into ERDAS, with structure heights of the most visible plant structures extruded to create a three dimensional model of the fully developed WPP;
- Representative tree models were digitised and imported around the proposed site and where necessary, in front of chosen vantage points, to cater for vegetated areas identified in aerial or land based photography (for existing vegetation scenario);
- Proposed screening trees (for landscaping scenario only);

- Representative buildings were digitised and imported around the proposed WPP footprint and, where necessary, in front of chosen vantage points. Houses were extruded by five metres, whilst sheds were extruded by three metres. In these situations the building outlines were shown as solid blocks only;
- Identified vantage points were marked using a hand held GPS unit and these positions used to generate snapshots within the model; and
- These snapshots were then placed against real-life photos.

As the snapshots are generated at an approximate head height for a viewer, the foreground is often poorly represented as a consequence of the image quality of the aerial photography. To overcome this problem, the foreground of the real-life photograph has been superimposed on the snapshot to further enhance the visual representation. In this way, the WPP image remains correct in scale, location and representation, and the snapshots provide a more realistic image.

2.2.3 Assessing the Visual Impact

GHD methodology for visual impact assessment is based on well accepted methods for impact assessment (Zube *et al*. 1975, Williamson 1979, Williamson 2004) and were used with appropriate modification to meet the requirements of this study. Specifically, the assessment has considered:

- The type of viewer (resident, tourist, highway user etc);
- Distance from the proposed WPP;
- Period of time that they will have this view (that is, a glimpse or an extended view from a residence);
- The physical modification of the view as measured by change to the centre field of view;
- The sensitivity of that view (a combination of context and distance); and
- An overall assessment of the visual impact on a low, moderate or high scale.

Visual Modification

A central field of view is considered to be an arc of 50°. Based on the GIS assessment, the proportion of this arc taken up by the proposed WPP was estimated and a visual modification impact value assigned. Where the 3D modelling indicated that only portions of the WPP would be visible from a given location, this assessment has looked at only that part of the site in assessing the change to the field of view. Impacts from changes to the field of view are detailed in Table 3.

Table 3 Changes to Field of View

Change to Field of View	Impact
Less than 5° of view	*Low* The development will take up less than 5% (that is 2.5°) of the central field of view (50°). The development, unless particularly conspicuous against the background, will not intrude significantly into the view.
5° to 30° of view	*Medium* The development may be noticeable, and its degree of visual intrusion will depend greatly on its ability to blend in with its surroundings.
More than 30° of view	*High* Developments that fill more than 50% of the central field of vision will always be noticed, and only sympathetic treatments will mitigate visual effects.

Viewer Sensitivity

Viewer sensitivity for a development is subject to the context of the view, the number of viewers and distance from it. If the viewer sees a major industrial facility in the context of a natural area, they are more likely to have experienced a greater impact than if they were viewing in the context of an industrial site. Viewer expectations of a visual experience area also considered. While some areas of scenic beauty (for example a remote National Park) may have low numbers of viewers, the viewer expectation will be one of attractive scenery and high scenic quality.

Distance from an object plays a significant role in reducing sensitivity. Due to perspective, the visible size of an object reduces with distance. As the distance from the object increases, the ability to perceive contrast between features diminishes, as does the perception of colour. As the distance to the view increases, discernable visual detail decreases and the size of the object in the field of view is reduced and the capacity to screen the object is increased.

Table 4 Viewer Sensitivity for Developments

Viewer Context	Period of View	Number of Viewers	Foreground 0 – 1 km	Middleground 1 – 3 km	Background > 3 km
Residential:					
- Rural	Long	Low	High	High – Moderate	Moderate
- Low/Medium Density	Long	Moderate	High - Moderate	Moderate	Moderate - Low
- High Density	Long	High	High - Moderate	Moderate	Moderate - Low
Recreational:					
- Natural Areas (e.g. National Parks)	Medium	Moderate	High	High	Moderate
- Recreational Areas (e.g. Golf Courses, Parks)	Medium	Moderate	High - Moderate	Moderate	Moderate - Low
Business:					
- Commercial Areas (e.g. CBD)	Long	High	High - Moderate	Moderate	Low
- Industrial Areas	Long	Moderate	Low	Low	Low
- Agricultural Areas	Long	Low	Moderate	Low	Low
Roads:					
- Tourist Roads	Short	Moderate	High - Moderate	Moderate - Low	Low
- Other Roads	Short	High - Low	Moderate	Moderate	Low

Visual Impact Rating

By assessing visual modification and viewer sensitivity, an overall visual impact assessment is possible. The matrix provided in Table 5 has been used as the basis for assigning visual impacts.

Table 5 Visual Impact Assessment Matrix

		Viewer Sensitivity		
		High	**Moderate**	**Low**
Visual Modification	**High**	High	High	Moderate
	Medium	High	Moderate	Low
	Low	Moderate	Low	Low

3. Results

When assessing the visual impact of each vantage point the mitigation measures listed in Section 1.2 (siting of the WPP in an area containing like infrastructure, placement of the WPP footprint within the site to allow maximum retention of vegetation, sympathetic building design and materials etc.) were considered incorporated into the concept design, and hence assessed as part of this study.

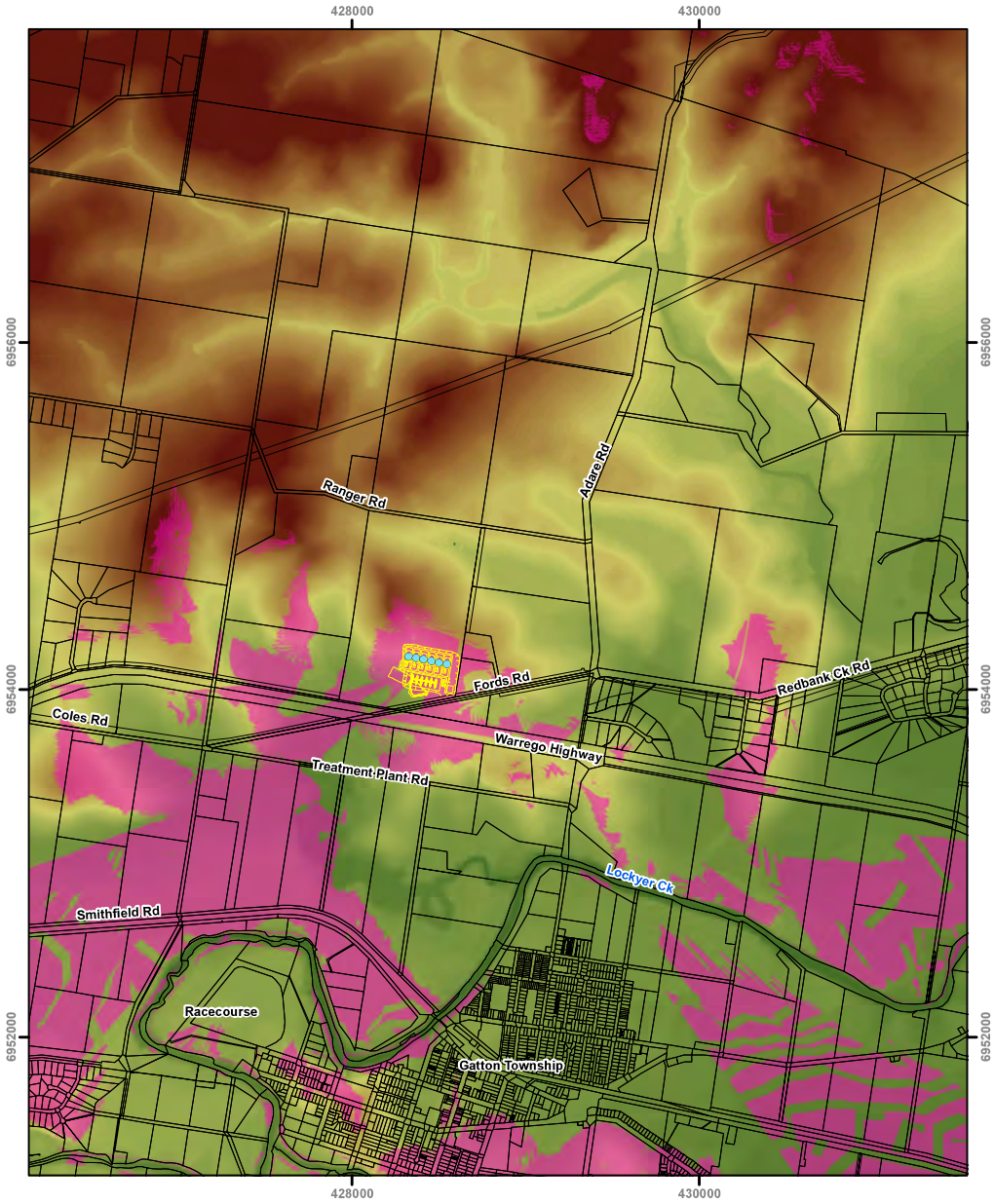
The WPP viewshed analysis identified areas where the proposed WPP, or parts of it, may be visible. Figure 14 contains the viewshed analysis results; portions highlighted in magenta represent areas where the proposed WPP, or parts of it, may be visible.

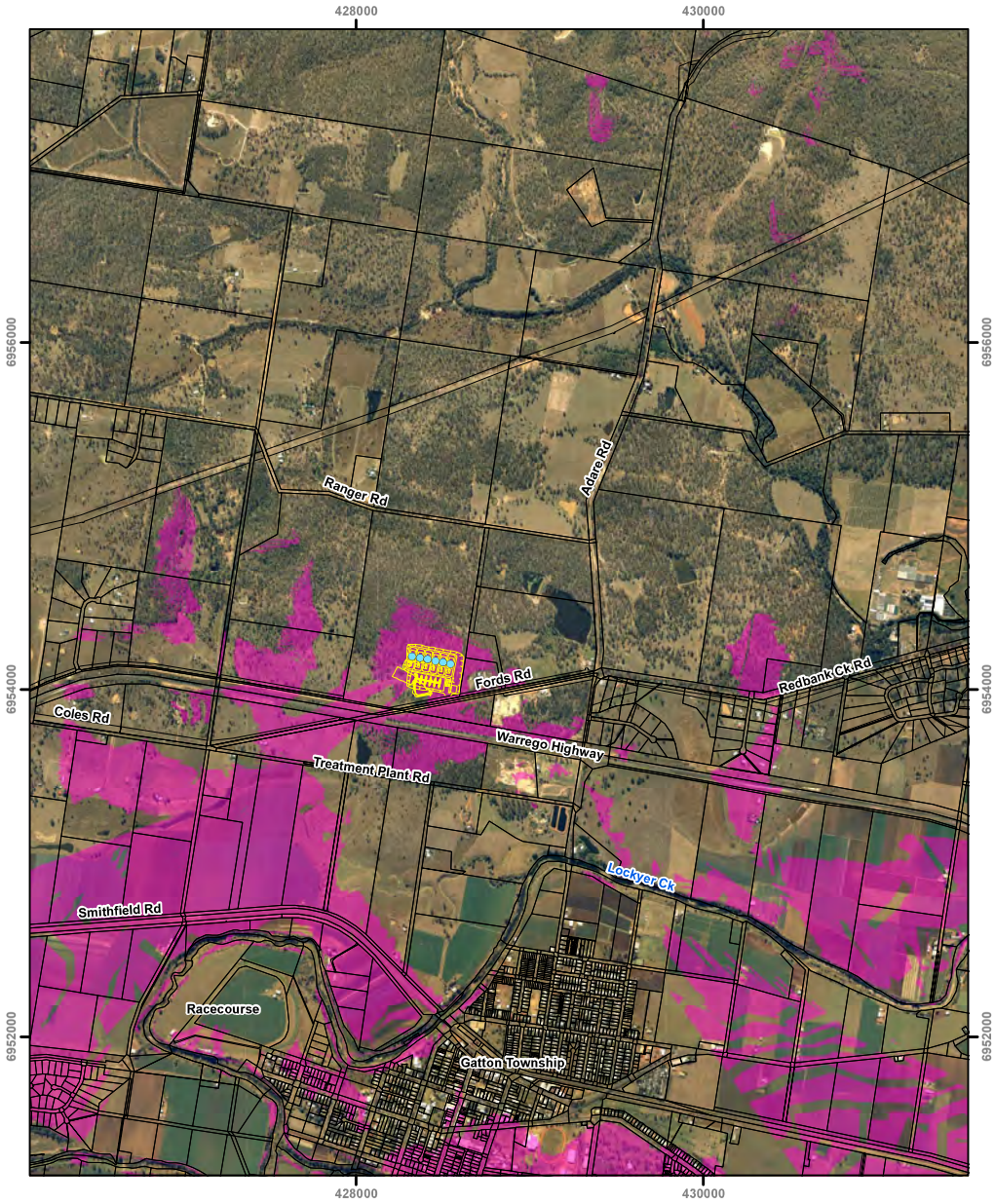
Using the following criteria 12 vantage points were selected as they:

- Provided a good representation from nearby residences that may potentially see the proposed WPP (it should be noted the selected vantage points were from public areas only, no private properties were accessed); or
- Provided a good representation from highly frequented public areas such as the Warrego Highway, residential estates, golf courses, or elevated areas throughout the Township of Gatton.

Figure 15 shows the areas where vantage points were selected to provide an overall assessment of the potential visual impacts from the proposed WPP.

Several vantage points selected demonstrated that the proposed WPP was unlikely to be visible due to topography and/or vegetation constraints (particularly areas to the north of the site). Photomontages were generated for each vantage point where infrastructure from the proposed WPP was expected to be visible (as indicated from the 3D model). The photomontages generated for each vantage point are located in Appendix A.





1:30,000

0 250 500 750 1,000

Metres

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

N

GHD

CLIENTS | PEOPLE | PERFORMANCE

Legend

Stacks

Viewshed

Areas that may have potential views of the stacks

Proposed WPP Footprint

Elevation (metres)

High : 205

Low : 0

Assumptions: Viewsheds are indicative only. Minor variations may be due to

1. Vegetation clearing or planting since 2001 in which the aerial photography was taken

2. Individual trees, small clumps of trees and buildings/structures have not been integrated into the model

3. Digital elevation model was based on 5m contours

4. Surrounding vegetation was assumed at 15m high

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

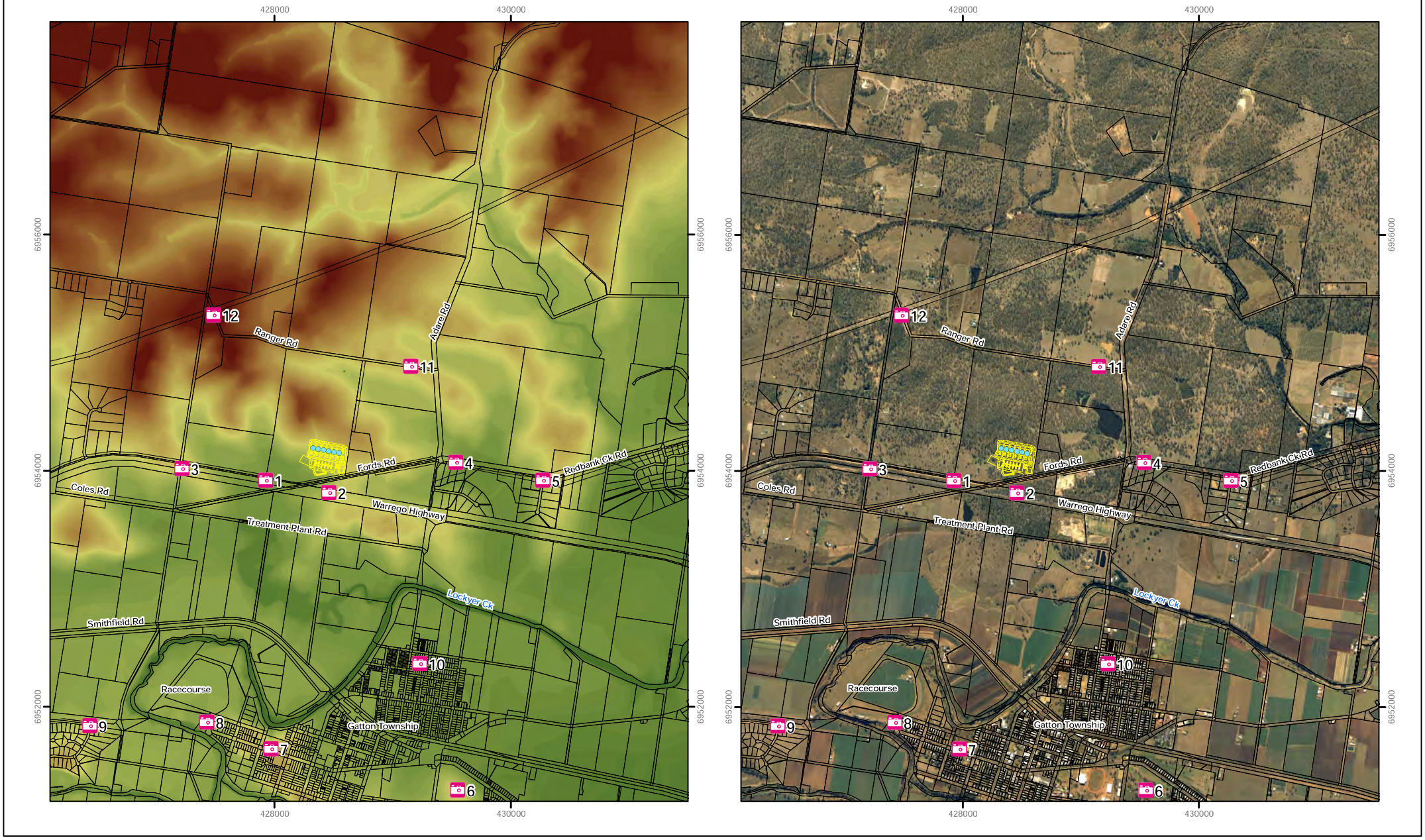
Figure 14

Viewshed Analysis

G:\41\21379\gis\map\rev2\fig4_viewshed.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), DEM derived from 5m contours (DERM), Detailed site survey (Westlink) and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gypmail@ghd.com.au W www.ghd.com.au



1:30,000

0 250 500 750 1,000

Metres

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

N

GHD

CLIENTS | PEOPLE | PERFORMANCE

Legend

- Stacks
- Vantage Points
- Proposed WPP Footprint

Elevation (metres)

High : 205

Low : 0

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure 15

Vantage Point Locations

G:\41\21379\gis\map\rev2\fig15a_vantagepoints.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), DEM derived from 5m contours (DERM), Detailed site survey (Westlink) and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

3.1 Visual Impacts from Viewsheds

The photomontages for the 12 vantage points are located in Appendix A and discussed below.

Warrego Highway

The Warrego Highway runs adjacent to the southern boundary of the site, with the site visible from travellers moving in east and west directions.

Users of the Warrego Highway travelling west (from Brisbane to Toowoomba) would be expected to only have glimpses of the WPP (represented in Vantage Point 2). While the site would be in the viewers foreground it would be shielded by existing vegetation between the highway and the site, and vegetation located in the median strip between the east and west lanes of the highway. In a visual context, travellers moving west would have views of the Gatton Landfill and the Energex Bulk Sub Station, and these form the prominent impact through that area.

Users of the Warrego Highway travelling east (from Toowoomba to Brisbane) would be expected to see portions of the WPP, though only when the site enters the foreground (closer than one kilometre). In a visual context the traveller would then pass the proposed WPP and have views of the Energex Bulk Sub Station and the Gatton Landfill. The view of the WPP would be of a short duration and in the visual context of the area is considered a low impact.

Residential Areas and Activities to the East

The closest residential area to the proposed WPP lies approximately one kilometre to the east. Topography of the area, coupled with existing vegetation, indicates that this area would not be able to view any of the WPP infrastructure (Vantage Point 4).

Further to the east lie more residences and commercial operations (such as Pohlman's Plant Nursery). This area is more elevated than the residents closer to the WPP. 3D modelling (Vantage Point 5) indicates that the existing vegetation, separation distance (greater than 1.5 kilometres), and topography would obstruct any views of the WPP.

Residential Areas and Activities to the West and North

The topography of the overall site includes a large hilly area north of the proposed WPP footprint, within the overall Development Site, and visually shields residences to the north from the infrastructure. To the west, topography is also elevated between residences and the proposed WPP footprint.

The topography, in combination with existing vegetation, obstructs views of the proposed WPP (Vantage Points 3, 11 and 12).

Residential Areas and Activities to the South

South of the Development Site is the Township of Gatton; incorporating residential areas, commercial operations and industrial activities.

Elevated areas in and around Gatton have the potential to view the proposed WPP. Vantage Point 10 assessed the closest medium density residential district. The 3D modelling indicates that elevation in the topography south of the Warrego Highway and existing vegetation would obstruct views of the proposed WPP from this vantage point.

Elevated areas in and around Gatton have the potential to view the proposed WPP.

Vantage Points 7 and 9 were assessed as the most elevated residential areas south of the proposed WPP. The 3D modelling indicates that the tallest infrastructure (stacks and air intakes) will be visible and appear in the viewers' far middleground to background region (between 2.5 to 3 kilometres away). Views of this infrastructure would be dependent on localised obstructions (such as other houses, sheds and vegetation). With the design mitigation measures incorporated the proposed WPP it is not expected to significantly intrude into the view.

Public areas with a potential view of the tallest infrastructure associated with the proposed WPP include the Gatton Golf Course and the Gatton Racecourse (Vantage Points 6 and 8). Viewers at these venues are 2.5 kilometres or more from the proposed development and would not be expected to experience a high or moderate level of modification to the existing view. Existing vegetation and other structures between these sites and the proposed WPP place reduce the already low visual impact of the proposed WPP.

3.2 Visual Impact Assessment

Based on the methodology outlined in Section 2.2 a visual assessment of each Vantage Point was completed (refer to Table 6).

Table 6 Visual Impact Assessment

Vantage Point	Viewer Type	Context of View	Period of View	Number of Viewers	Distance	Visual Modification	Sensitivity of View	Visual Impact Rating
1	Motorist, tourist	Other roads, views from highway (east bound)	Short	High	500 metres	Medium	Moderate	Moderate
2	Motorist, tourist	Other roads, views from highway (west bound)	Short	High	330 metres	Low	Moderate	Low
3	Motorist, tourist, residential	Other roads, views from highway (east bound)	Short	High	1,200 metres	Low	Low	Low
		Rural residential outlook	Long	Low		Low	High - Moderate	Moderate - Low
4	Residential	Rural residential outlook	Long	Low	1,000 metres	WPP will not be visible (refer Appendix A)		
5	Residential	Rural residential outlook	Long	Low	1,750 metres	WPP will not be visible (refer Appendix A)		
6	Recreational	Recreational area, view from golf course	Medium	Moderate	3,000 metres	Low	Moderate - Low	Low
7	Residential	Low to Medium density residential outlook	Long	Moderate	2,500 metres	Low	Moderate	Low
8	Recreational	Recreational area, view from racecourse	Medium	Moderate	2,500 metres	Low	Moderate	Low
9	Residential	Low to Medium density residential outlook	Long	Low	3,000 metres	Low	Moderate	Low
10	Residential	Low to Medium density residential outlook	Long	Low	1,900 metres	WPP will not be visible (refer Appendix A)		
11	Residential	Rural residential outlook	Long	Low	1,000 metres	WPP will not be visible (refer Appendix A)		
12	Residential	Rural residential outlook	Long	Low	1,450 metres	WPP will not be visible (refer Appendix A)		

4. Further Mitigation Measures

The project would introduce power generation infrastructure into an area that consists of complimentary infrastructure. To mitigate the visual impact of the proposed WPP, Westlink has incorporated a number of mitigation measures into the concept design, including:

- A detailed site selection to locate the WPP adjacent to infrastructure of a similar nature. The site selected is adjacent to the APA Gatton Compressor Station, opposite the Energex Bulk Supply Sub-station, and near the Gatton Landfill, allowing the WPP to be situated in an area of similar visual context;
- Location of the WPP footprint within the Development Site to minimise vegetation clearing, and utilise topography and existing vegetation as a visual barrier; and
- Sympathetic building design, including using non-reflective building materials and appropriate colour schemes to minimise the extent to which the most prominent features (air intakes and stacks) would be visible within the local area.

To further mitigate visual impacts in the foreground of the project area, primarily for users of the Warrego Highway and land use directly south of the Warrego Highway, it is proposed to landscape the site and create a visual buffer.

4.1 Landscaping

Mitigation of negative visual amenity can in part be achieved through successful revegetation of areas surrounding the proposed WPP development, particularly along the southern property boundary. Planting of native/endemic species must be a priority for any landscape/revegetation scheme. Provision of tree species that grow to a mature height of greater than 20 metres and have large canopy spread would provide effective screening. The mature height would be achieved over an approximate ten to fifteen year period, assuming a new growth rate of approximately 1.8 to 3.6 metres annually.

Conics (2009) list suitable native species, which should be used for buffer planting, screening and revegetation, such as *Eucalyptus* and *Corymbia species*. Planting for screening and revegetation purposes should allow a minimum separation distance of 20 metres between trees and infrastructure.

An existing belt of shrubs on the southern property boundary should be enhanced through installation of new shrub specimens' native/endemic to the site such as *Jacksonia* and *Hovea*. Planting of these species this would add to the density and size of the belt and provide a greater level of screening.

Where possible, native species should be planted to retain the existing landscape character and enhance natural habitats on site. A concept landscape plan has been developed to allow creation of photomontages with revegetation measures and determine the reduction in visual impact from doing so. The concept landscaping is shown in Figure 16; Appendix A contains the photomontages for each vantage point with revegetation mitigation measures applied.

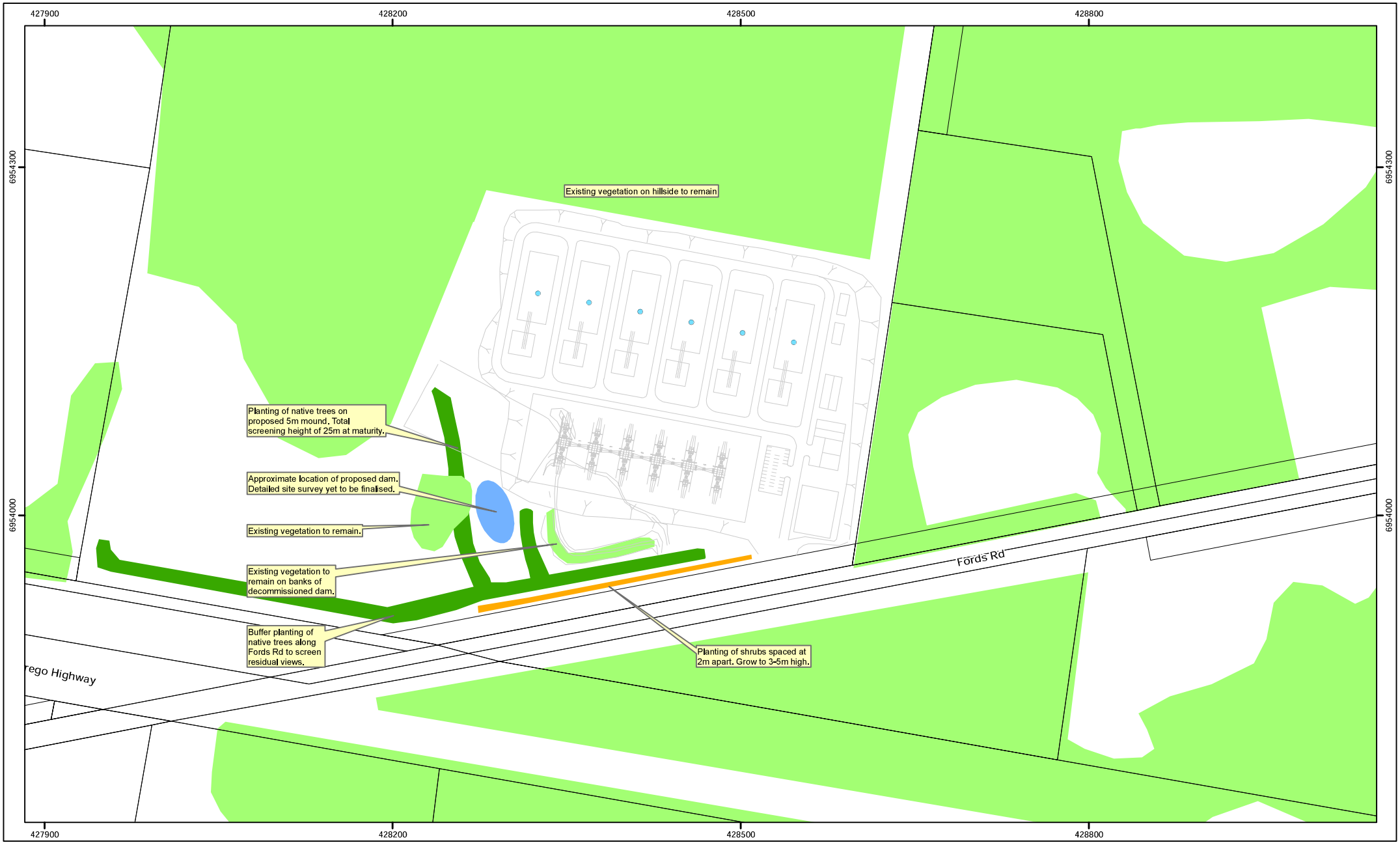
Revegetation with native/endemic species would enhance the natural habitat and support diversity of flora and fauna on site.

4.2 Visual Impacts after Additional Mitigation Measures

An assessment of the visual impact after implementation of concept landscape plan would result in the lessening of the visual modification for Vantage Point 1 to Low through a reduction in the amount of visual modification. Hence, the impact of the users of the Warrego Highway would be reduced to Low.

The remainder of the visual impacts assessed (Vantage Points 2 to 12) ratings remain unchanged. However, it should be noted that while most of these points have a viewer sensitivity of Moderate they would typically only be able to see the taller infrastructure (air intakes and stacks) and would not be significantly visually impacted by the project. With the design mitigation measures incorporated the proposed WPP is not expected to be particularly conspicuous against the background and is not expected to significantly intrude into the view.

Vantage Points 4, 5, 10, 11 and 12 would not be able to view any infrastructure and would not be visually impacted by the project.



1:3,000

0 20 40 60 80 100

Metres

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

N

GHD

CLIENTS | PEOPLE | PERFORMANCE

Legend

- Stacks
- Proposed WPP Footprint
- Cadastre
- Existing vegetation
- Proposed planting of tree species
- Proposed planting of shrub species

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Westlink Power Project
Visual Impact Assessment

Figure 16

Landscape Concept Plan

G:\41\21379\gis\map\rev2\fig11_landscaping.mxd

Data source: Cadastre Feb 2009 (DERM), Landscape Concept Plan and Proposed WPP Design (GHD) and Detailed site survey (Westlink).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

5. Conclusion and Recommendations

5.1 Conclusion

A VIL Assessment was conducted to determine the potential visual impact of the WPP. Incorporated into the assessment were design mitigation measures to lessen the potential visual impact of the WPP, including:

- A detailed site selection to locate the WPP adjacent to infrastructure of a similar nature. The site selected is adjacent to the APA Gatton Compressor Station, opposite the Energex Bulk Supply Sub-station, and near the Gatton Landfill, allowing the WPP to be situated in an area of similar visual context;
- Location of the WPP footprint within the Development Site to minimise vegetation clearing, and utilise topography and existing vegetation as a visual barrier;
- Sympathetic building design, including using non-reflective building materials and appropriate colour schemes to minimise the extent to which the most prominent features (air intakes and stacks) would be visible within the local area; and
- Landscaping of the Development Site is also proposed to mitigate impact to views in the foreground (closer than one kilometre) of the WPP.

Eastbound users of the Warrego Highway would experience the greatest visual impact, although only for short periods while passing. The impact is Low post landscaping for this vantage and the proposed WPP is located among like infrastructure, which is also visible from the highway. After full maturity of the proposed vegetation landscaping the photomontage depicts that only portions of the tallest infrastructure may be visible.

Vantage points that would experience the WPP as a component of the background may experience Moderate to Low visual impact. With the design mitigation measures incorporated the proposed WPP is not expected to be particularly conspicuous against the background and is not expected to significantly intrude into the view.

Five of the assessed vantage points would not view the proposed WPP.

Overall, the proposed WPP is assessed to have a Low impact on the visual amenity of the area. In a visual context, the site location is consistent with the surrounding land uses and as such the development is not anticipated to alter visual perceptions of that area.

5.2 Recommendations

Prior to construction of the WPP it is recommended that the concept landscape plan be developed into a detailed landscaping plan which would include:

- Confirmation of screening and buffer revegetation locations;
- Specification of native flora for revegetation;

- Specification of appropriate quantities of plants; and
- Specification and design of the proposed dam and other bunding options.

6. References

Bureau of Meteorology (2009) Climate data online, website <http://www.bom.gov.au/climate/averages/tables/cw_040082_all.shtml>, accessed 22/05/09.

Conics (2009) *Westlink Pty Ltd Detailed Ecological Assessment Lot 191 CSH2361, Ford's Road, Gatton,* Prepared for Westlink Pty Ltd April 2009.

Forman R.T.T., Godron M. (1986) *Landscape Ecology,* John Wiley & Sons, Inc.

GHD (2009), *Concept Geotechnical Assessment*, Prepared for Westlink Pty Ltd, June 2009.

Katestone Environmental Pty Ltd (2009) *Aviation Safety Assessment of the Proposed Power Station, Rangers Road, Adare*, Prepared for Solstice Development Services, April 2009.

Katestone Environmental Pty Ltd (2009) *Fatal Flaws Air Quality Assessment for the Proposed Power Station, Ranger Road, Adare*, Prepared for Solstice Development Services, April 2009.

McDonald R.C., Isbell R.F., Speight J.G., Walker J., Hopkins M.S. (1990) *Australian Soil and Land Survey,* Field Handbook, Second Edition, Inkata Press.

Williamson D. N. (1979) *Scenic Perceptions of Australian Landscapes: Research Needs in a New Frontier*. Landscape Australia, Volume 2: 94 – 101.

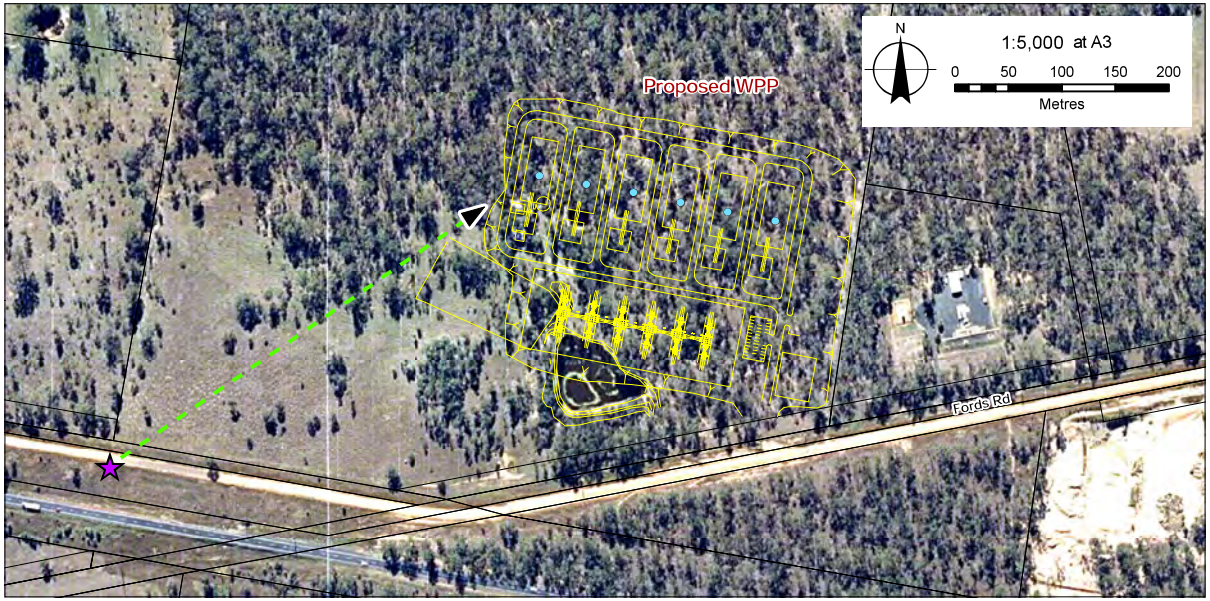
Williamson (2004) *Guide to Visual Effects Assessment: A State of the Art Review and Introduction to the Scenic Spectrums Visual Evaluation Model (SS-VEM)*.

Zube, E.H., Pitt, D.G. and Anderson, T.W. (1975) *Perception and prediction of scenic resource values of the North-east*. In E.N. Zube, R.O. Brush and J.G. Fabos (eds), Landscape Assessment: Values, Perceptions and Resources. Stroudsburg: Dowden Hutchinson and Ross, 151 – 167.

Appendix A

Photomontages

Site Photo - May 2009



Location of Vantage Point 1

Photomontage with Proposed WPP (no landscaping)

Photomontage of Proposed WPP (with landscaping after 10-15 years)

Please Note: Photomontages are indicative only.
Assumptions include:

1. Existing surrounding vegetation was assumed at 15m high
2. The mature height of planted vegetation on-site (approximately 20m) would be achieved over an approximate 10-15 year period or/at an approximate rate of 1.8-3.6m of new growth per year (subject to rainfall and climatic conditions).
3. The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 5 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout).

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 1
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure A1

Vantage Point 1
Fords Road

G:\41\21379\gis\map\rev2\figA1_vantage1.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009

Location of Vantage Point 2

Photomontage with Proposed WPP (no landscaping)

Photomontage of Proposed WPP (with landscaping after 10-15 years)

Please Note: Photomontages are indicative only.
Assumptions include:

1. Existing surrounding vegetation was assumed at 15m high
2. The mature height of planted vegetation on-site (approximately 20m) would be achieved over an approximate 10-15 year period or/at an approximate rate of 1.8-3.6m of new growth per year (subject to rainfall and climatic conditions).
3. The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 5 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout).

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 2
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure A2

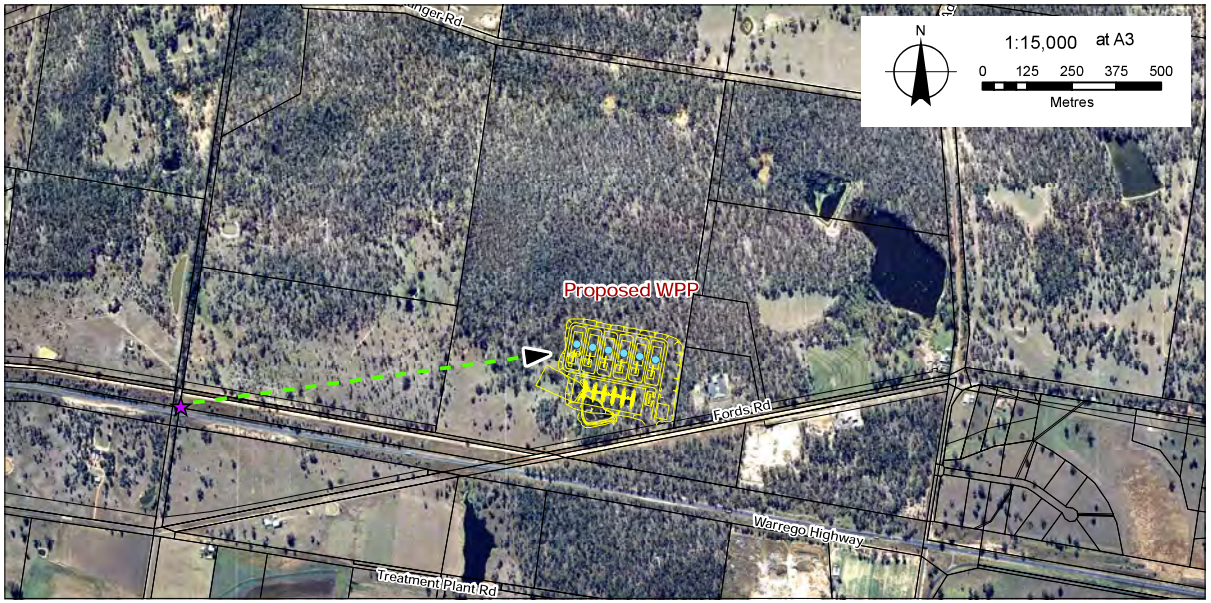
Vantage Point 2
Warrego Highway

G:\41\21379\gis\map\rev2\figA2_vantage2.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), DEM derived from 5m contours (DERM) and detailed site survey (Westlink), Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 3

Photomontage with Proposed WPP (no landscaping)

Photomontage of Proposed WPP (with landscaping after 10-15 years)

Please Note: Photomontages are indicative only.
Assumptions include:

1. Existing surrounding vegetation was assumed at 15m high
2. The mature height of planted vegetation on-site (approximately 20m) would be achieved over an approximate 10-15 year period or/at an approximate rate of 1.8-3.6m of new growth per year (subject to rainfall and climatic conditions).
3. The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 5 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout).

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 3
- Proposed WPP Footprint

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Westlink Power Project
Visual Impact Assessment

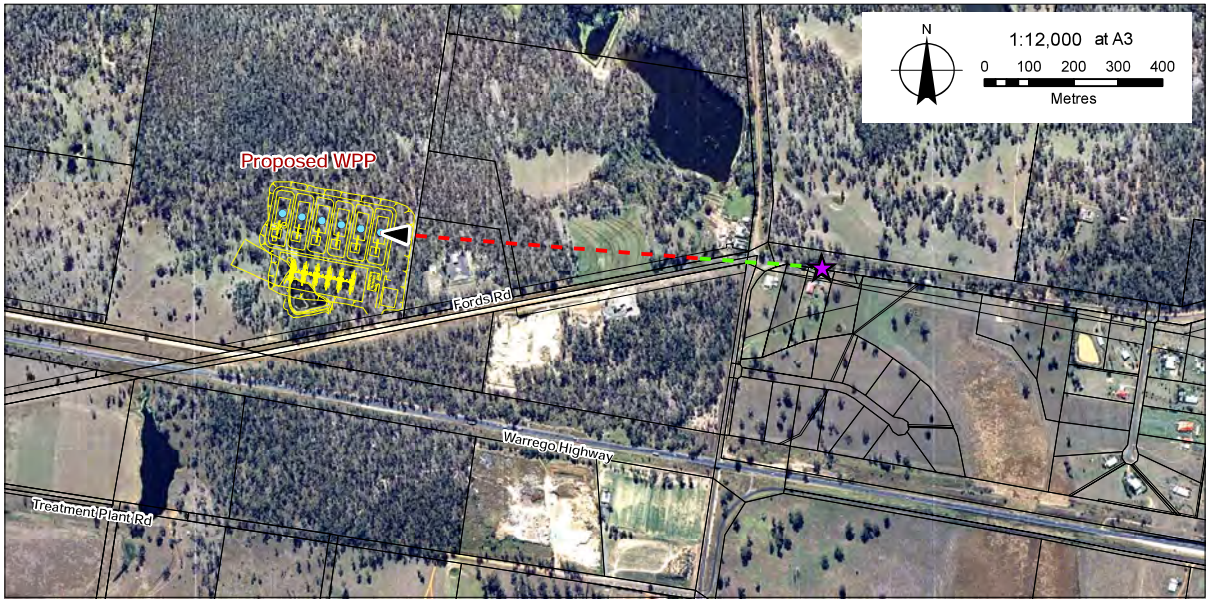
Figure A3
Vantage Point 3
Warrego Highway (Heading East)

G:\41\21379\gis\map\rev2\figA3_vantage3.mxd

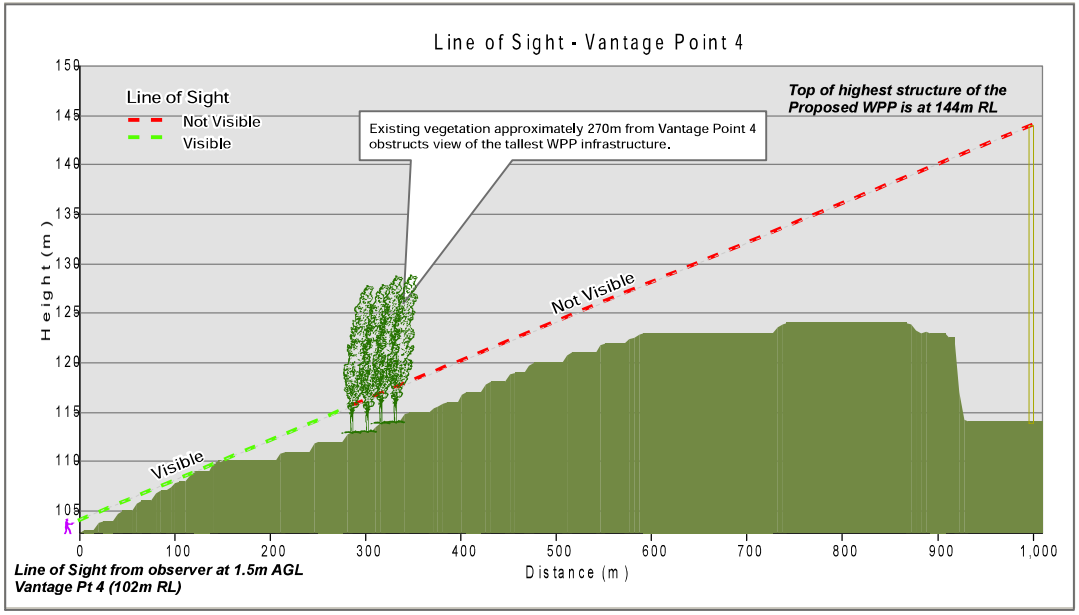
Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 4



Terrain profile demonstrating the Proposed WPP will not be visible from Vantage Point 4

View from Vantage Point 4 is expected to be unaltered by installation of the Proposed WPP

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 4
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure A4

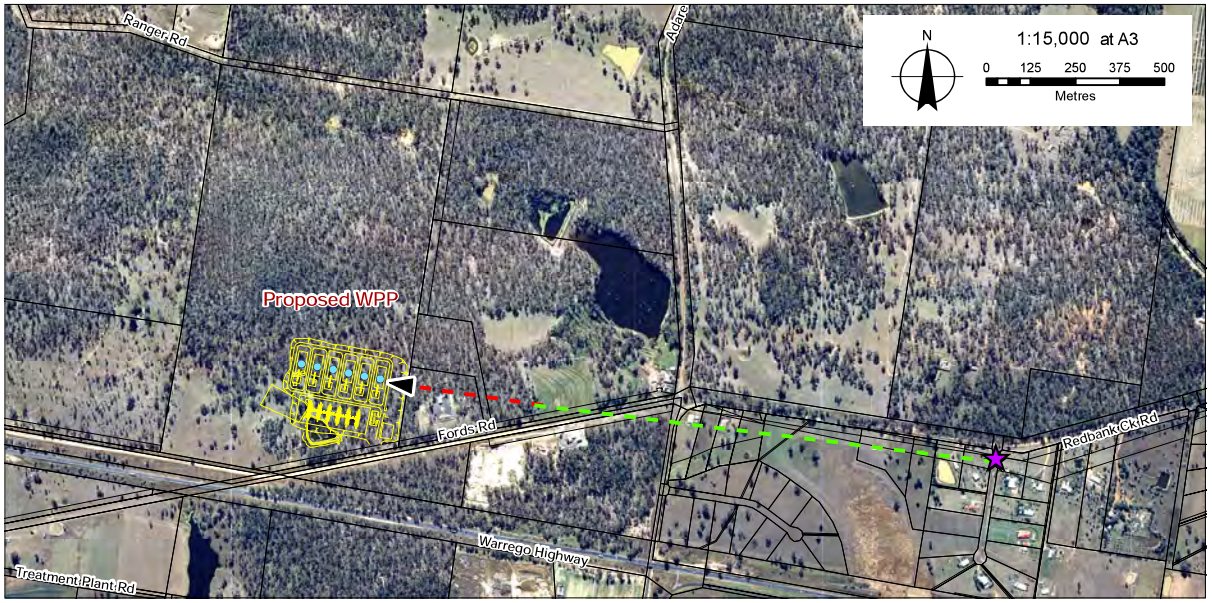
Vantage Point 4
Redbank Creek Rd

G:\41\21379\gis\map\rev2\figA4_vantage4.mxd

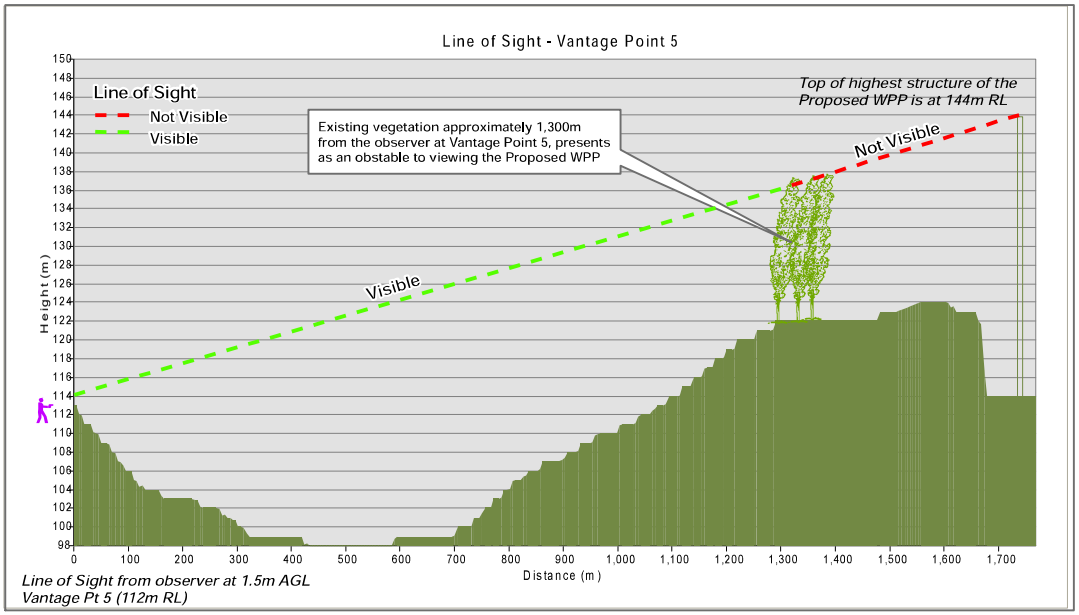
Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Terrain Profile derived from 5m contours (DERM) and Detailed site survey (Westlink), Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 5



Terrain profile demonstrating the Proposed WPP will not be visible from Vantage Point 5

View from Vantage Point 5 expected to be unaltered by installation of the Proposed WPP

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 5
- Proposed WPP Footprint

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Westlink Power Project
Visual Impact Assessment

Figure A5

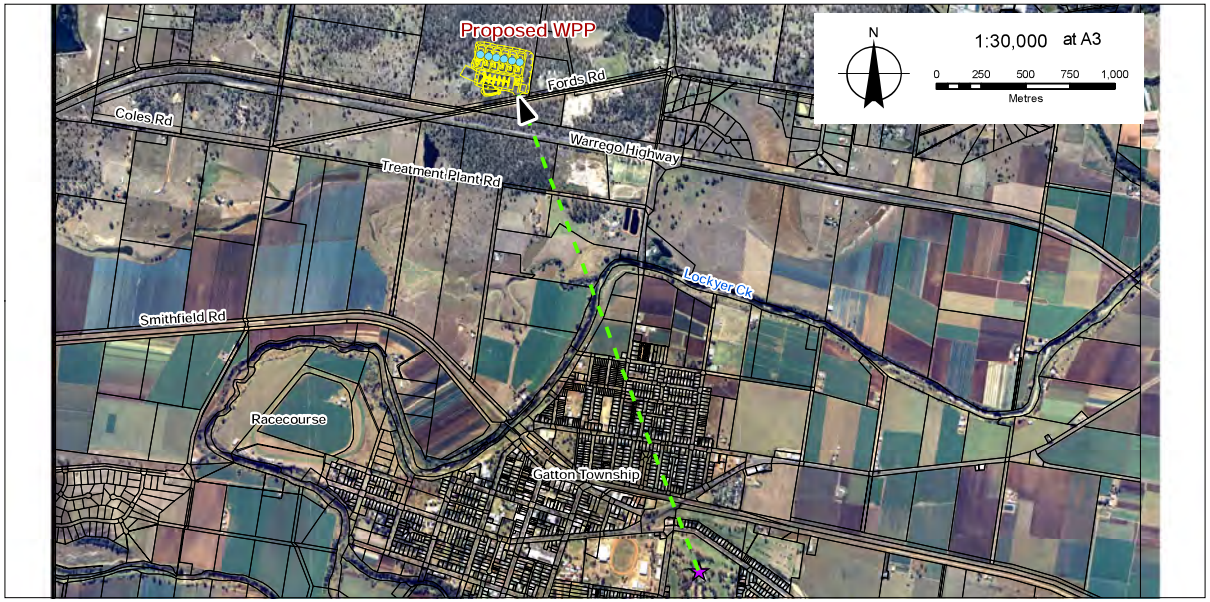
Vantage Point 5
Deroydon Court (Entrance)

G:\41\21379\gis\map\rev2\figA5_vantage5.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Terrain Profile derived from 5m contours (DERM) and Detailed site survey (Westlink), Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 6

Photomontage with Proposed WPP (no landscaping)

Photomontage of Proposed WPP (with landscaping after 10-15 years)

Please Note: Photomontages are indicative only.
Assumptions include:

1. Existing surrounding vegetation was assumed at 15m high
2. The mature height of planted vegetation on-site (approximately 20m) would be achieved over an approximate 10-15 year period or/at an approximate rate of 1.8-3.6m of new growth per year (subject to rainfall and climatic conditions).
3. The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 5 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout).

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 6
- Proposed WPP Footprint

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Westlink Power Project
Visual Impact Assessment

Figure A6

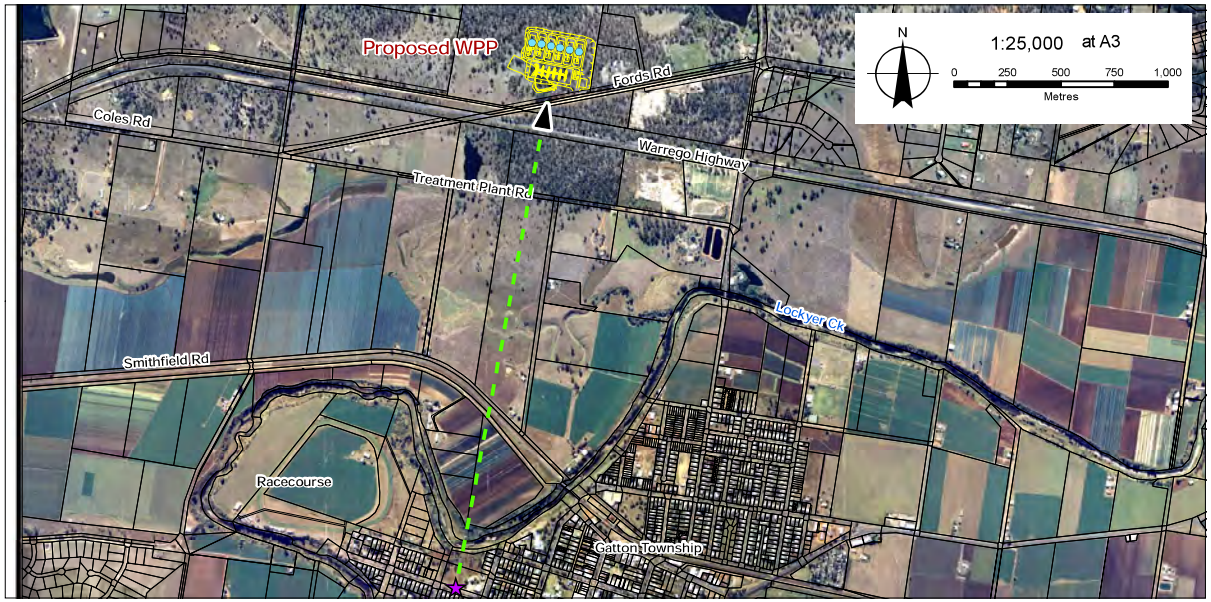
Vantage Point 6
Golf Course

G:\41\21379\gis\map\rev2\figA6_vantage6.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 7

Photomontage with Proposed WPP (no landscaping)

Photomontage of Proposed WPP (with landscaping after 10-15 years)

Please Note: Photomontages are indicative only.
Assumptions include:

1. Existing surrounding vegetation was assumed at 15m high
2. The mature height of planted vegetation on-site (approximately 20m) would be achieved over an approximate 10-15 year period or/at an approximate rate of 1.8-3.6m of new growth per year (subject to rainfall and climatic conditions).
3. The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 5 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout).

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 7
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure A7

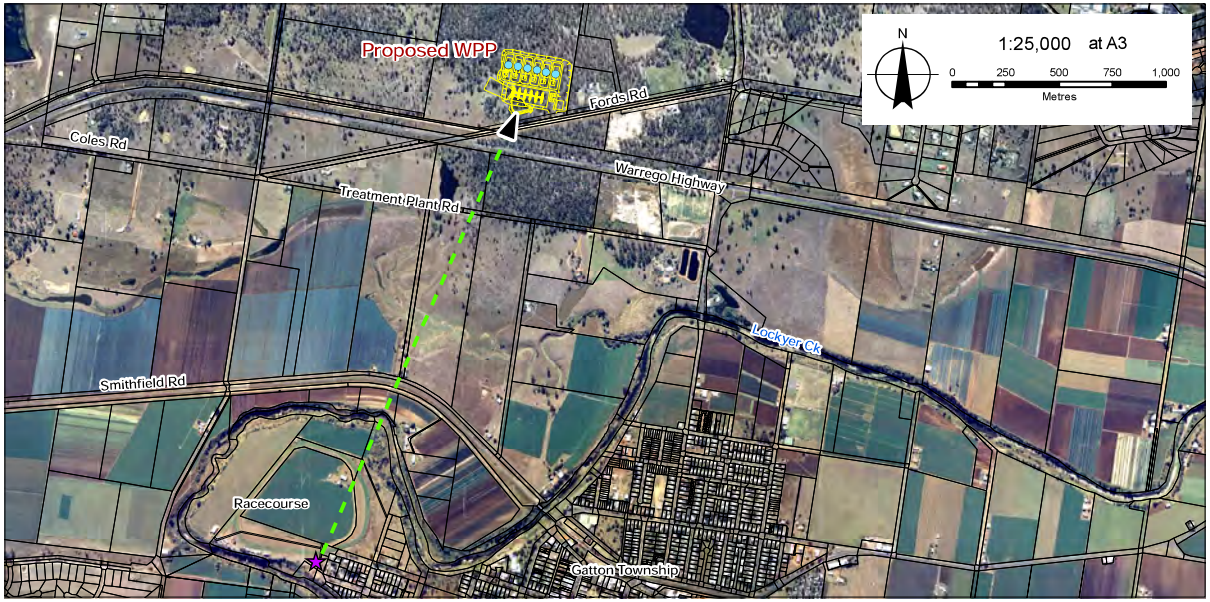
Vantage Point 7
Spencer St

G:\41\21379\gis\map\rev2\figA7_vantage7.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 8

Photomontage with Proposed WPP (no landscaping)

Photomontage of Proposed WPP (with landscaping after 10-15 years)

Please Note: Photomontages are indicative only.
Assumptions include:

1. Existing surrounding vegetation was assumed at 15m high
2. The mature height of planted vegetation on-site (approximately 20m) would be achieved over an approximate 10-15 year period or/at an approximate rate of 1.8-3.6m of new growth per year (subject to rainfall and climatic conditions).
3. The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 5 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout).

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 8
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure A8

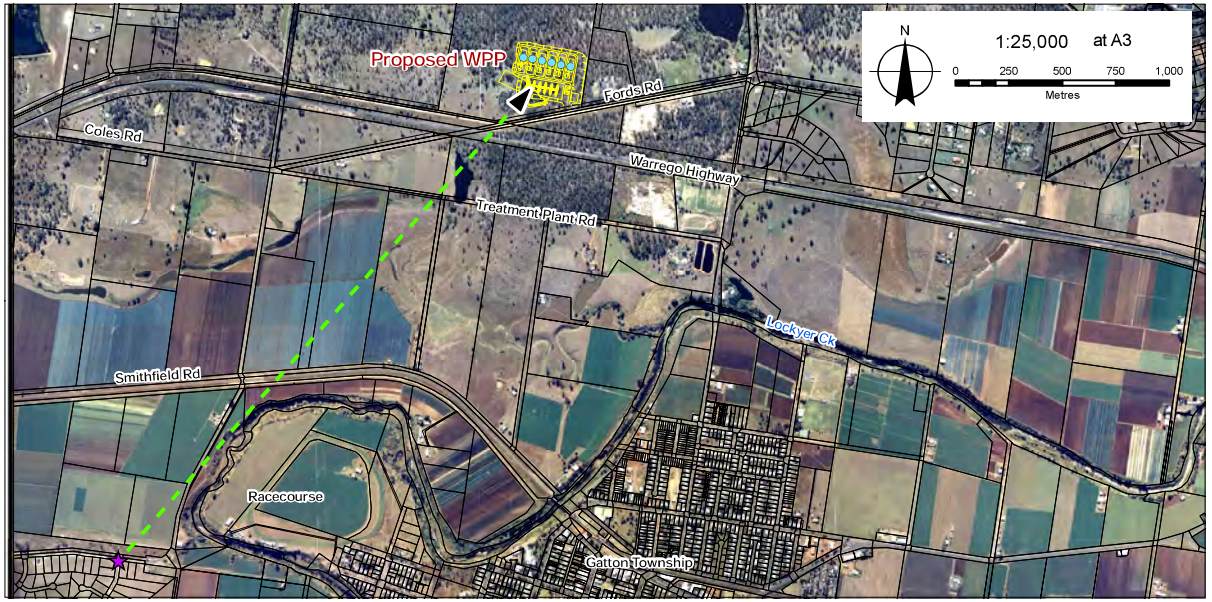
Vantage Point 8
Gatton Racecourse

G:\41\21379\gis\map\rev2\figA8_vantage8.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 9

Photomontage with Proposed WPP (no landscaping)

Photomontage of Proposed WPP (with landscaping after 10-15 years)

Please Note: Photomontages are indicative only.
Assumptions include:

1. Existing surrounding vegetation was assumed at 15m high
2. The mature height of planted vegetation on-site (approximately 20m) would be achieved over an approximate 10-15 year period or/at an approximate rate of 1.8-3.6m of new growth per year (subject to rainfall and climatic conditions).
3. The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 5 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout).

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 9
- Proposed WPP Footprint

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Westlink Power Project
Visual Impact Assessment

Figure A9 Vantage Point 9
Old Toowoomba Rd and Parklea Dr

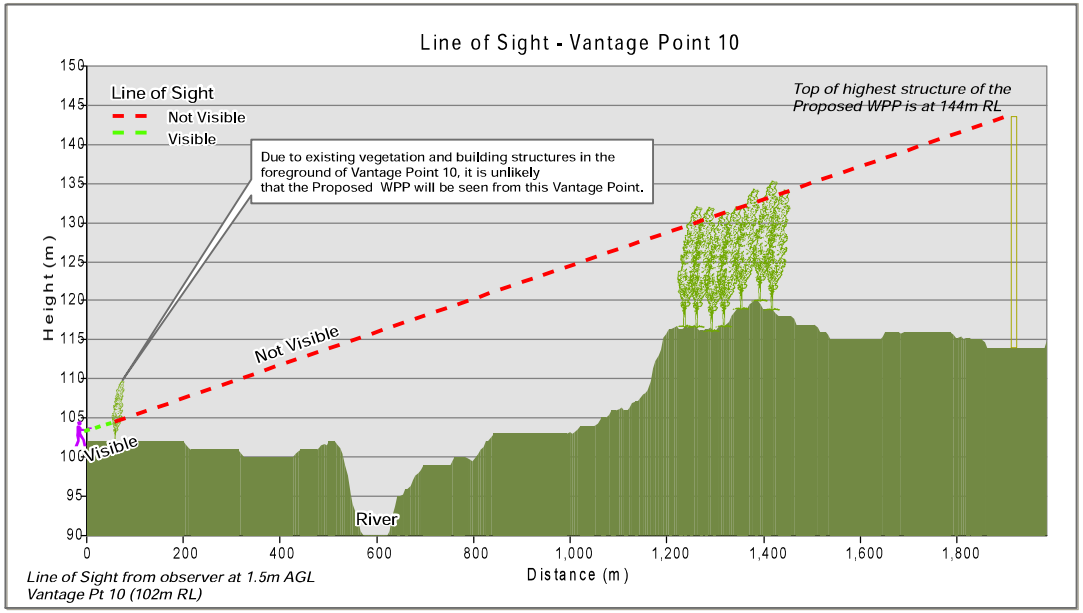
G:\41\21379\gis\map\rev2\figA9_vantage9.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009

Location of Vantage Point 10



Terrain profile demonstrating the Proposed WPP will not be visible from Vantage Point 10

View from Vantage Point 10 is expected to be unaltered by installation of the Proposed WPP

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 10
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure A10

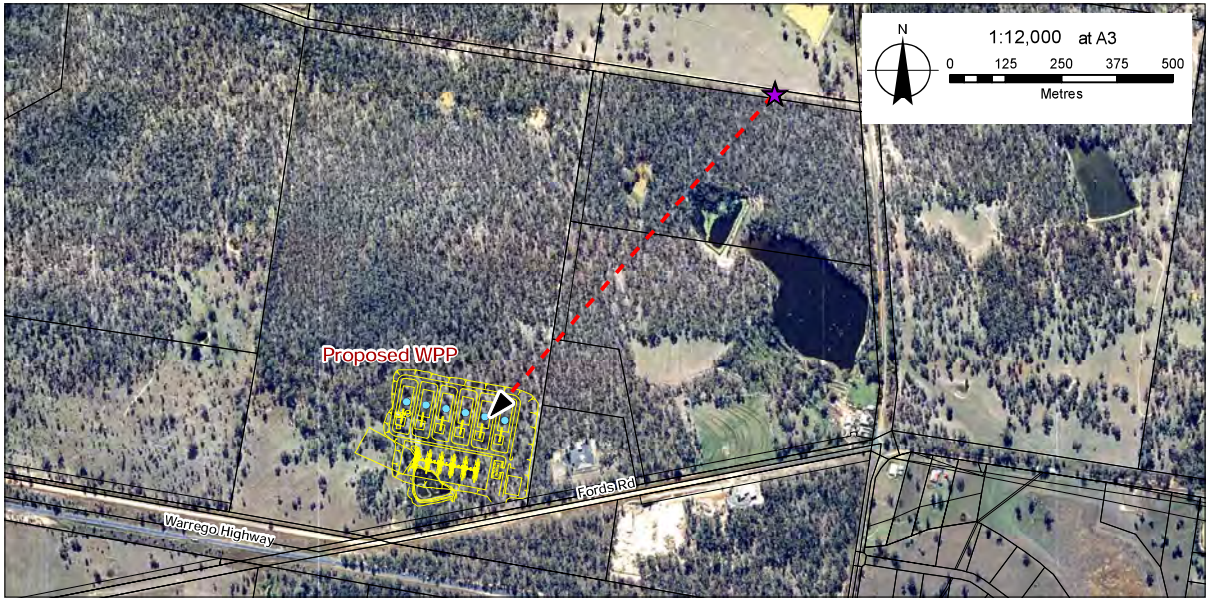
Vantage Point 10
Dwyer Street

G:\41\21379\gis\map\rev2\figA10_vantage10.mxd

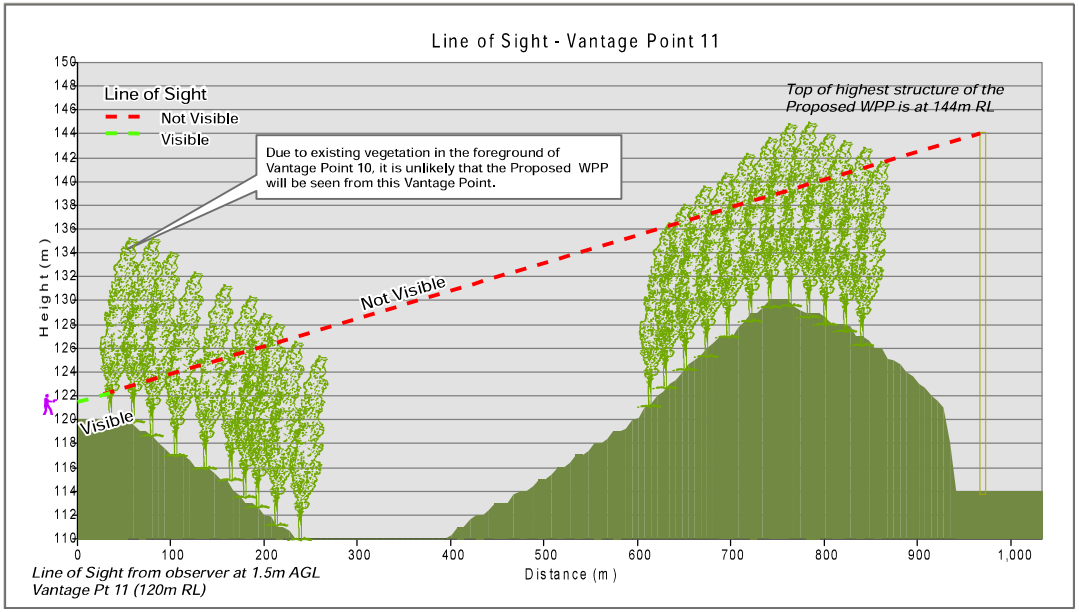
Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Profile derived from 5m contours (DERM) and Detailed site survey (Westlink), and WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 11



Terrain profile demonstrating the Proposed WPP will not be visible from Vantage Point 11

View from Vantage Point 11 expected to be unaltered by installation of the Proposed WPP

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 11
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure A11

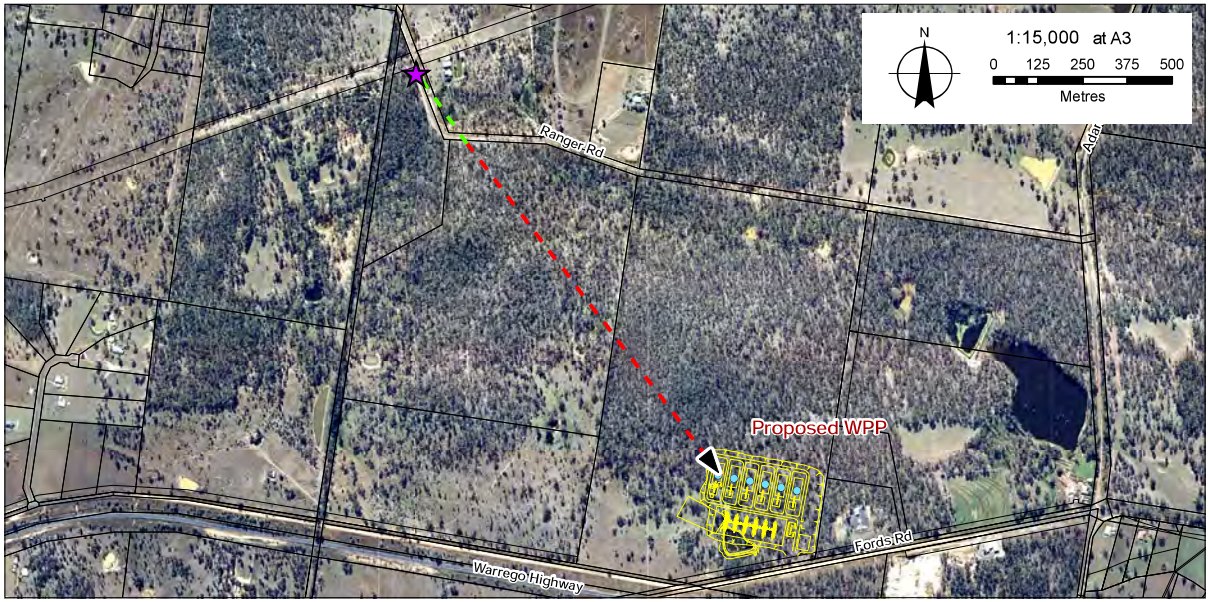
Vantage Point 11
Ranger Road

G:\41\21379\gis\map\rev2\figA11_vantage11.mxd

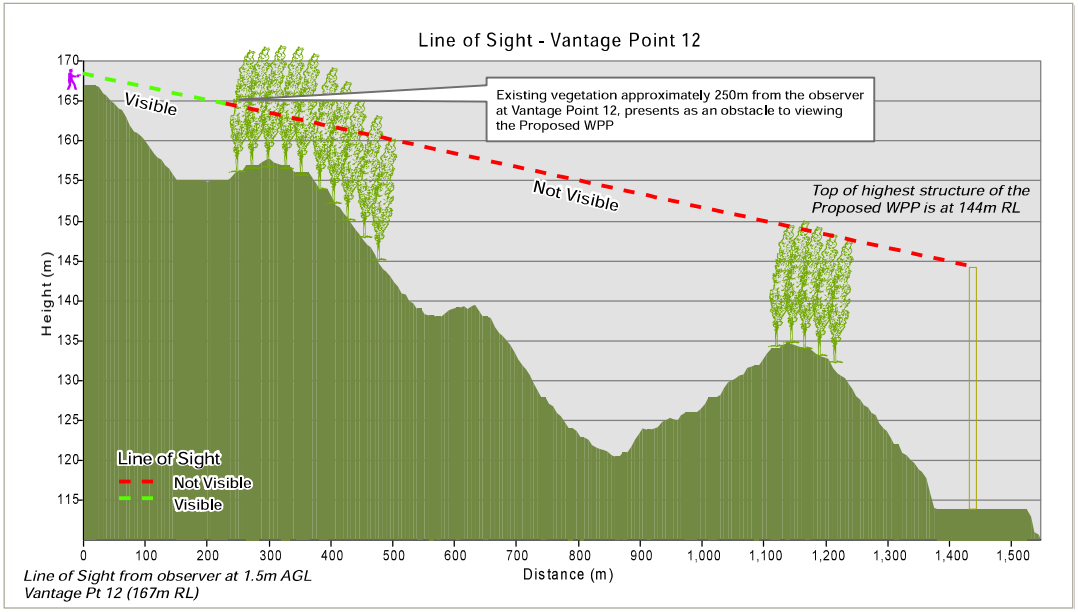
Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Profile derived from 5m contours (DERM) and Detailed site survey (Westlink), and WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gypmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 12



Terrain profile demonstrating the Proposed WPP will not be visible from Vantage Point 12

View from Vantage Point 12 expected to be unaltered by installation of the Proposed WPP

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS | PEOPLE | PERFORMANCE

Legend
- Stacks
- Vantage Point 12
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision B
Date 4 AUGUST 2009

Figure A12

Vantage Point 12
Ranger Road

G:\41\21379\gis\map\rev2\figA12_vantage12.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Profile derived from 5m contours (DERM) and Detailed site survey (Westlink), and WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympail@ghd.com.au W www.ghd.com.au

GHD

1-3 Annand Street Toowoomba QLD 4350 Australia
PO Box 1642 Toowoomba Qld 4350 Australia
T: (07) 4633 8000 F: (07) 4613 1687 E: tbamail@ghd.com.au

GHD has produced the Report in accordance with the terms of engagement for the commission with WPL.

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	J Bohn	C Charalambou		P Wootton	PWootton	31/08/09
A	DRAFT					14/05/09
B	DRAFT					08/07/09
C	DRAFT					06/08/09

APPENDIX 13: WESTLINK POWER PROJECT VISUAL IMPACT ADDENDUM REPORT

CLIENTS | PEOPLE | PERFORMANCE

Westlink Pty Ltd

Westlink Power Project

Visual Impact Addendum Report

February 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Attachments

1. Introduction

1.1 The Project

In response to rapidly growing demand for electricity, Westlink Pty Ltd (Westlink) is proposing a staged development of a natural gas-fired power station at a site north of Gatton in South-East Queensland, referred to as the Westlink Power Project (WPP).

The proposed WPP is to be located on a parcel of land near the township of Gatton; approximately 90 km west of Brisbane and approximately two kilometres north of Gatton, immediately north of the Warrego Highway on Fords Rd, Adare.

On the 4th of September 2009, Westlink lodged with the Lockyer Valley Regional Council (LVRC) a Development Application (DA) complete with a detailed Review of Environmental Factors (REF) for the WPP. Specifically, the DA is over Lot 191 on Crown Plan CSH2361 situated in the County of Cavendish, Parish of Lockyer contained in Certificate of Title, Title Reference 17000028 and is seeking a:

- Development Permit for a Material Change of Use (MCU) for the Electricity Generation Infrastructure;
- Development Permit for Environmentally Relevant Activity (ERA) No.14; and
- Development Permit for Operational Work (OW) for Vegetation Clearing.

The proposed use is more specifically defined as a natural gas-fired power station, consisting of the following elements:

- Staged installation of six open-cycle gas turbines;
- An electrical switchyard;
- A gas receiving unit;
- An operations building, workshop, administration building and car park; and
- Associated safety and monitoring equipment.

The proposed WPP is to be built in stages, in line with growing demand for electricity. Subject to development approval, the first stage of the project is expected to consist of 200 to 300 MW of generating capacity, with future expansion leading to a total project comprising up to 1,000 MW of open cycle gas turbines.

1.2 Purpose

This report forms an addendum to Chapter 12 – Visual Amenity (and Appendix F) of the Review of Environmental Factors (REF) dated August 2009 submitted with the WPP Development Application.

Although matters relating to visual impact were not specifically raised by Council as

part of its formal information request, Westlink wishes to include more detailed information to assist Council in making an informed decision on the project. The additional information that has been acquired is outlined below.

1.2.1 Measured Foreground Tree Heights

The original REF assumed tree heights of 15m for foreground vegetation.

A detailed survey of foreground vegetation has now been conducted which measured tree heights of up to 30m and determined the average tree height to be approximately 25m. This will have a significant impact on the screening of some parts of the development.

Refer to section 4.2 of the Survey Report located in Attachment A for further detail.

1.2.2 WPP Site Design Additions (Increase in Bund Height)

The proposed bund which surrounds the WPP site is to be increased from RL 114 to RL120 and is designed to more effectively utilise cut material extracted during construction of the WPP base. This increase in bund height will assist in better screening the development from view, as the height of trees planted on the bund as part of the revegetation process will be increased by approximately 6m.

1.2.3 Updated Growth Rate Data

The original REF made provision for tree species with growth rates of approximately 1.8 to 3.6 metres annually for revegetation and visual screening purposes. The Detailed Landscape Plan, prepared as part of this submission, specifically proposes spotted gums as the primary vegetation to be used to provide additional screening of the taller elements of the development. Spotted gums are a native local species on Council's approved species list for revegetation. The Queensland DPI propose, that under appropriate conditions, spotted gum growth rate of at least 3.3m/yr can be achieved in the Gatton region (refer to Attachment D for further detail).

This growth rate has now been assumed for revegetated parts of the site for the purposes of the visual impact analysis. The revegetation process will be supported by irrigation from onsite dams to assist trees in becoming established.

2. Additional Information Provided

2.1 Overview

In light of the additional information now available, Westlink has commissioned further quantitative assessments in order to assist Council to confirm the extent of the visual impact from the proposed development.

The additional work includes:

- A survey report which utilises additional survey data to predict the visual impact of the proposed development on the surrounding area;
- Detailed landscape designs and management plans designed to minimise the impact of the WPP on the surrounding area; and
- Reassessment of the visual impact of the proposal from certain vantage points, including reproduction of photomontages incorporating the findings from the survey and reflecting implementation of the proposed landscape designs and management plans.

This additional work applies an increased level of scientific rigour to the visual assessment process and provides objectively measured data to deliver a higher level of accuracy in determining the visual impact of the WPP on the surrounding area. The extent of this additional work is further detailed below.

2.2 Landscape Management and Revegetation Plan

In order to assess the impact of using additional vegetation to effectively minimise the visual impact of the WPP on the surrounding area, a detailed Landscape Management and Revegetation Plan (LMRP) has been prepared as part of this submission.

The LMRP provides details regarding:

- species to be used in the revegetation process;
- identification of existing vegetation to be retained;
- roles and responsibilities for rehabilitation work;
- management of risks for flora rehabilitation work;
- management of risks for weed management;
- revegetation techniques;
- planting regime;
- maintenance program for rehabilitation work;
- erosion and sediment control;

- weed control and management; and
- potential impacts and mitigation measures for rehabilitation.

These details will inform the process for reinstating vegetation throughout the operational, construction and maintenance phases of the project. This information is designed to provide Council with a level of surety that the methods of screening for the purposes of reducing visual impact are able to be effectively implemented. The LMRP also contains the following subordinate document and drawings which provide technical details of how the proposed measures are to be implemented during the construction phase of the development:

- Landscape Detail Design Planting Layout 1 Drawings 41-22282-L001 to 41-22282-L005; and
- Detailed Landscape Specification Document.

Please refer to Attachment C and Attachment D of this report for further detail.

2.3 Updated Visual Impact Assessment and Revised Visual Photomontages

Determination of visual impact can be subjective and is often dependent on numerous factors (as described in the REF, Appendix F - Visual impact and Landscape Assessment). In order to minimise the reliance on subjective criteria, the visual assessment employed objective analysis where possible (e.g. the Visual Impact Assessment is based on well established visual modification and viewer sensitivity models).

Given the new information available (outlined in section 1.2 of this report), an updated Visual impact Assessment and revised photomontages have been produced for those vantage points affected by the additional analysis.

The visual montages amended as part of this addendum report are as follows:

- Vantage Point 3 - Warrego Highway (Heading East);
- Vantage Point 6 - Golf Course;
- Vantage Point 7 - Spencer St;
- Vantage Point 8 - Gatton Racecourse;
- Vantage Point 9 - Old Toowoomba Rd and Parklea Dr; and
- Vantage Point 10 - Dwyer Road

It is important to note that the plant concept design and the vantage points assessed are unchanged from the original VIL Report contained in the REF. The revised photomontages are contained with Attachment B.

2.4 Survey Report

To further refine the information provided in the REF, a detailed Survey Report has been completed (refer Attachment A of this report). The following discussion outlines the survey activities.

The Survey Report includes a series of cross-sections for each of the relevant vantage points. These vantage points are those that the original VIL Assessment identified as having residual visuals at locations around Gatton within a 4km distance from the Development Site. The ground profile for each elevation was modelled using the Department of Environment and Resource Management (DERM) digital elevation model and the contour plan discussed above. The extent of vegetation was determined using aerial photography of the area produced by DERM.

The vantage point sections in the survey report have also factored proposed landscaping in accordance with the LMRP prepared for the development. Vegetation growth rates were based on both observed growth rates of Spotted Gum (an existing species on the Development Site), and the Queensland DPI Hardwoods advice Plantation species profiles for Spotted Gums (refer to Attachment E for further detail). The eye height for each vantage point was determined as about 1.5 metres above the Digital Elevation Model (DEM) surface.

3. Key Findings

3.1 Original Findings

The Visual Impact and Landscape (VIL) Assessment provided in Chapter 12 of the REF was based on well accepted methods for impact assessment (Zube et al. 1975, Williamson 1979, Williamson 2004), modified as appropriate to meet the requirements of this study.

The following steps were undertaken as part of this process:

- Identification of potential landscape alterations;
- GIS viewshed analysis to identify those areas where the WPP can be seen from;
- Development of photomontages for the WPP from various vantage points; and
- A visual impact assessment based on visual modification and viewer sensitivity.

Of particular note the assessment reviewed impacts on twelve (12) vantage points in the following localities:

- Warrego Highway;
- Residential Areas and Activities to the East;
- Residential Areas and Activities to the West
- Residential Areas and Activities to the North; and
- Residential Areas and Activities to the South.

The assessment concluded that:

- five (5) of the assessed vantage points would not view the WPP; and
- vantage points that would experience the WPP as a component of the background would experience a Moderate to Low visual impact.

It was determined that with design mitigation measures, such as sympathetic building design and landscaping, the proposed WPP is not expected to be particularly conspicuous against the background and is not expected to significantly intrude into the view. Overall it was assessed that after adoption of mitigation measures, the proposed WPP will have a Low impact on the visual amenity of the area.

It must be noted that this addendum report does not seek to contradict the findings of the original VIL Assessment Report. It merely seeks to provide updated information and additional detail which has been newly acquired, to further demonstrate that the proposed development will have a minimal visual impact.

3.2 Survey Report Findings

From each vantage point, cross-sections have been calculated to the tallest structures

being exhaust stack and air intakes for Gas Turbine 1 (Stage 1) and Gas Turbine 6 (Stage 3). The finished height of RL144 has been used for each exhaust stack. Taking into consideration the site design and the surveyed information outlined previously, elevations looking towards the WPP have been developed for each of the vantage points. These have been developed to reflect a tree growth height in revegetated areas of 23.1m after 7 years of growth, as opposed to a fully mature vegetation screening height of approximately 25-30m.

The revised photomontages show that the visual impact of the development is negligible, with the facilities being fully screened upon completion of Stage 3 (i.e. after 7 years of growth); and that view sheds from existing sensitive receivers will not be detrimentally affected.

Refer to Appendix 2 of the Survey Report located in Attachment A of this report for further detail.

3.3 Landscape Management and Rehabilitation Plan Recommendations

A Landscape Management and Revegetation Plan (LMRP) has been produced to govern the management and reinstatement of vegetation in specified areas, throughout the operation, construction and maintenance phases of the Westlink Power Project (WPP). The aim of plan is to:

- restore and enhance disturbed areas in the post construction phase;
- maximise survival opportunities for areas of retained vegetation and newly rehabilitated areas; and
- improve the ecological values of the site by providing a naturally vegetated weed-free area with habitat complexity, food resources and linkages to other areas.

Implementation of this plan will allow vegetation to be re-established on site in a manner that integrates with surrounding bushland. This will assist in achieving effective screening of the development within the 7 year development timeframe. A key feature of this revegetation process is the creation of a natural buffer with aesthetic characteristics resembling natural bushland, which will greatly assist in diminishing the visual impact of the proposal, whilst promoting on-site biodiversity. A key aspect of this plan is to create a varied vegetation community which not only grows to a sufficient height to screen the taller elements of the facilities, but provides an understorey which provides enough density to adequately screen lower elements as well. Accordingly, in additional to tall, fast growing gums, this plan proposes understory vegetation species with varied growth heights and dense foliage.

Refer to Attachment C - Landscape Management and Rehabilitation Plan of this report for further details.

3.4 Updated Visual Assessment and Montages

Revised photomontages for a number of vantage points have been produced based on updated information, including:

- average tree heights of up to 25m for existing vegetation (refer the Survey Report in Attachment A);
- increasing the bund surrounding the plant site to RL 120 (refer LMRP in Attachment C); and
- adopting growth rates of approximately 3.3m/yr for Spotted Gums (refer Queensland DPI document *"Hardwood Advice Plantation Species Profile - Spotted Gums"* in Attachment E).

Changes to each relevant vantage point photomontage are outlined below.

3.4.1 Vantage Point 3 - Warrego Highway (Heading East)

Along the southern boundary of the adjacent allotment to the west of the WPP, the existing vegetation (approximate tree height of 15-20m on ground level RL105-110), combined with other scattered vegetation in the intervening ground, will provide complete screening of the plant from this vantage point.

Please refer to Figure A3 located in Attachment B of this report for the amended photomontage which supports this conclusion.

3.4.2 Vantage Point 6 - Golf Course

The existing vegetation on the intervening ground immediately south of the Warrego Highway (approximate tree height of 25m on ground level RL115-120), will provide complete screening of the plant from this vantage point.

Please refer to Figure A6 located in Attachment B of this report for the amened photomontage which supports this conclusion.

3.4.3 Vantage Point 7 - Spencer St

The existing vegetation on the intervening ground immediately south of the Warrego Highway (approximate tree height 25m on ground level RL105-115), will provide partial screening of the plant.

However, when screening from existing vegetation is combined with the proposed revegetation plans as described in the Section 3.3, the plant will be fully screened from this location by the completion of Stage 3.

A summary of the degree to which the stack structures would be visible from this vantage point over time is provided in Table 1.

Table 1 Visible portion of stack structures – VP7

Phase	Vertical portion visible (approximate)
Stage 1 - 0 years	3m
Stage 2 - 4 years	3m
Stage 3 – 7 years	0m

At the completion of Stage 1, the top 3 meters of the exhaust stacks protrude above the vegetation. At the completion of Stage 2 this is unchanged, as existing vegetation in the line of sight of the new turbine stacks is at a lower RL, but is compensated for by additional growth in revegetated areas around the site.. As the revegetated areas further develop the plant becomes fully screened by the completion of Stage 3.

Please refer to Figure A7 located in Attachment B of this report for the amened photomontage which supports this conclusion.

3.4.4 Vantage Point 8 - Gatton Racecourse

The existing vegetation on the intervening ground immediately south of the Warrego Highway (approximate tree height 25m on ground level RL100-110), will provide partial screening of the plant.

However, when screening from existing vegetation is combined with the proposed revegetation plans as described in the Section 3.3, the plant will be fully screened from this location by the completion of Stage 3.

A summary of the degree to which the stack structures would be visible from this vantage point over time is provided in Table 2.

Table 2 Visible portion of stack structures – VP8

Phase	Vertical portion visible (approximate)
Stage 1- 0 years	4m
Stage 2- 4 years	1m
Stage 3- 7 years	0m

As described in Section 3.4.3, as the revegetation around the WPP site becomes established it progressively screens residual visible elements of the WPP such that the facilities are fully screened by the completion of Stage 3.

Please refer to Figure A8 located in Attachment B of this report for the amened photomontage which supports this conclusion.

3.4.5 Vantage Point 9 - Old Toowoomba Rd and Parklea Dr

The existing vegetation on the intervening ground immediately south of the Warrego Highway (approximate tree height 25m on ground level RL100-105), will provide partial screening of the plant.

However, when screening from existing vegetation is combined with the proposed revegetation plans as described in the Section 3.3, the plant will be fully screened from this location by the completion of Stage 3.

A summary of the degree to which the stack structures would be visible from this vantage point over time is provided in Table 3.

Table 3 Visible portion of stack structures – VP9

Phase	Vertical portion visible (approximate)
Stage 1- 0 years	10m
Stage 2- 4 years	2m
Stage 3- 7 years	0m

As described in Section 3.4.3, as the revegetation around the WPP site becomes established it progressively screens residual visible elements of the WPP such that the facilities are fully screened by the completion of Stage 3.

Please refer to Figure A9 located in Attachment B of this report for the amened photomontage which supports this conclusion.

3.4.6 Vantage Point 10 - Dwyer Road

The existing vegetation on the intervening ground immediately south of the Warrego Highway (approximate tree height of 25m on ground level RL115-120), will provide complete screening of the plant from this vantage point.

Please refer to Figure A10 located in Attachment B of this report for the amened photomontage which supports this conclusion.

3.5 Updated Visual Impact Summary

The information outlined in Section 3.4 above has a significant bearing on the visual impact ratings for the vantage points discussed above. Accordingly, an updated visual impact rating has been produced for each of these vantage points prior to and post implementation of the proposed mitigation measures (refer Table 7 and Table 5). These ratings supersede those contained in the REF. Vantage points for which revised photomontages have not been produced are shaded grey in the tables. This assessment of visual impact has been undertaken in accordance with the methodology described in Section 2.2.3 of the REF.

Table 4 Updated Visual Impact Summary - prior to mitigation

Vantage Point	Viewer Type	Context of View	Period of View	Number of Viewers	Distance	Visual Modification	Sensitivity of View	Visual Impact Rating
1	Motorist, tourist	Other roads, views from highway (east bound)	Short	High	500 metres	Medium	Moderate	Moderate
2	Motorist, tourist	Other roads, views from highway (west bound)	Short	High	330 metres	Low	Moderate	Low
3	Motorist, tourist, residential	Views from highway (east bound)	Short	High	1,200 metres	Low	Low	Low
		Rural residential outlook	Long	Low		Low	High - Moderate	Moderate - Low
4	Residential	Rural residential outlook	Long	Low	1,000 metres		WPP will not be visible	
5	Residential	Rural residential outlook	Long	Low	1,750 metres		WPP will not be visible	
6	Recreational	Recreational area, view from golf course	Medium	Moderate	3,000 metres		WPP will not be visible	
7	Residential	Low to medium density residential outlook	Long	Moderate	2,500 metres	Low	Moderate	Low
8	Recreational	Recreational area, view from racecourse	Medium	Moderate	2,500 metres	Low	Moderate	Low
9	Residential	Low to medium density residential outlook	Long	Low	3,000 metres	Low	Moderate	Low
10	Residential	Low to medium density residential outlook	Long	Low	1,900 metres		WPP will not be visible	
11	Residential	Rural residential outlook	Long	Low	1,000 metres		WPP will not be visible	
12	Residential	Rural residential outlook	Long	Low	1,450 metres		WPP will not be visible	

Table 5 Updated Visual Impact Summary - post-implementation of mitigation measures

Vantage Point	Viewer Type	Context of View	Period of View	Number of Viewers	Distance	Visual Modification	Sensitivity of View	Visual Impact Rating (at ~ year 7)
1	Motorist, tourist	Other roads, views from highway (east bound)	Short	High	500 metres	Low	Moderate	Low
2	Motorist, tourist	Other roads, views from highway (west bound)	Short	High	330 metres	Low	Moderate	Low
3	Motorist, tourist, residential	Views from highway (east bound) Rural residential outlook	Short Long	High Low	1,200 metres		WPP will not be visible	
4	Residential	Rural residential outlook	Long	Low	1,000 metres		WPP will not be visible	
5	Residential	Rural residential outlook	Long	Low	1,750 metres		WPP will not be visible	
6	Recreational	Recreational area, view from golf course	Medium	Moderate	3,000 metres		WPP will not be visible	
7	Residential	Low to medium density residential outlook	Long	Moderate	2,500 metres		WPP will not be visible	
8	Recreational	Recreational area, view from racecourse	Medium	Moderate	2,500 metres		WPP will not be visible	
9	Residential	Low to medium density residential outlook	Long	Low	3,000 metres		WPP will not be visible	
10	Residential	Low to medium density residential outlook	Long	Low	1,900 metres		WPP will not be visible	
11	Residential	Rural residential outlook	Long	Low	1,000 metres		WPP will not be visible	
12	Residential	Rural residential outlook	Long	Low	1,450 metres		WPP will not be visible	

4. Conclusion

This report forms an Addendum to the REF and outlines the findings of a number of updated studies completed to provide further details on visual amenity impacts from the proposed development. The Survey Report provides further detail which supports the conclusion reached in the REF that the proposed development will have a low impact on the visual amenity of the surrounding area. To further assist Council, new photomontages, which reflect the findings of this Survey Report and incorporate the new landscape management plan and designs, have now been produced.

It must be recognised that these images are not intended to be accurate down to minor details, but rather have been developed to show the scale and form of potential visual impacts.

To demonstrate that landscaping and revegetation measures will be effectively implemented as part of the development process, a Landscape Management and Revegetation Plan has also been prepared as part of this submission.

With this information, it is anticipated that Council will have sufficient detail to conclude that the development will have a negligible visual impact on the surrounding area.

Attachment A

Survey Report

Westlink Pty Ltd

Westlink Power Project

Survey Report

Simon Baker Registered Surveyor 2048 (Cadastral and Engineering)

December 2009

Contents

1 INTRODUCTION

In response to the rapidly growing demand for electricity, Westlink Pty Ltd (Westlink) is proposing a staged development of a natural gas-fired power station at a site north of Gatton in South-East Queensland referred to as the Westlink Power Project (WPP).

The proposed WPP is to be located on a parcel of land near the township of Gatton; approximately 90 km west of Brisbane and approximately two kilometres north of Gatton, immediately north of the Warrego Highway on Fords Rd, Adare.

On the 4th of September 2009, Westlink lodged with the Lockyer Valley Regional Council (LVRC) a Development Application (DA) complete with a detailed Review of Environmental Factors (REF) for the WPP. Specifically, the DA is over Lot 191 on Crown Plan CSH2361 situated in the County of Cavendish, Parish of Lockyer contained in Certificate of Title, Title Reference 17000028 and is seeking a:

- Development Permit for a Material Change of Use (MCU) for the Electricity Generation Infrastructure;
- Development Permit for Environmentally Relevant Activity (ERA) No.14; and
- Development Permit for Operational Work (OW) for Vegetation Clearing.

The proposed use is more specifically defined as a natural gas-fired power station, consisting of the following elements:

- Staged installation of six open-cycle gas turbines;
- An electrical switchyard;
- A gas receiving unit;
- An operations building, workshop, administration building and car park; and
- Associated safety and monitoring equipment.

The proposed WPP is to be built in stages, in line with growing demand for electricity. Subject to development approval, the first stage of the project is expected to consist of 200 to 300 MW of generating capacity, with future expansion leading to a total project comprising up to 1,000 MW of open cycle gas turbines.

2 PURPOSE

The purpose of this Report is to summarise the findings of a number of detailed survey assessments of the proposed Westlink Power Project (WPP) and adjacent areas.

Specifically the survey activities undertaken were required to produce:

- a detailed 0.5m interval contour plan of the proposed Development Site;
- an assessment of the existing vegetation within and nearby to the Development Site; and
- a series of cross sections within a 4km distance from the Development Site to demonstrate the effectiveness of the existing vegetation and proposed new vegetation in screening the WPP from surrounding areas.

3 THE DEVELOPMENT SITE SURVEY PLAN (0.5M CONTOUR)

A detailed survey of the Development Site was carried out between February and March 2009.

The survey was performed using trigonometric methods with a nominal point separation of 15m over the surveyed area. The level datum for the survey is AHD derived vide PSM68599 (RL103.617), and the meridian is MGA 94 zone 56 determined by post process GPS.

The surveyed data was then reduced using a 12D model. When reduced, a TIN was created and 0.5 metre contours extracted using the same software.

A plot of the 0.5m contours was generated from the field survey with contours in cyan at 0.5m intervals, and contours in magenta at 5m intervals (refer Appendix 1 - Site survey (0.5m contours)).

4 VANTAGE POINT ASSESSMENT

Information regarding the location of the potential features of the WPP plant structures were obtained from the GHD plant layout (refer Appendix 5 – WPP Plant Layout) and have been included in the various cross sections.

4.1 THE TERRAIN

The ground profile for each cross section has been modelled using both: the Department of Environment and Resource Management (DERM) digital elevation model (DEM) map sheet 9342-14; and the detail survey plan for the Development Site as described in Section 3.

The State of Queensland (DERM) is the copyright owner of the DEM information which includes the following Disclaimer:

- The State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws."

The vertical datum for the detail survey of the site is AHD derived vide PSM 68599 (RL103.617). The DEM is AHD derived and was verified against the following PSM's; 139320, 10387, 36084, 1890, 1915, and 1971. In clear areas the variance between the recorded PSM level and that determined by the DEM was approximately 1metre.

4.2 EXISTING VEGETATION

The extent of vegetated areas was determined using aerial photography of the area contained in DERM map sheets: 9342-1441-2001; 9342-1442-2001; 9342-1443-2001; and 9342-1444-2001. This imagery is dated June 2001 and the State of Queensland (DERM) is the Copyright owner of this information which includes the following disclaimer:

- The State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws."

The extent of the vegetation in the vicinity of the WPP plant (refer Appendix 5 – WPP Plant Layout) was surveyed in November 2009 to establish general tree heights, sizes and densities. This vegetation was found to consist mainly of Gum and Iron Bark regrowth with a trunk diameter of less

than 200mm. Larger trees with a trunk diameter of about 300mm are scattered throughout, but the smaller regrowth dominates the area. The height of the vegetation in this area is generally 20m to 25m.

To the east of the site, the height of this more mature stand of vegetation about the Gas Compressor Station was observed to average above 25m with some of the Gums approaching 30m.

The trees on the existing dam wall near Fords Road (on the southern boundary of the site) again appeared to be reasonably young regrowth. These gums generally measured approximately 20m – 23m high and being young regrowth probably would have several metres further to grow.

Trees on the lot in the vicinity of the Energex substation measured on average approximately 25m in height.

The trees between the sewage treatment plant and the rubbish tip were measures to approximately 23m in height.

Exiting tree heights were further verified by setting up a "total station" at VP6, VP7, VP8, and VP10, and observing the tree line along the visible ridges. When intersected with the ridge lines identified in the DEM the separation between the tree line and the ridge line was generally 25m.

Accordingly, an average tree height of 25m was adopted as the nominal tree height for existing vegetation in the cross sections discussed in section 4.6. Note in some cases a lesser height is shown where it was determined in the field that the height of vegetation was less than 25m. These areas are mainly directly in front of the existing dam wall and the vegetation along the East side of Lot 36 on RP205167.

4.3 LANDSCAPING

A landscaped bund included in the GHD plant layout drawing (refer Appendix 5 – WPP Plant Layout) is proposed to be constructed to RL120. New vegetation grown on the bund has been shown to a height of 23m (i.e. after 7 years of growth) which is a similar height to some of the existing (regrowth) vegetation.

Vegetation growth rates were based on both observe growth rates of existing species on or near the Development Site and a Department of Primary Industries publication which estimates achievable spotted gum growth rates of 3.3 meters or more per year for regions such as Gatton (refer GHD Visual Impact and Landscape Assessment Report – Addendum Appendix XXX).

Spotted Gum, Iron Bark, Bloodwood, and Moreton Bay Ash are native to the area. Spotted Gum and Iron Bark are the most prevalent.

4.4 EYE HEIGHT

The eye height for each vantage point was determined as about 1.5 metres above the DEM surface.

4.5 POWER PLANT HORIZONTAL AND VERTICLE TARGET

A series of cross section (elevations) were considered for locations around Gatton that potentially might have partial views of the WPP. Two plans showing the location of assessed vantage points

have been included in Appendix 2 – Vantage Points Plan View (Cadastral) and Appendix 3 – Vantage Points Plan View (Aerial).

The 30m exhaust stack and the 25m air intakes on the gas turbine have been shown at a height of RL144 and RL 139 respectively. The location and size of WPP structures has been extracted from the GHD plant layout (refer Appendix 5 – WPP Plant Layout).

4.6 VANTAGE POINT CROSS SECTIONS

Taking into consideration the site design and the surveyed information outlined previously, cross sections looking towards the WPP have been developed for each of the vantage points (refer Appendix 4 – Vantage Points (Cross Sections)).

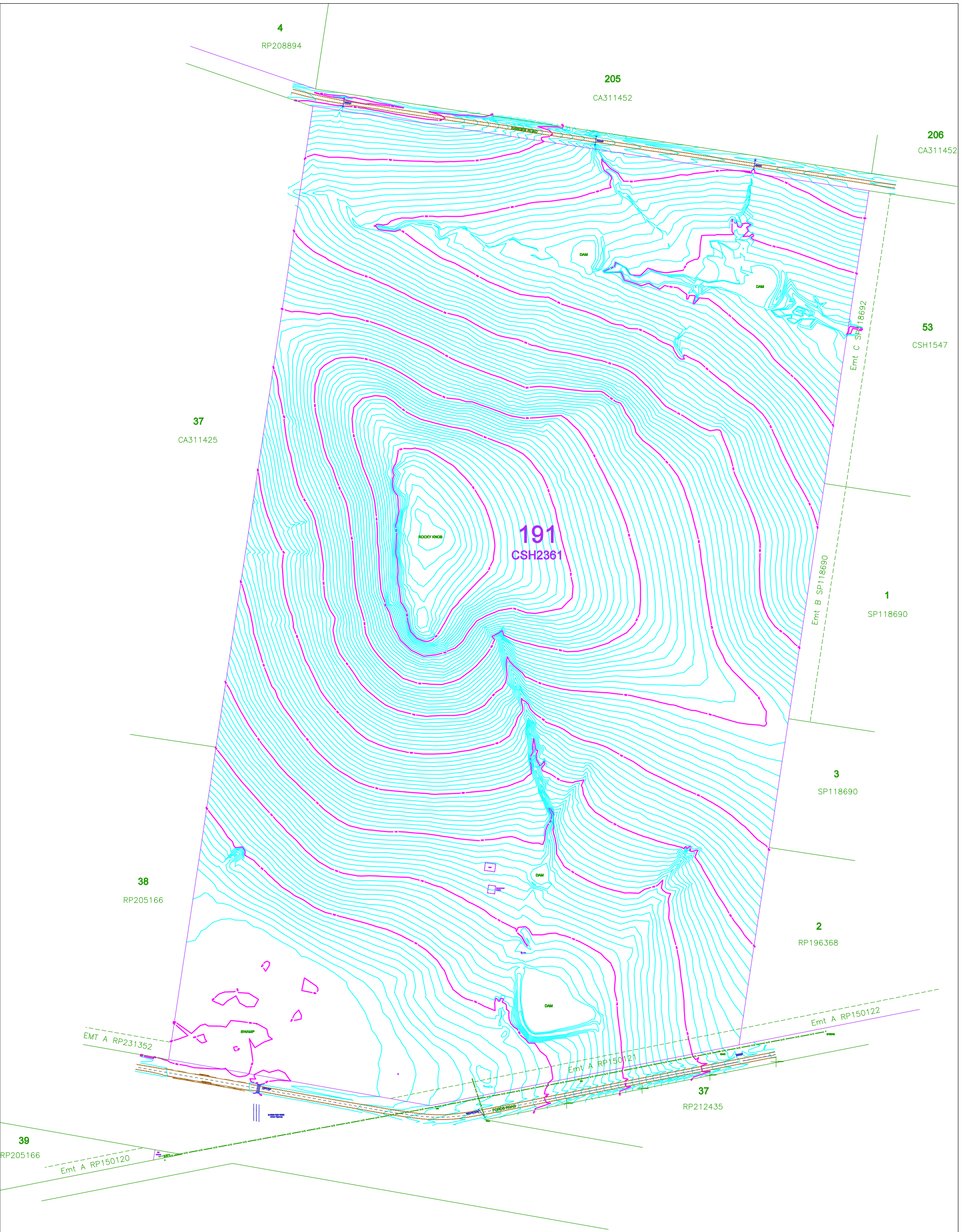
Each cross section produced demonstrates the profile between each vantage point through to the exhaust stack and air intake (the most prominent structures) for Gas Turbine 1 (reflecting the view of Stage 1) and similarly Gas Turbine 6 (reflecting the view of Stage 3).

The cross sections show that existing and planned vegetation will provide an effective screen from all vantage points assessed as having a potential view of the WPP.

Simon Baker - Registered Surveyor 2048 (Cadastral and Engineering)

18th January 2010

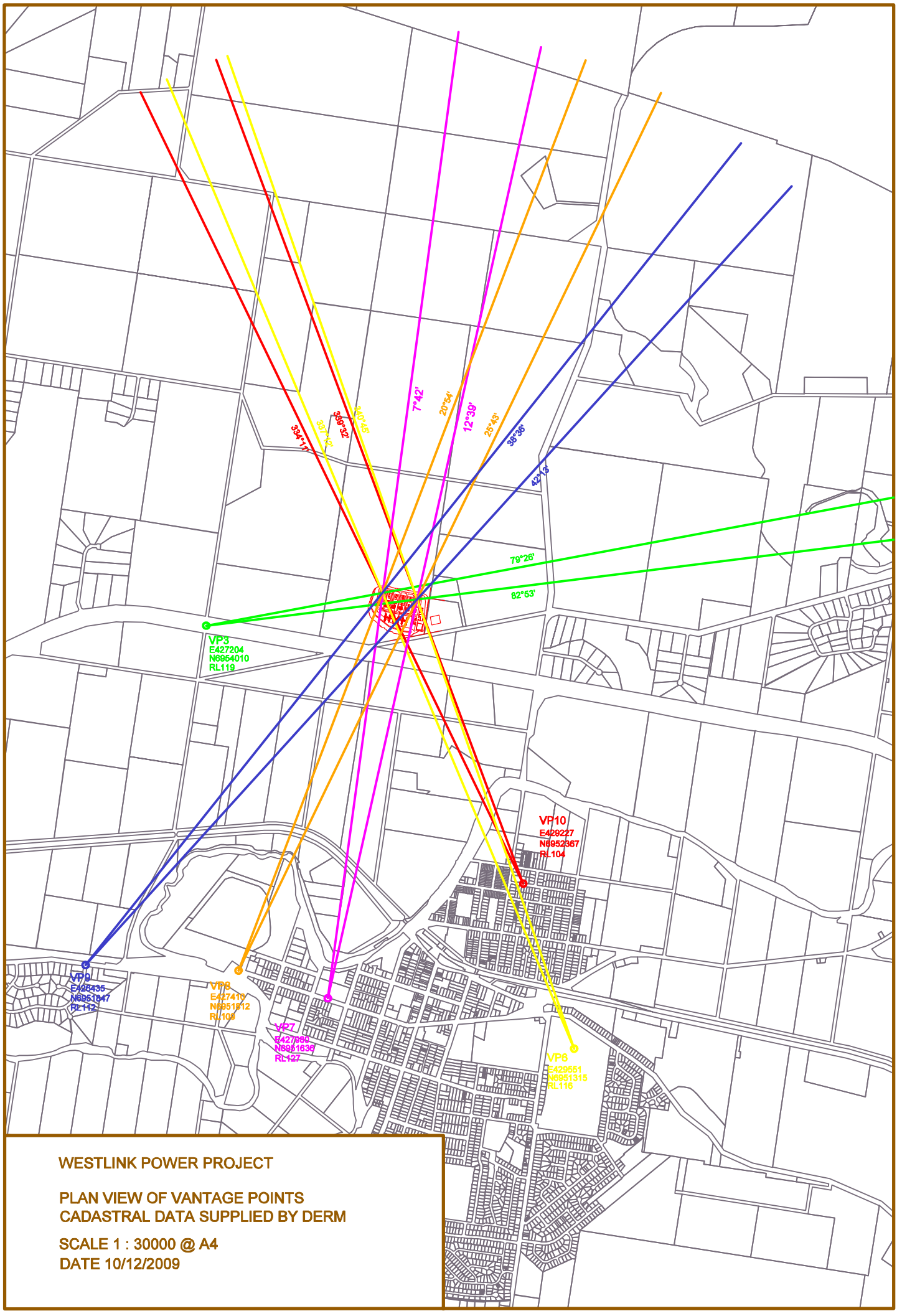
Appendix 1 - Site survey (0.5m contours)



Detail Survey Lot 191 on CSH2361
Westlink Gatton

12d Model
Scale 1:4000
Thu Mar 12 08:33:30 2009

Appendix 2 – Vantage Points Plan View (Cadastral)

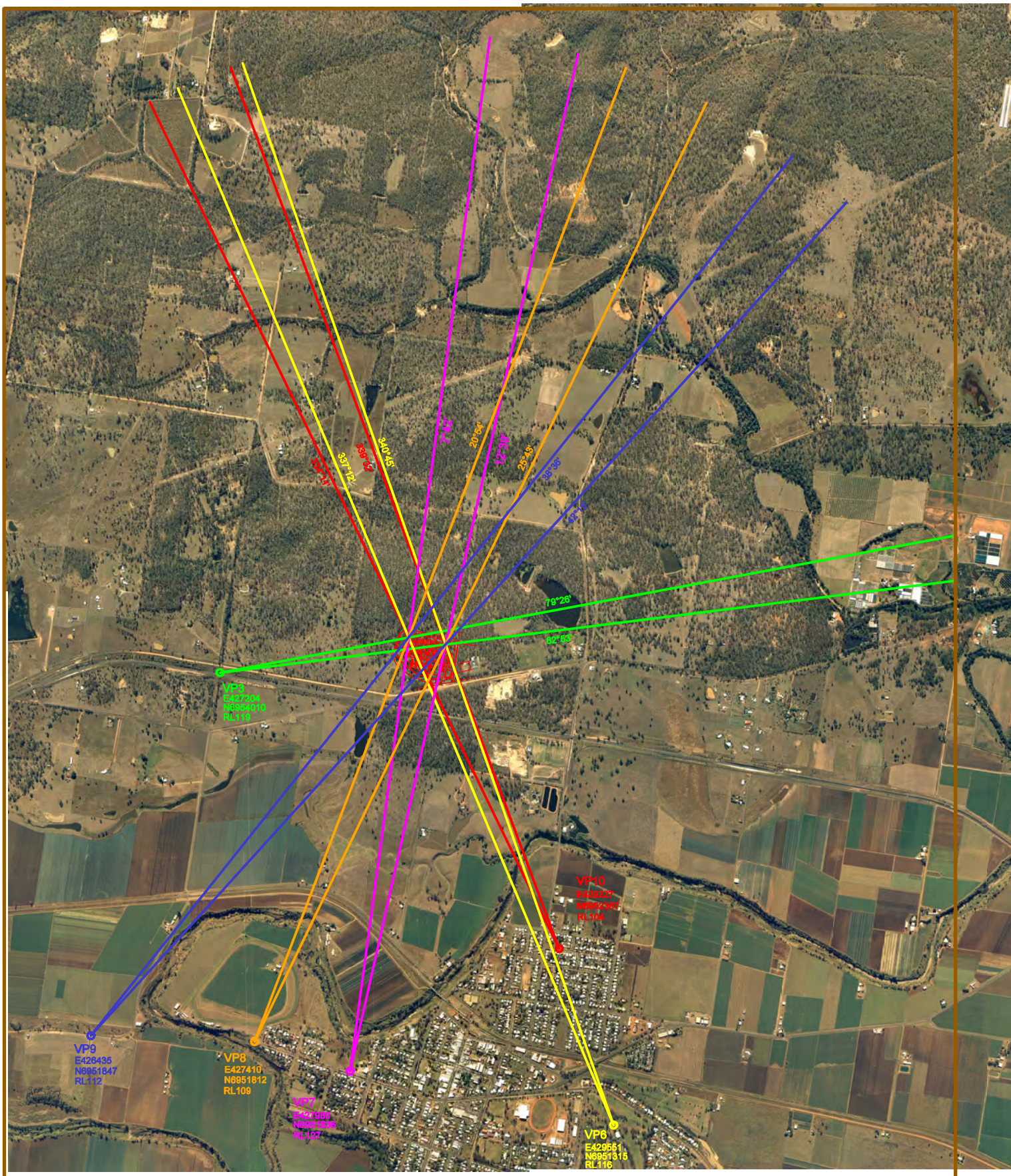


WESTLINK POWER PROJECT

PLAN VIEW OF VANTAGE POINTS
CADASTRAL DATA SUPPLIED BY DERM

SCALE 1 : 30000 @ A4
DATE 10/12/2009

Appendix 3 – Vantage Points Plan View (Aerial)

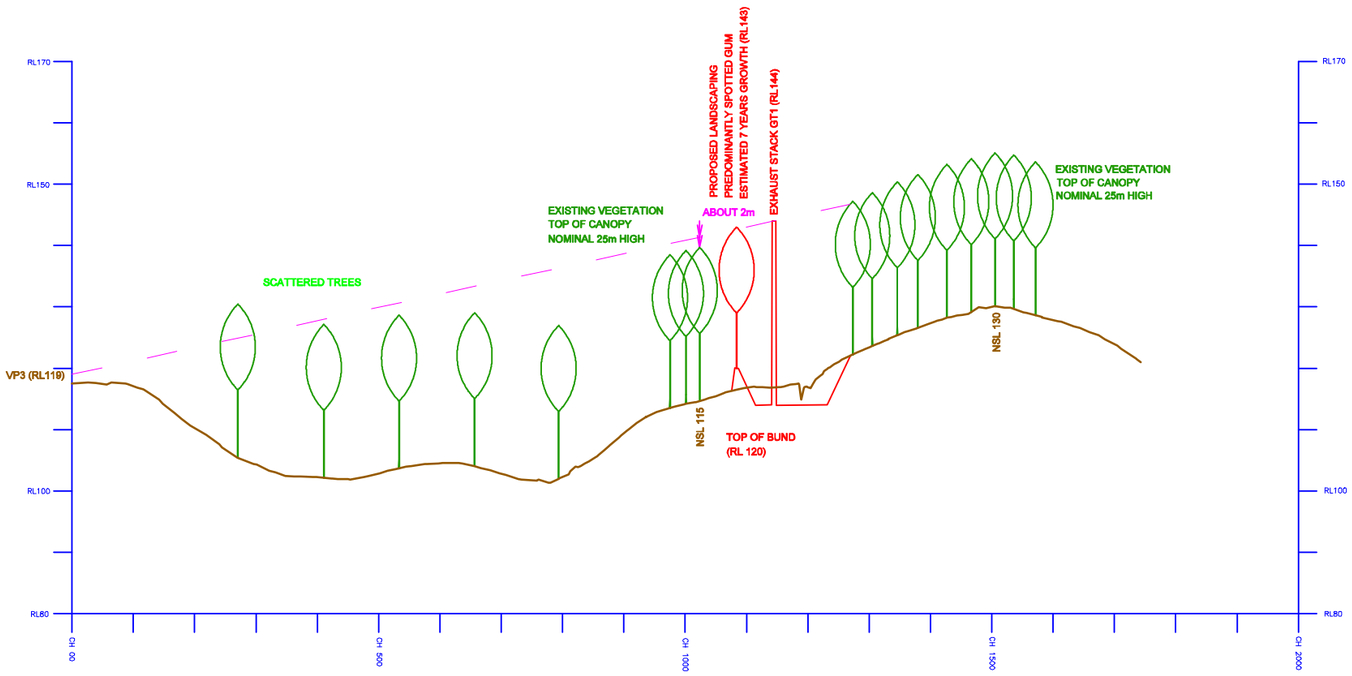


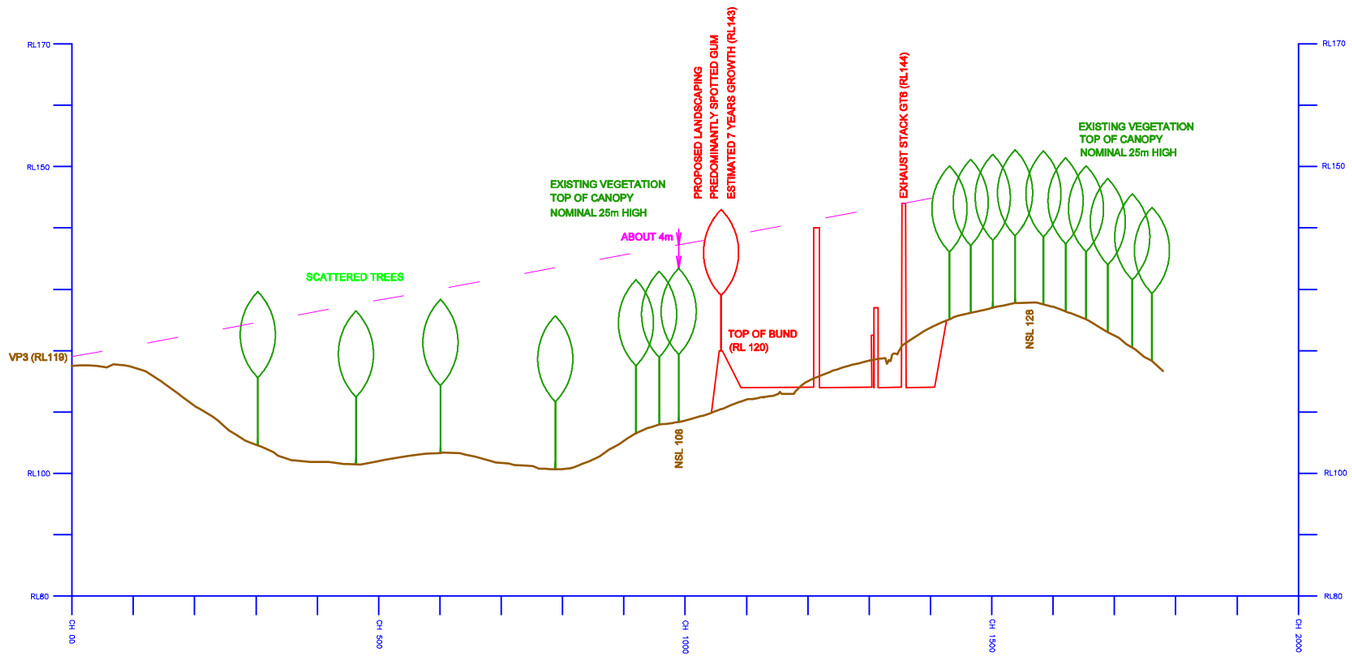
WESTLINK POWER PROJECT

PLAN VIEW OF VANTAGE POINTS
AERIAL PHOTOGRAPHY SUPPLIED BY DERM

SCALE 1 : 30000 @ A4
DATE 10/12/2009

Appendix 4 – Vantage Points (Cross Sections)





WESTLINK POWER PROJECT

SECTION OF VP3 TO GT1 and GT6

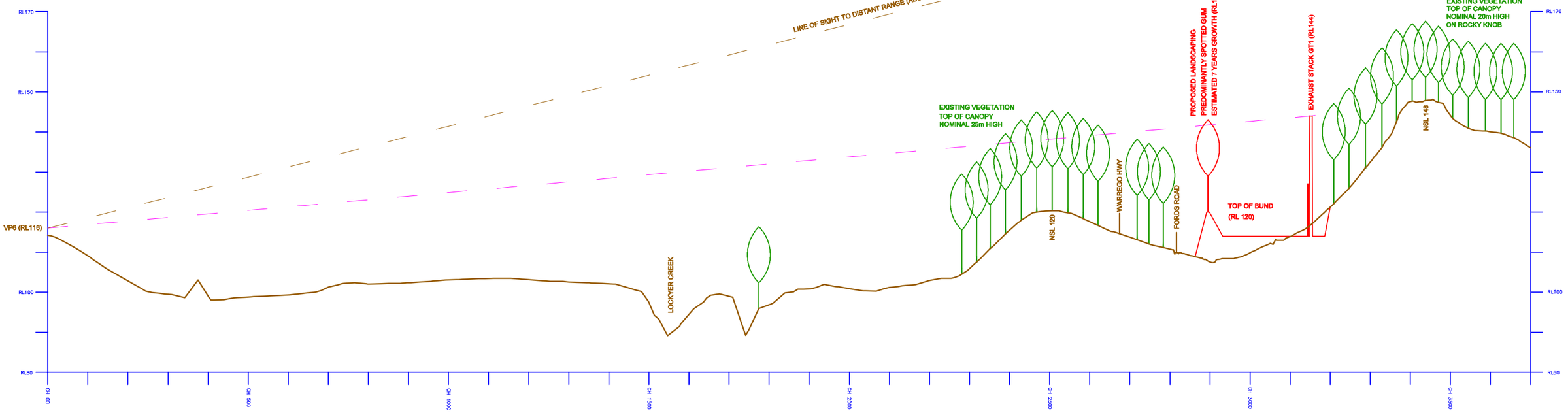
DATE: 1/12/2009

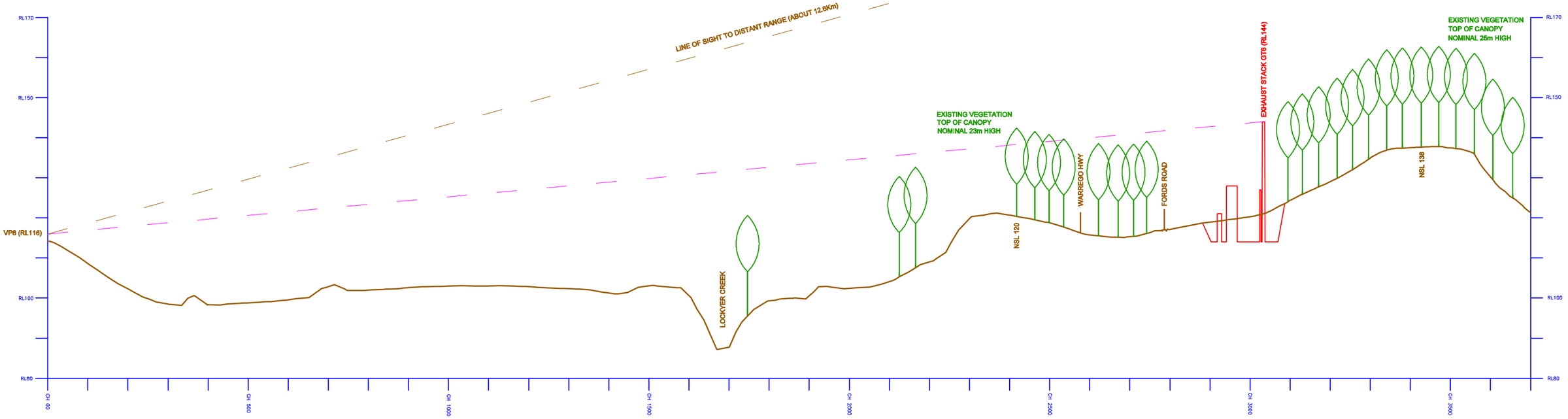
LEVEL DATUM AHD DERIVED

SCALE 1 : 10000 HORIZONTAL @ A3

SCALE 1 : 1000 VERTICAL @ A3

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY





WESTLINK POWER PROJECT

SECTION OF VP6 TO GT1 and GT6

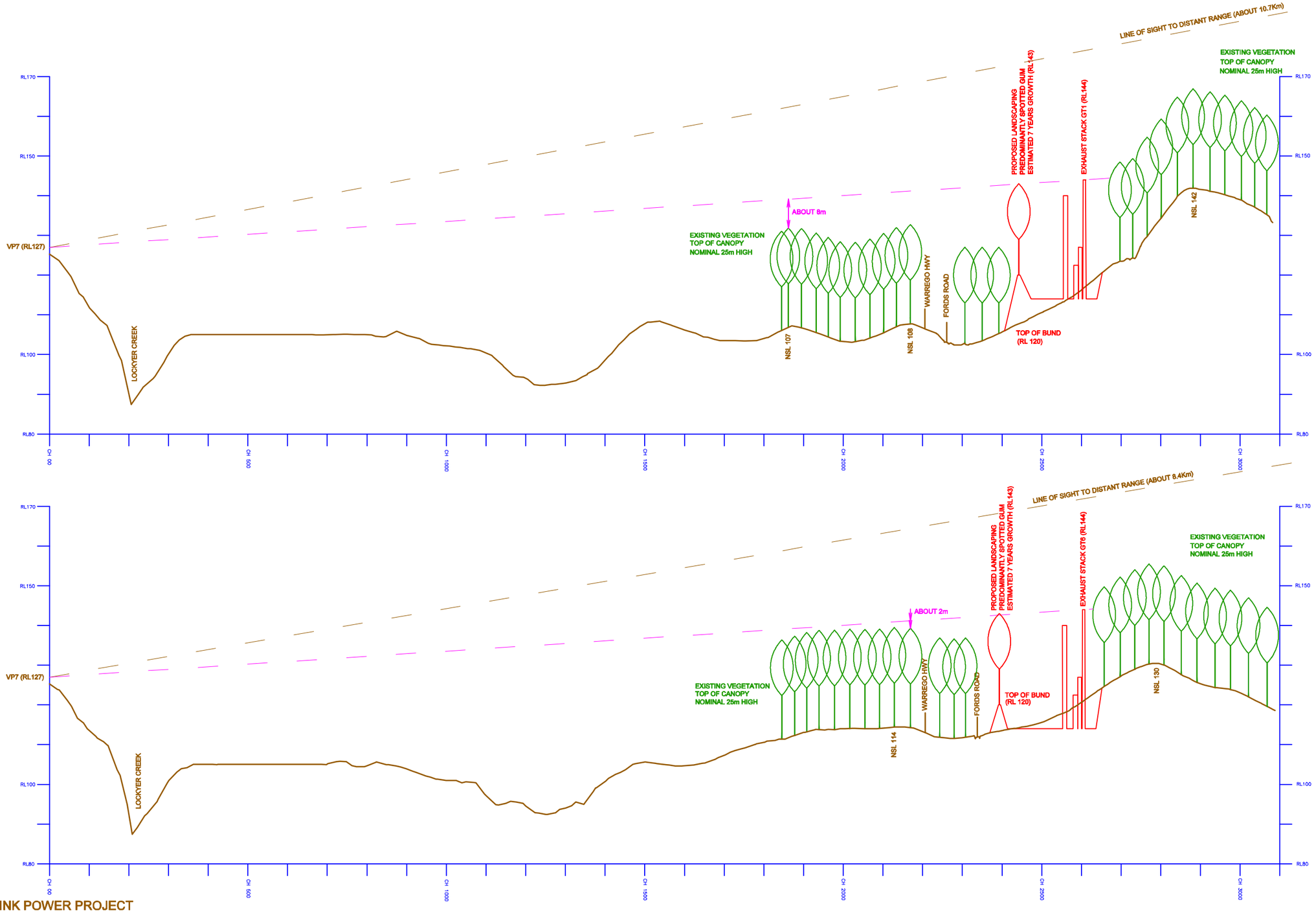
DATE: 1/12/2009

LEVEL DATUM AHD DERIVED

SCALE 1 : 10000 HORIZONTAL @ A3

SCALE 1 : 1000 VERTICAL @ A3

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY



WESTLINK POWER PROJECT

SECTION OF VP7 TO GT1 and GT6

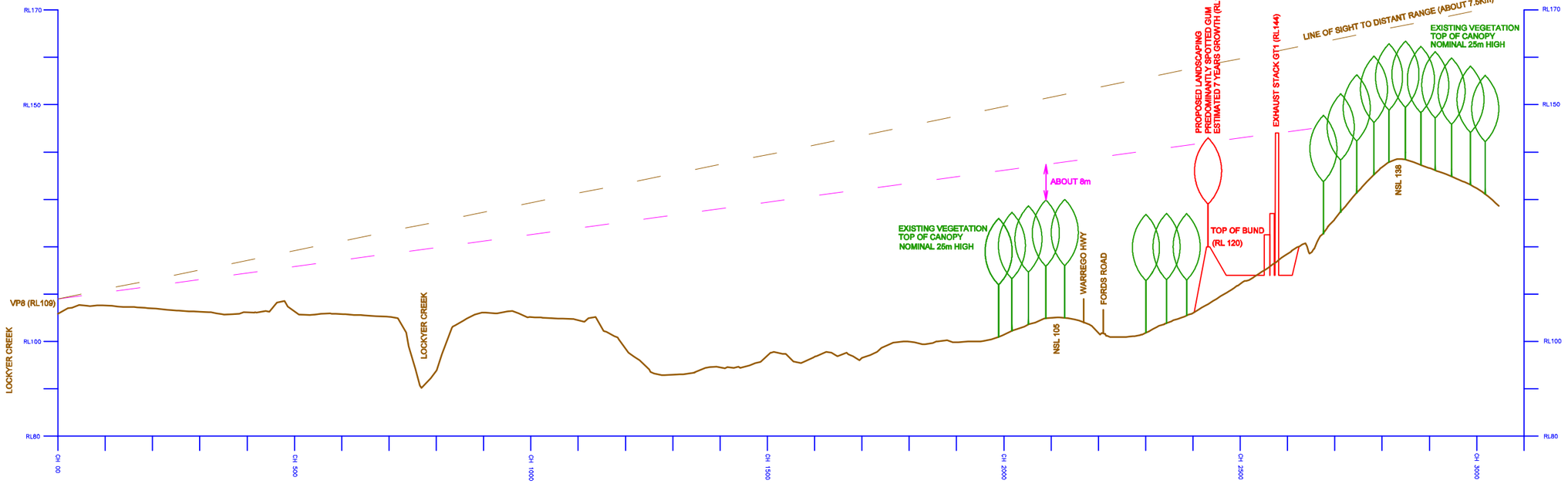
DATE: 1/12/2009

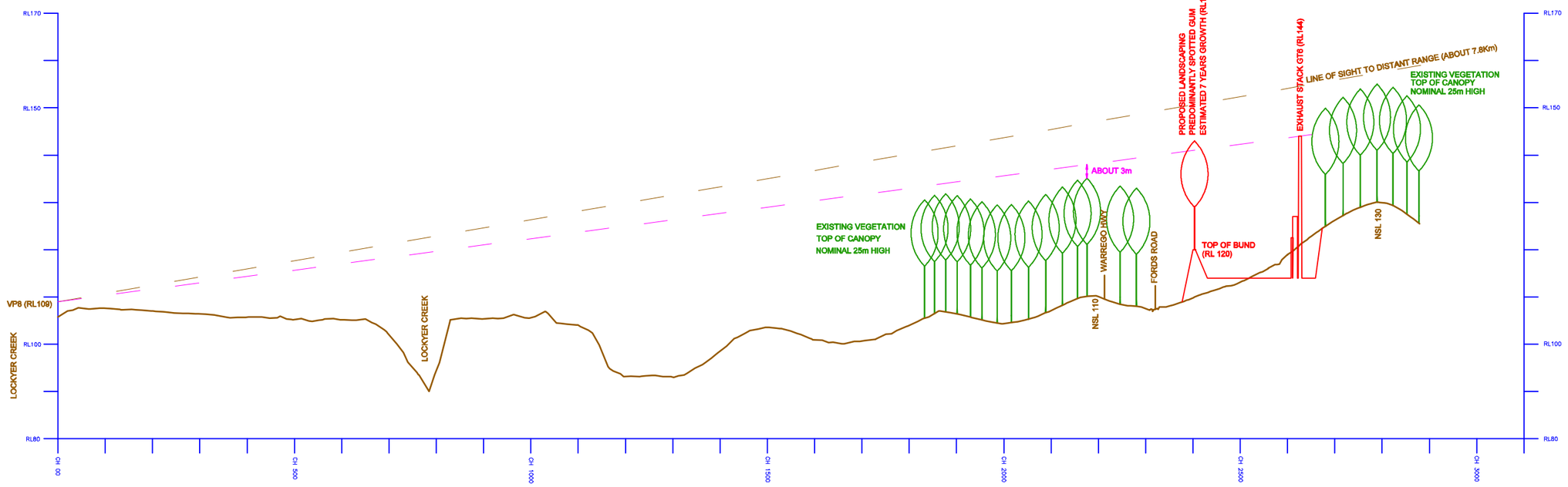
LEVEL DATUM AHD DERIVED

SCALE 1 : 10000 HORIZONTAL @ A3

SCALE 1 : 1000 VERTICAL @ A3

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY





WESTLINK POWER PROJECT

SECTION OF VP8 TO GT1 and GT6

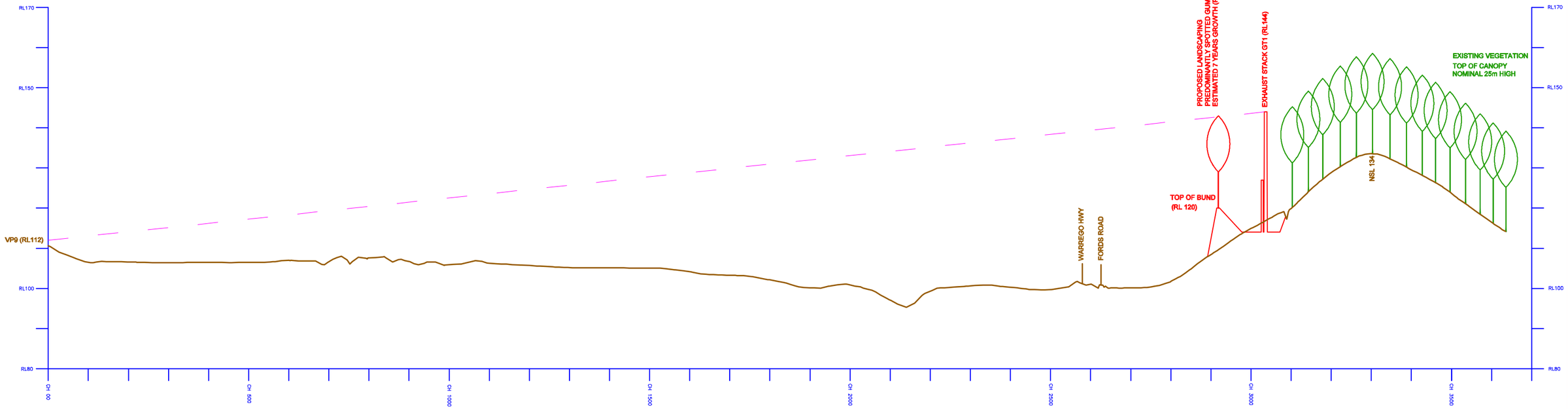
DATE: 1/12/2009

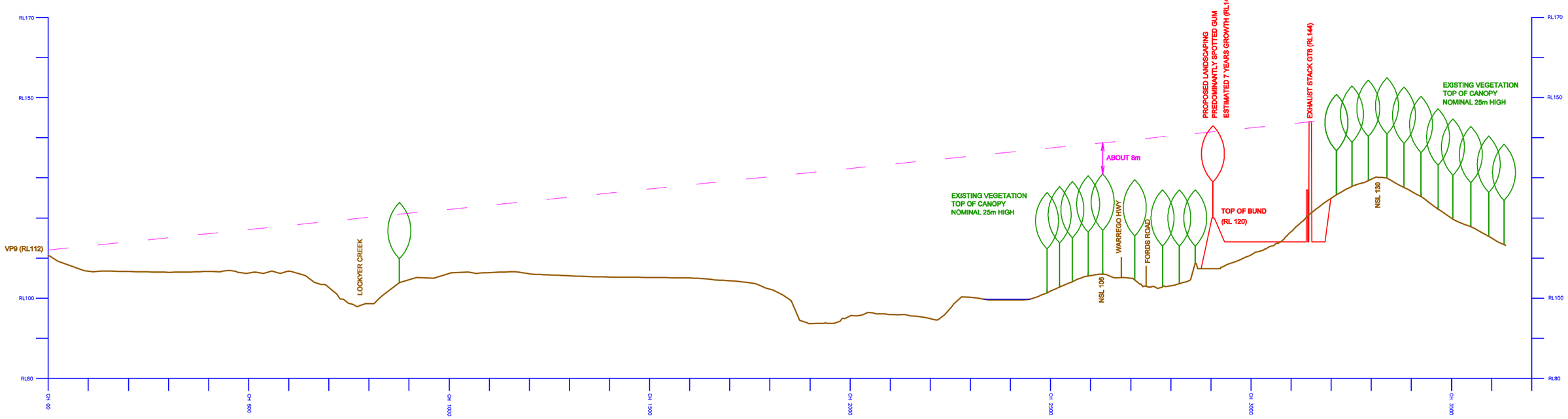
LEVEL DATUM AHD DERIVED

SCALE 1 : 10000 HORIZONTAL @ A3

SCALE 1 : 1000 VERTICAL @ A3

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY





WESTLINK POWER PROJECT

SECTION OF VP9 TO GT1 and GT6

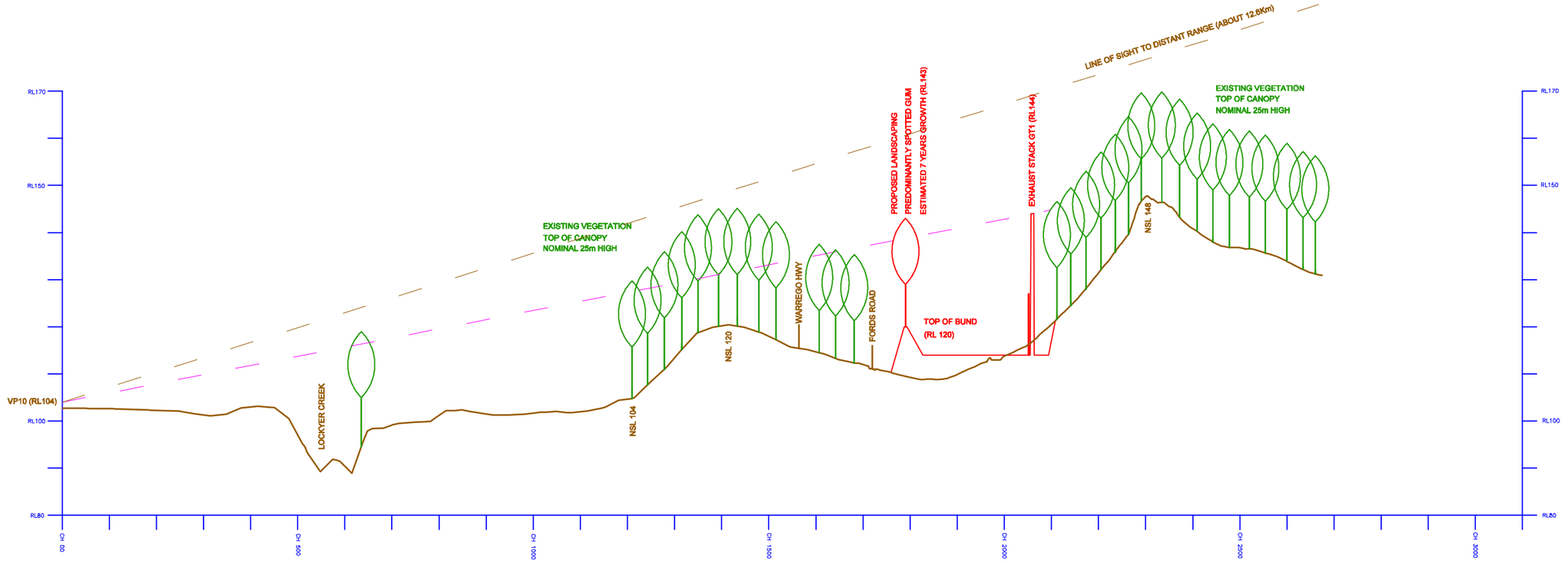
DATE: 1/12/2009

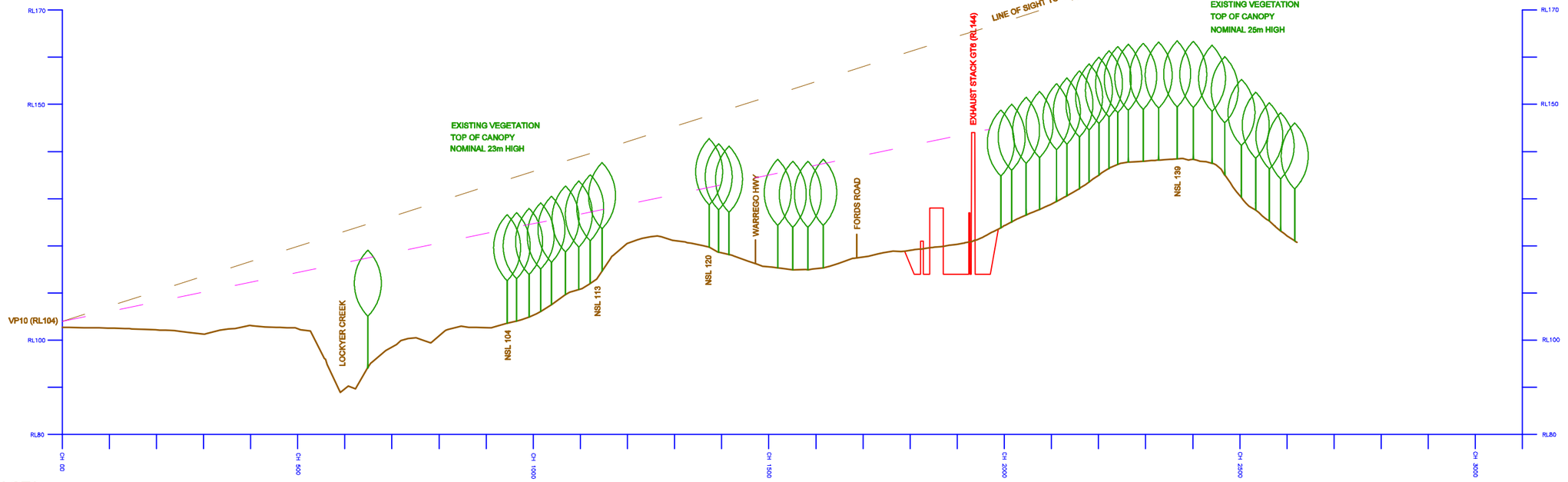
LEVEL DATUM AHD DERIVED

SCALE 1 : 10000 HORIZONTAL @ A3

SCALE 1 : 1000 VERTICAL @ A3

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY





WESTLINK POWER PROJECT

SECTION OF VP10 TO GT1 and GT6

DATE: 1/12/2009

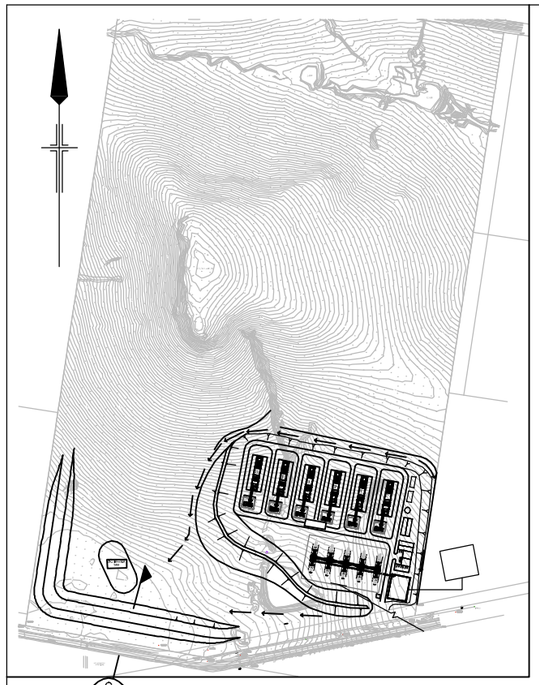
LEVEL DATUM AHD DERIVED

SCALE 1 : 10000 HORIZONTAL @ A3

SCALE 1 : 1000 VERTICAL @ A3

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY

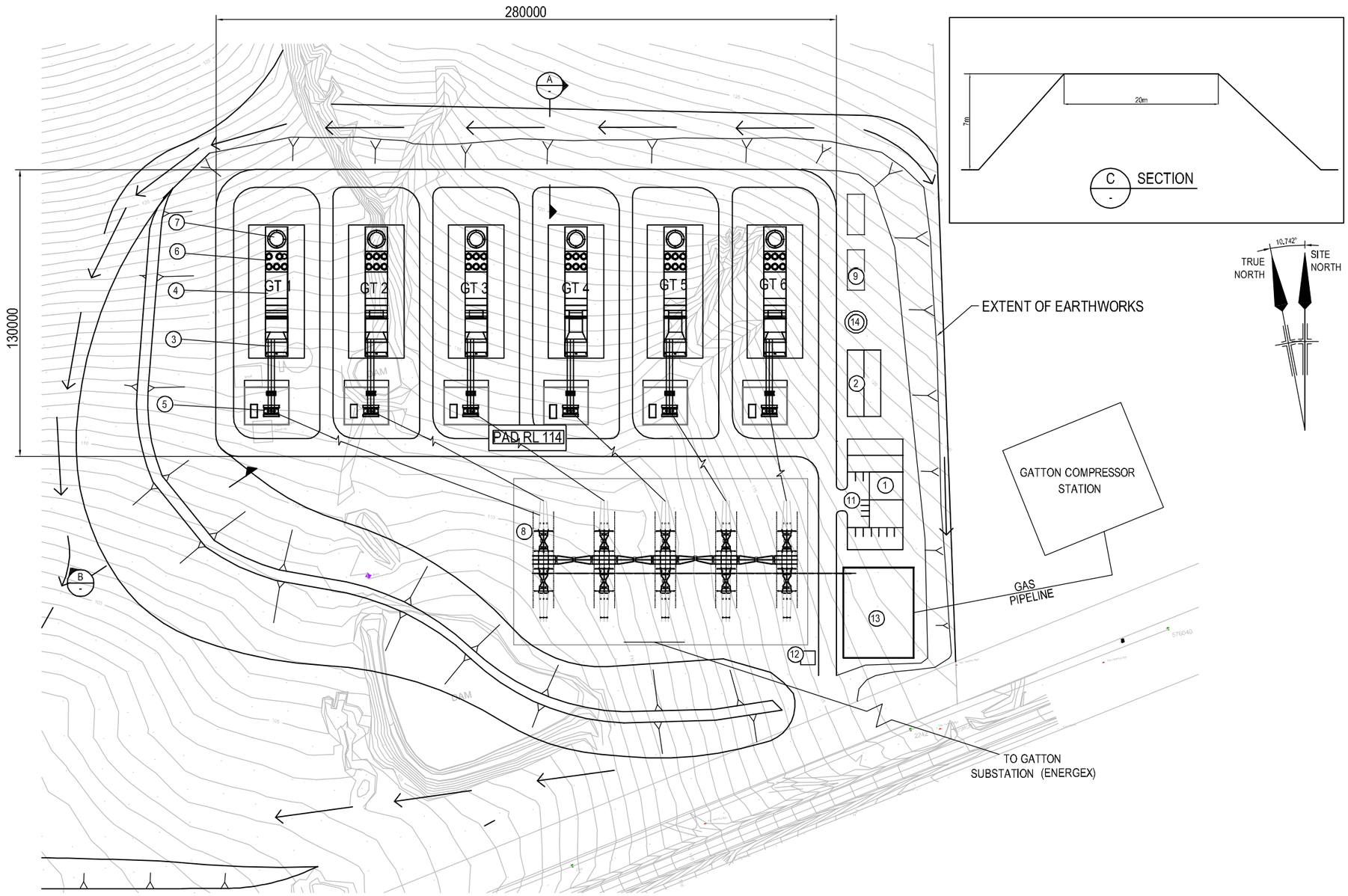
Appendix 5 – WPP Plant Layout



C
-

SITE LOCATION

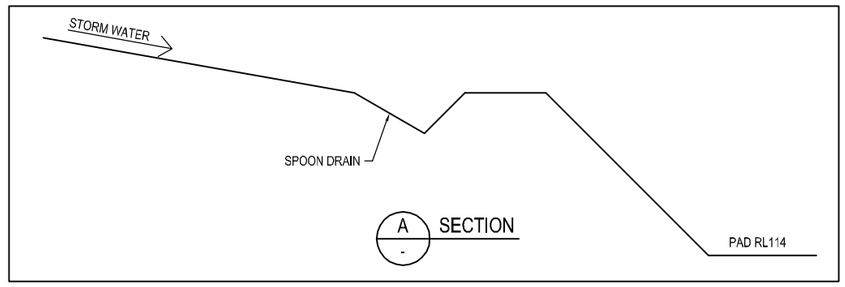
SCALE 1:5000



	DESCRIPTION	HEIGHT (m)
1	CONTROL AND ADMIN BUILDING	7.0
2	WAREHOUSE AND WORKSHOP	14.0
3	GAS TURBINE AIR INTAKE	26.0
4	GAS TURBINE ENCLOUSRE	8.5
5	TRANSFORMER	5.0
6	COOLING FANS	13.0
7	EXHAUST STACK	30.0
8	SWITCHYARD	11.0
9	OTHER TANKS & PUMPS	7.0
10	FIRE SYSTEM	4.0
11	CAR PARK	-
12	SECURITY HOUSE	4.0
13	GAS SKID (IF REQUIRED)	6.0
14	FIRE TANK	9.0

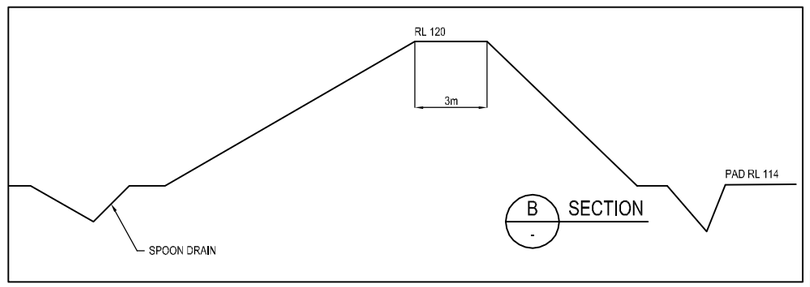
NOTES:

1. SITE LOCATION, SIZING AND LAYOUT INDICITIVE ONLY.
2. EXISTING DAM TO BE FILLED IN.
3. ARROWS INDICATE STORMWATER FLOW



SITE LAYOUT

SCALE 1:1000



PRELIMINARY

No	Revision	Drawn	Checked	Approved	Date
E	BUND MODIFIED	GHD			03/12/09
D	BUND & STORMWATER ADDED	GHD			24/11/09
C	EXTERNAL INFRASTRUCTURE INCLUDED	GHD			25/08/09
B	CLIENT COMMENTS INCORPORATED	GHD			17/07/09
A	ISSUED FOR CLIENT REVIEW	GHD			

Notes * Indicates signatures on original issue of drawing or last revision of drawing

GHD CLIENTS | PEOPLE | PERFORMANCE

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

Drawn	GHD	Designed	
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: **WESTLINK PTY. LTD.**

Project: **WESTLINK POWERSTATION DEVELOPMENT ASSISTANCE**

Title: **PLANT LAYOUT OPTION 1 PLAN VIEW**

Original Size **A1**

Drawing No: **41-21379-SK004**

Rev: **E**

Plot Date: 3 December 2009 - 2:55 PM Plotted by: Cameron Cassar

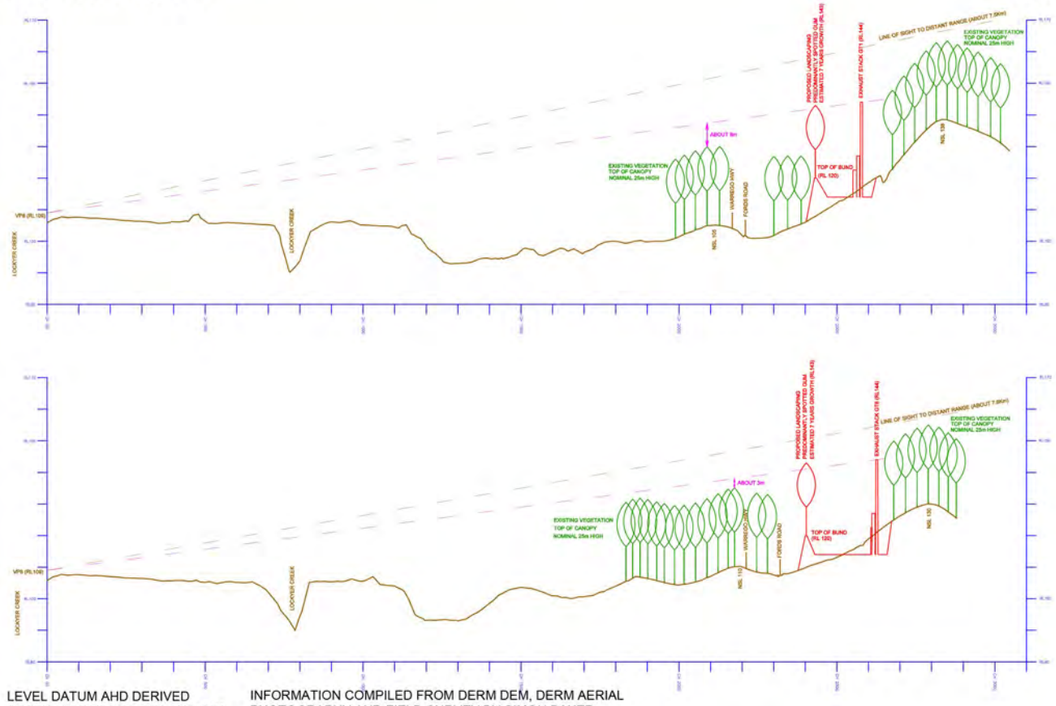
Cad File No: G:\41\21379\CADD\Drawings\41-21379-SK004_ALT_E.dwg

Attachment B

Amended Photomontage Images

Site Photo - May 2009

Location of Vantage Point 8



LEVEL DATUM AHD DERIVED
SECTION OF VP8 TO GT1 AND GT6
DATE: 1/12/2009

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY BY SIMON BAKER REGISTERED SURVEYOR 2048 (CADASTRAL AND ENGINEERING)

Terrain profile demonstrating the proposed WPP will not be visible from Vantage Point 8

View from Vantage Point 8 expected to be unaltered by installation of the Proposed WPP after 7 years

Please Note: Photomontages are indicative only. Assumptions include:

1. **Existing vegetation top of canopy nominal 25m high as identified by Simon Baker registered Surveyor 2048 (Cadastral and Engineering) during a field survey (refer longitudinal sections prepared by Simon Baker dated 01/12/2009 for further detail);**
2. **Proposed landscape screening predominantly Spotted Gum estimated 7 years growth 23.1m;**
3. **The mature height of planted vegetation on-site (approximately 23.1m) would be achieved over an approximate 7 year period or/at an approximate rate of 3.3m of new growth per year (subject to rainfall and climatic conditions). Early age plantation growth rate data (for the Spotted Gum) has been supplied by DERM, DEM and DEEDI (Primary Industry and Fisheries) for the Gatton area that has been defined as a medium rainfall area; and**
4. **The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 7 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout) to establish the necessary vegetation screen.**

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

CLIENTS PEOPLE PERFORMANCE

Legend

- Stacks
- Vantage Point 8
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision D
Date 22 JANURAY 2010

Figure A8

**Vantage Point 8
Gatton Racecourse**

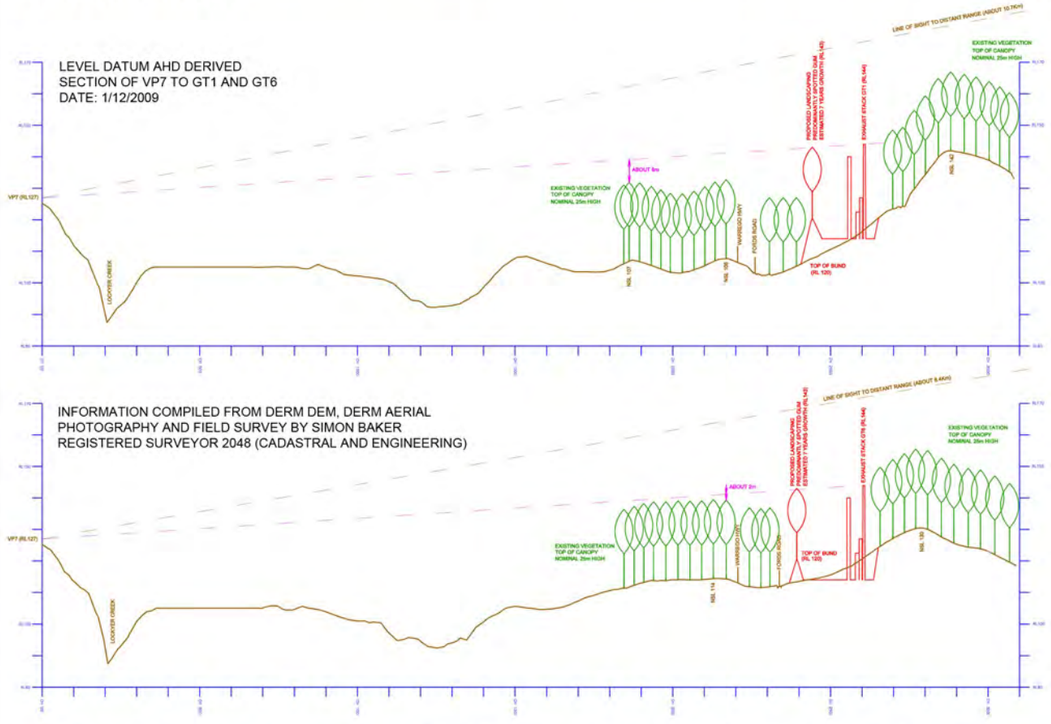
G:\41\21379\gis\map\rev2\figA8_vantage8.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gypmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009

Location of Vantage Point 7



Terrain profile demonstrating the proposed WPP will not be visible from Vantage Point 7 after 7 years

View from Vantage Point 7 expected to be unaltered by installation of the Proposed WPP after 7 years

Please Note: Photomontages are indicative only. Assumptions include:

1. **Existing vegetation top of canopy nominal 25m high as identified by Simon Baker registered Surveyor 2048 (Cadastral and Engineering) during a field survey (refer longitudinal sections prepared by Simon Baker dated 01/12/2009 for further detail);**
2. **Proposed landscape screening predominantly Spotted Gum estimated 7 years growth 23.1m;**
3. **The mature height of planted vegetation on-site (approximately 23.1m) would be achieved over an approximate 7 year period or/at an approximate rate of 3.3m of new growth per year (subject to rainfall and climatic conditions). Early age plantation growth rate data (for the Spotted Gum) has been supplied by DERM, DEM and DEEDI (Primary Industry and Fisheries) for the Gatton area that has been defined as a medium rainfall area; and**
4. **The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 7 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout) to establish the necessary vegetation screen.**

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

CLIENTS PEOPLE PERFORMANCE

Legend

- Stacks
- Vantage Point 7
- Proposed WPP Footprint

Job Number	41/21379
Revision	D
Date	22 JANURAY 2010

Westlink Power Project
Visual Impact Assessment

Figure A7

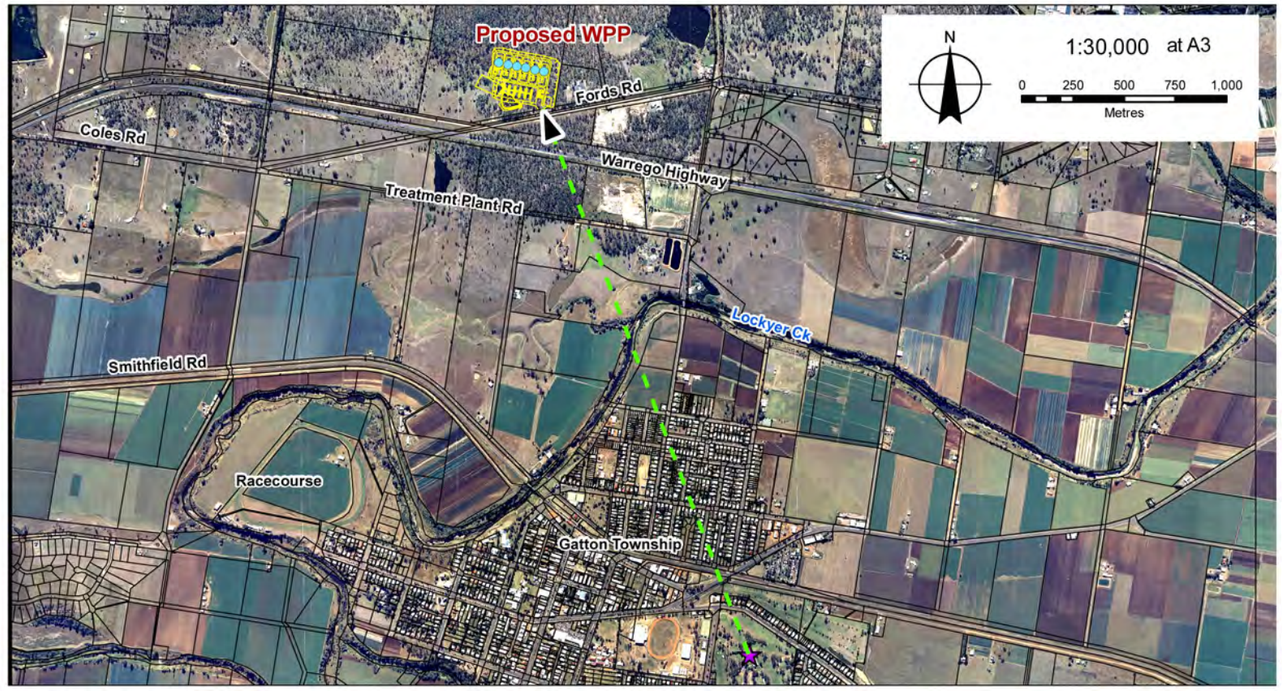
Vantage Point 7 Spencer St

G:\41\21379\gis\map\rev2\figA7_vantage7.mxd

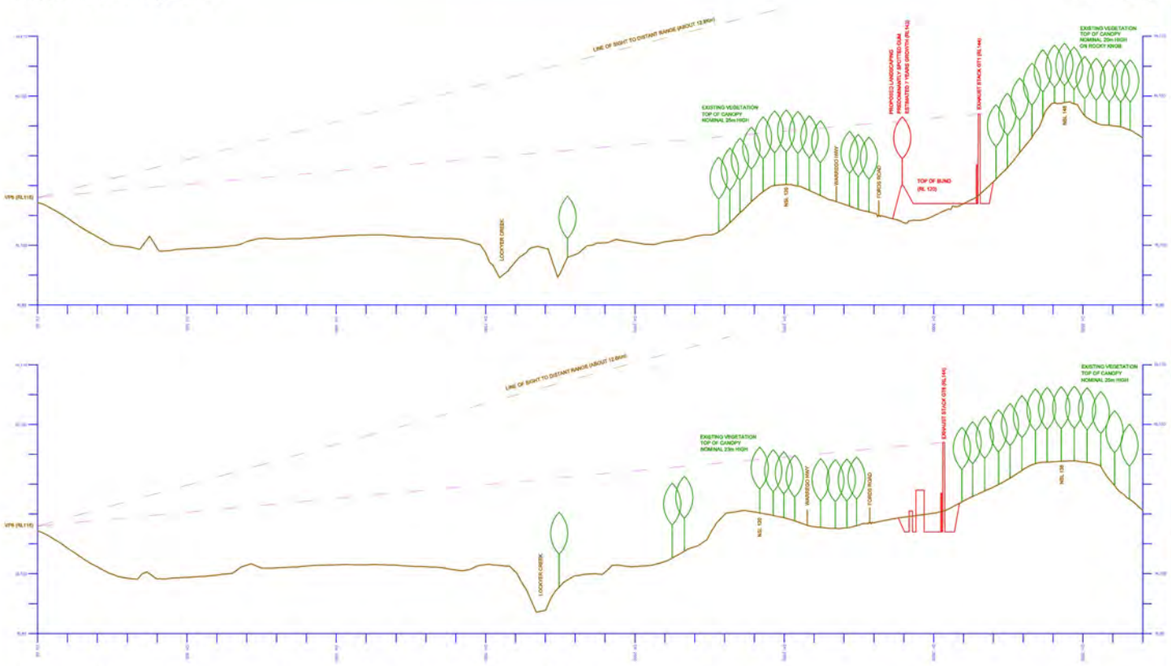
Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 6



LEVEL DATUM AHD DERIVED
SECTION OF VP6 TO GT1 AND GT6
DATE: 1/12/2009

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY BY SIMON BAKER REGISTERED SURVEYOR 2048 (CADASTRAL AND ENGINEERING)

Terrain profile demonstrating the proposed WPP will not be visible from Vantage Point 6

View from Vantage Point 6 expected to be unaltered by installation of the Proposed WPP after 7 years

Please Note: Photomontages are indicative only. Assumptions include:

1. **Existing vegetation top of canopy nominal 25m high as identified by Simon Baker registered Surveyor 2048 (Cadastral and Engineering) during a field survey (refer longitudinal sections prepared by Simon Baker dated 01/12/2009 for further detail);**
2. **Proposed landscape screening predominantly Spotted Gum estimated 7 years growth 23.1m;**
3. **The mature height of planted vegetation on-site (approximately 23.1m) would be achieved over an approximate 7 year period or/at an approximate rate of 3.3m of new growth per year (subject to rainfall and climatic conditions). Early age plantation growth rate data (for the Spotted Gum) has been supplied by DERM, DEM and DEEDI (Primary Industry and Fisheries) for the Gatton area that has been defined as a medium rainfall area; and**
4. **The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 7 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout) to establish the necessary vegetation screen.**

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

GHD
CLIENTS PEOPLE PERFORMANCE

Legend

- Stacks
- Vantage Point 6
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision D
Date 22 JANURAY 2010

Figure A6

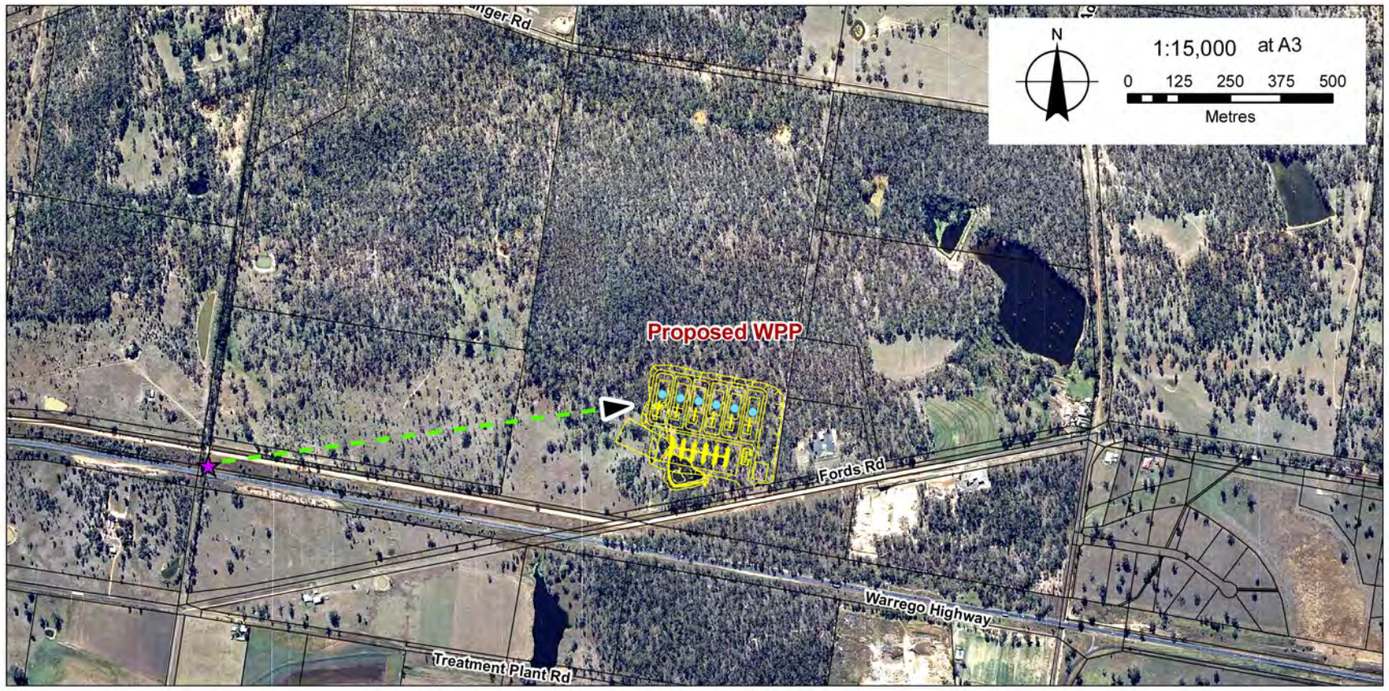
Vantage Point 6 Golf Course

G:\41\21379\gis\map\rev2\figA6_vantage6.mxd

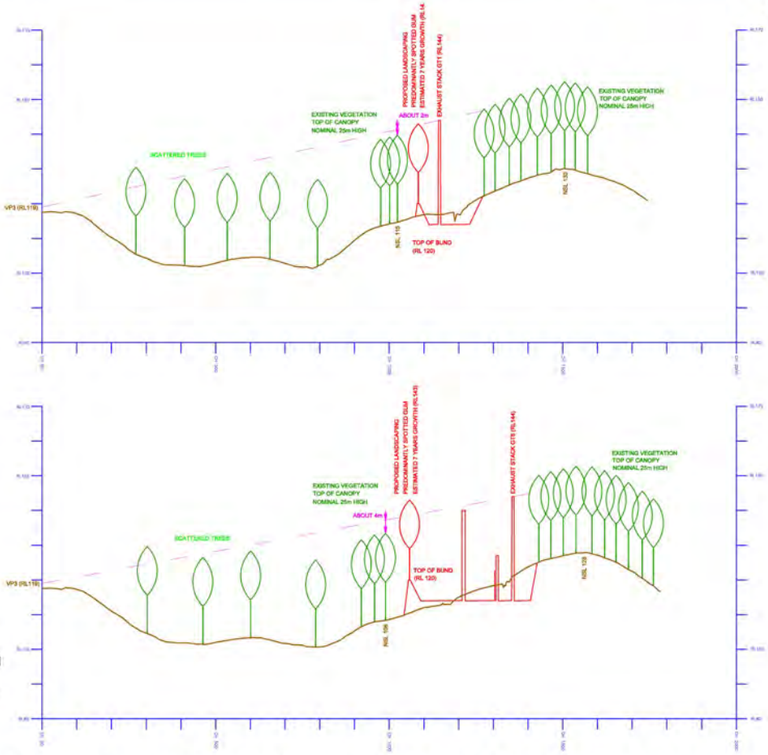
Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gypmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 3



LEVEL DATUM AHD DERIVED
SECTION OF VP3 TO GT1 AND GT6
DATE: 1/12/2009

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY BY SIMON BAKER REGISTERED SURVEYOR 2048 (CADASTRAL AND ENGINEERING)

Terrain profile demonstrating the proposed WPP will not be visible from Vantage Point 3 after 7 years

View from Vantage Point 3 expected to be unaltered by installation of the Proposed WPP after 7 years

Please Note: Photomontages are indicative only. Assumptions include:

1. **Existing vegetation top of canopy nominal 25m high as identified by Simon Baker registered Surveyor 2048 (Cadastral and Engineering) during a field survey (refer longitudinal sections prepared by Simon Baker dated 01/12/2009 for further detail);**
2. **Proposed landscape screening predominantly Spotted Gum estimated 7 years growth 23.1m;**
3. **The mature height of planted vegetation on-site (approximately 23.1m) would be achieved over an approximate 7 year period or/at an approximate rate of 3.3m of new growth per year (subject to rainfall and climatic conditions). Early age plantation growth rate data (for the Spotted Gum) has been supplied by DERM, DEM and DEEDI (Primary Industry and Fisheries) for the Gatton area that has been defined as a medium rainfall area; and**
4. **The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 7 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout) to establish the necessary vegetation screen.**

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

CLIENTS PEOPLE PERFORMANCE

Legend

- Stacks
- Vantage Point 3
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision D
Date 22 JANURAY 2010

Figure A3 **Vantage Point 3 Warrego Highway (Heading East)**

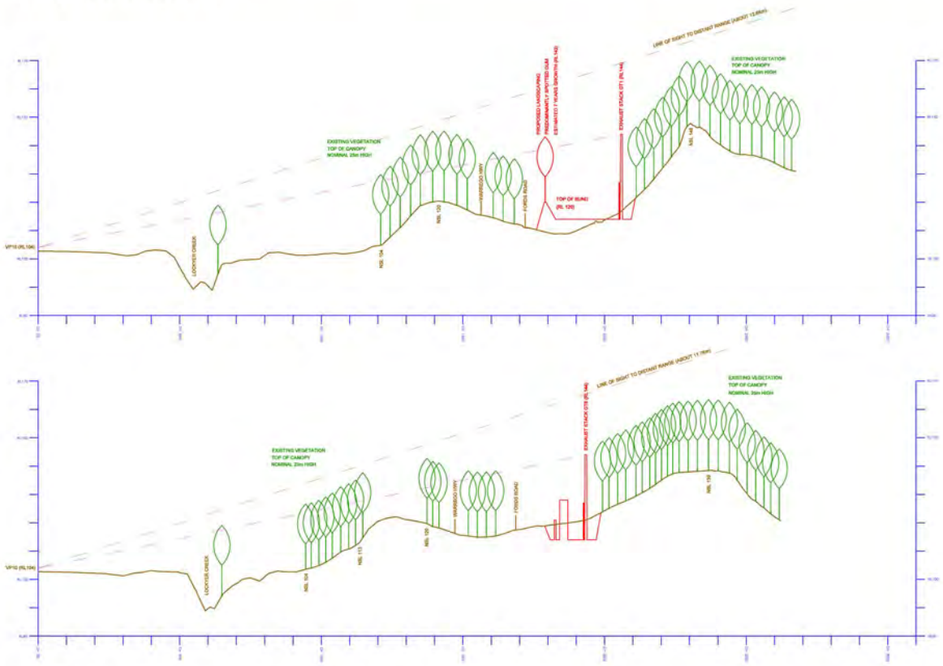
G:\41\21379\gis\map\rev2\figA3_vantage3.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gympmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009

Location of Vantage Point 10



LEVEL DATUM AHD DERIVED
SECTION OF VP10 TO GT1 AND GT6
DATE: 1/12/2009

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY BY SIMON BAKER REGISTERED SURVEYOR 2048 (CADASTRAL AND ENGINEERING)

Terrain profile demonstrating the proposed WPP will not be visible from Vantage Point 10

View from Vantage Point 10 expected to be unaltered by installation of the Proposed WPP after 7 years

Please Note: Photomontages are indicative only. Assumptions include:

1. **Existing vegetation top of canopy nominal 25m high as identified by Simon Baker registered Surveyor 2048 (Cadastral and Engineering) during a field survey (refer longitudinal sections prepared by Simon Baker dated 01/12/2009 for further detail);**
2. **Proposed landscape screening predominantly Spotted Gum estimated 7 years growth 23.1m;**
3. **The mature height of planted vegetation on-site (approximately 23.1m) would be achieved over an approximate 7 year period or/at an approximate rate of 3.3m of new growth per year (subject to rainfall and climatic conditions). Early age plantation growth rate data (for the Spotted Gum) has been supplied by DERM, DEM and DEEDI (Primary Industry and Fisheries) for the Gatton area that has been defined as a medium rainfall area; and**
4. **The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 7 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout) to establish the necessary vegetation screen.**

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

CLIENTS PEOPLE PERFORMANCE

Legend

- Stacks
- Vantage Point 10
- Proposed WPP Footprint

Job Number 41/21379
Revision C
Date 22 JANURAY 2010

Westlink Power Project
Visual Impact Assessment

Figure A10

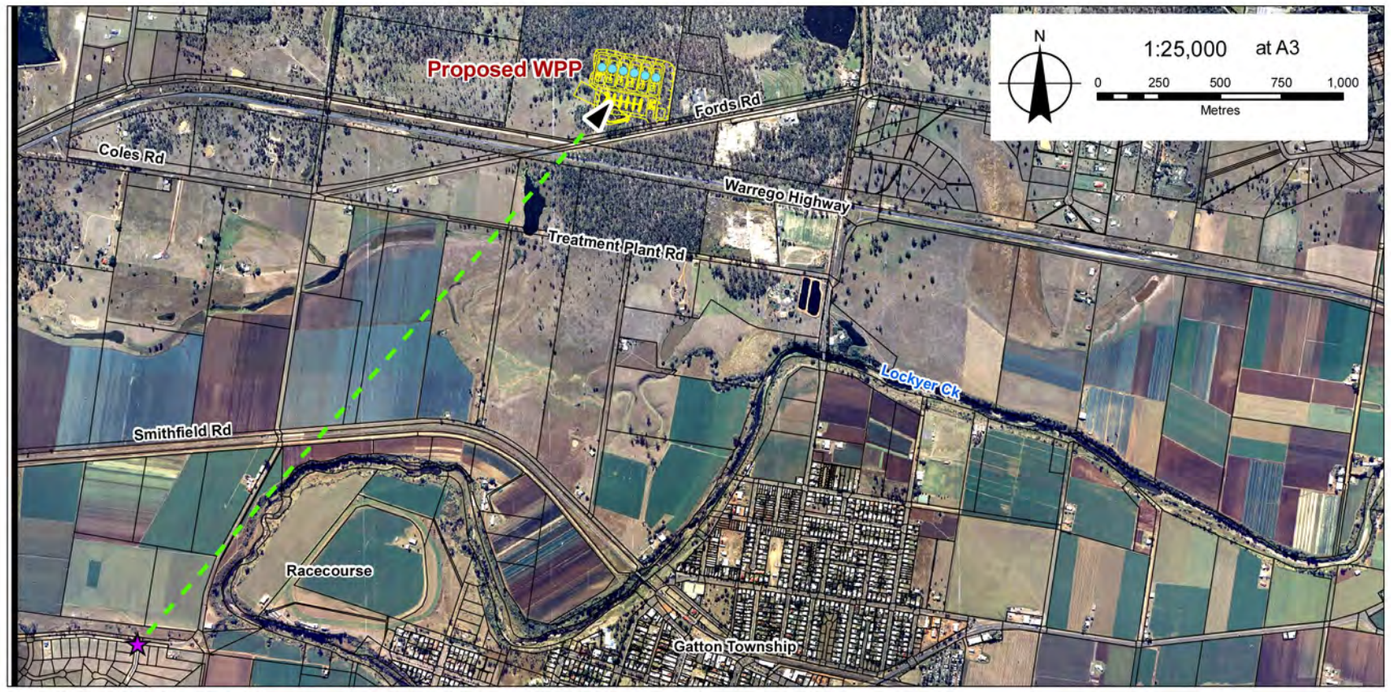
Vantage Point 10 Dwyer Street

G:\41\21379\gis\map\rev2\figA10_vantage10.mxd

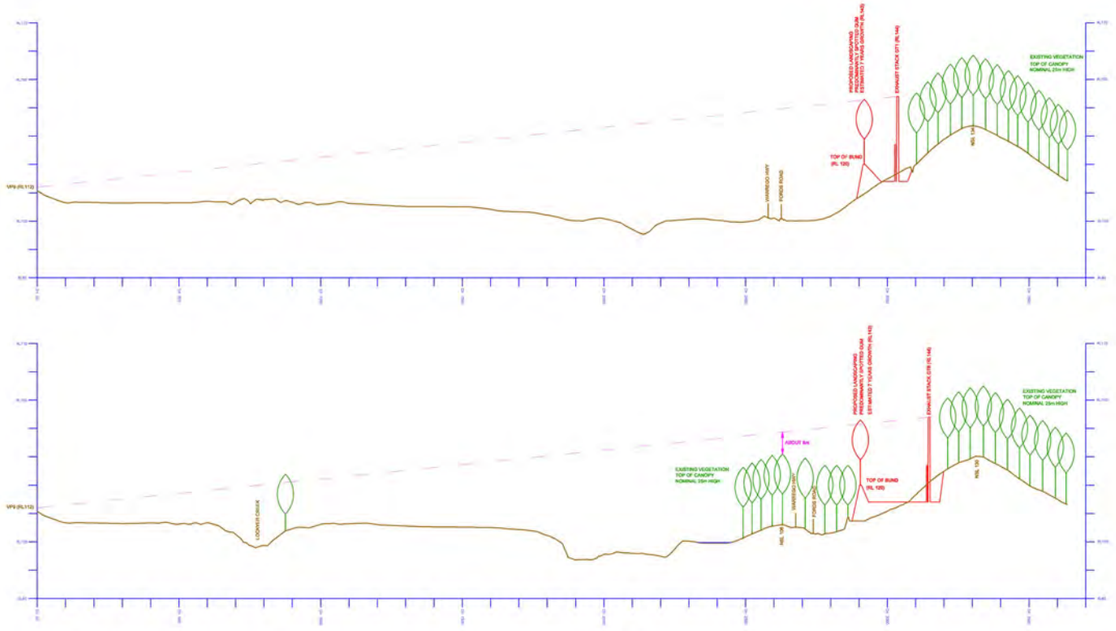
Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Profile derived from 5m contours (DERM) and Detailed site survey (Westlink), and WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gypmail@ghd.com.au W www.ghd.com.au

Site Photo - May 2009



Location of Vantage Point 9



LEVEL DATUM AHD DERIVED
SECTION OF VP8 TO GT1 AND GT6
DATE: 1/12/2009

INFORMATION COMPILED FROM DERM DEM, DERM AERIAL PHOTOGRAPHY AND FIELD SURVEY BY SIMON BAKER REGISTERED SURVEYOR 2048 (CADASTRAL AND ENGINEERING)

Terrain profile demonstrating the proposed WPP will not be visible from Vantage Point 9 after 7 years

View from Vantage Point 9 expected to be unaltered by installation of the Proposed WPP after 7 years

Please Note: Photomontages are indicative only. Assumptions include:

1. Existing vegetation top of canopy nominal 25m high as identified by Simon Baker registered Surveyor 2048 (Cadastral and Engineering) during a field survey (refer longitudinal sections prepared by Simon Baker dated 01/12/2009 for further detail);
2. Proposed landscape screening predominantly Spotted Gum estimated 7 years growth 23.1m;
3. The mature height of planted vegetation on-site (approximately 23.1m) would be achieved over an approximate 7 year period or/at an approximate rate of 3.3m of new growth per year (subject to rainfall and climatic conditions). Early age plantation growth rate data (for the Spotted Gum) has been supplied by DERM, DEM and DEEDI (Primary Industry and Fisheries) for the Gatton area that has been defined as a medium rainfall area; and
4. The mature height of planted shrubs on-site (approximately 5m) would be achieved over an approximate 7 year period (subject to a range of variables such as soil type, rainfall, average temperatures and planting design layout) to establish the necessary vegetation screen.

Map Projection: Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

CLIENTS PEOPLE PERFORMANCE

Legend

- Stacks
- Vantage Point 9
- Proposed WPP Footprint

Westlink Power Project
Visual Impact Assessment

Job Number 41/21379
Revision D
Date 22 JANURAY 2010

Figure A9 Vantage Point 9
Old Toowoomba Rd and Parklea Dr

G:\41\21379\gis\map\rev2\figA9_vantage9.mxd

Data source: Cadastre Feb 2009 (DERM), Aerial photography 2001 (DERM), Detailed site survey (Westlink), and Proposed WPP Design (GHD).

1/58 Channon St Gympie QLD 4570 Australia T 61 7 5482 9444 F 61 7 5482 9433 E gypmail@ghd.com.au W www.ghd.com.au

Attachment C

Landscape Revegetation and Management Plan

CLIENTS | PEOPLE | PERFORMANCE

Westlink Pty Ltd

Report for Westlink Power Station Development

Landscape Management and Revegetation Plan

February 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

1. Introduction

1.1 Scope of Works

The Landscape Management and Revegetation Plan (LMRP) has been produced to manage and reinstate vegetation throughout the operation, construction and maintenance phases of specified areas of Westlink Power Project (WPP) site. Refer to Landscape Detail Design Planting Layout 1, Dwg 41-22282-L001, L002, L003 and L004, Rev A, located in Appendix A of this document. A Detailed Landscape Specification document has also been prepared which sets out the procedures to be followed fro implementation of the soft landscape components of the project. Please Refer to Appendix D of the Visual Impact and Landscape Assessment Addendum Report for details. Additionally, a Detailed Ecological Assessment, dated 21st April 2009, has been prepared by Conics and relevant information on existing vegetation, fauna, weed species has been referred to in this LMRP.

1.2 Aims and Objectives of Revegetation

The LMRP aims to provide a clear, concise and practical framework for the management and revegetation of the areas outlined in 41-22282-L001 to L004 Planting Layout Plan for the WPP located in Appendix A of this document. The objectives of the LMRP are described in Table 1 below.

Table 1 Aims and Objectives of Rehabilitation Works

Components	Objective	Management Response
Project Management	To formulate and implement vegetation management actions; To clearly identify, methods and reporting lines; To inform all relevant players of their responsibilities; To promote and maintain stable vegetation cover.	Project management will incorporate LMRP as an integral part of the construction and operational phase. Nominate the person with responsibility for overseeing development works (e.g. the site supervisor or works supervisor) to be responsible for implementing vegetation management actions on site, and for point-of-contact for local Council or other agencies. Advise all contractors as to their role in vegetation management. Supply an action plan outlining timeframes for the implementation of each phase, and monitoring and reporting activities.

Catchment Management and Action	To protect catchments during construction and operational phases of development.	Implement catchment protection measures prior to construction works commencing. Ensure that short (construction phase) impacts on water quality are minimized. Ensure that hydrology quality of runoff is restored in the long-term.

Components	Objective	Management Responses
Clearing and Disposal of Vegetation	To minimise the adverse impacts of vegetation clearance; To maximise recycling or reuse of cleared vegetation; To minimise the impacts of habitat loss due to the removal of vegetation or hollow bearing trees; To minimise impacts to native flora and fauna; To minimise soil erosion and sedimentation; To minimise the introduction and/or spread of weeds; To promptly identify and control weeds and to eliminate noxious weed species; To maintain existing floristic characteristics of the region throughout the proposed developed landscape; To minimise the negative impacts of pest plant and animal species within and adjoining the power station footprint, during construction of the project; To ensure the most appropriate measures are implemented to mitigate potential negative impacts of infestation by pest plant & animal species, caused before, prior to, during construction and throughout the maintenance period of the project; To ensure no negative impacts in water quality resulting from pathogens, bacteria, and nutrients; and To define the roles, responsibilities and the tasks to be performed, in regard to the control and monitoring of weed infestations.	Clearly identify areas of vegetation to be cleared or retained, and areas containing hollow bearing trees. Relocate wildlife including possums, sugar gliders, and native beehives prior to the removal of habitat trees. Ensure appropriate permits have been obtained prior to these actions. Use clearing methods that will not damage adjacent protected vegetation and will minimise soil profile disturbance. Recycle cleared vegetation for reuse on or off site such as mulch. Trees with identified hollows should have the hollow section preserved and this section should be suitably mounted on nearby or adjacent suitable trees, subject to Council approval. Establish an inventory of both native and exotic species on the site. Identify any species listed under the *Nature Conservation Act 1992 (Qld)*, and the *Environmental Protection and Biodiversity Conservation Act 2000 (Commonwealth)* which are to be protected under this legislation. Implement vegetation protection measures prior to construction works commencing. These commonly include designating vehicle access ways and work areas, signage, barrier fences, and tree guards, to minimize compaction of the remaining vegetation's root zone. Protect the root zones of individual trees or clumps of trees from compaction, filling, stockpiling or excavation, by excluding such activities to a location outside the vegetation canopy drip-line.

Revegetation and Maintenance	To restore and enhance disturbed areas in the post construction phase; To maximise survival opportunities for areas of retained vegetation and newly rehabilitated areas; To protect vegetation and catchments during construction and operational phases of development; To restore and enhance disturbed areas in the post construction phase; To maximise survival opportunities for areas of retained vegetation and newly rehabilitated areas; To improve the ecological values by providing a naturally vegetated weed-free area with habitat complexity, food resources and linkages to other areas; and To prevent existing and new weeds from restabilising within the rehabilitated areas.	Determine the revegetation techniques suitable for the site taking into account the topography, soils, and ecological processes (i.e. natural regeneration, direct seeding, and soil seed-bank translocation techniques). Provide planting densities and techniques as required. Provide recommended native species lists for revegetation, as well as priority weed species recommended for control. Ensure recommended native plant species will not aggressively compete or displace existing native species. Specify a maintenance program in the LMRP to ensure the long-term health and vigour of retained vegetation and the healthy growth of new plantings and/or direct seeded areas. Give details on mulching, watering and fertiliser regimes, regular inspection schedules for damage or disease, replacement planting criteria and weed eradication measures in this program. Implement a monitoring program to measure the effectiveness of adopted measures. Provide for monitoring of any adjacent waterways for sedimentation and erosion with an action plan to remediate as necessary. Weed management and control methods should be applied in dry weather conditions only throughout the year. Chemical control of weeds should have a minimum of 4 – 24 hrs of non-contact exposure to heavy rain. All exposed soil surfaces are to be rehabilitated within 24 hrs of construction or landscaping completion and where necessary have temporary or permanent sediment control devices in place prior or during construction phase.

2. Existing Vegetation to be Retained

A field assessment was conducted to establish existing conditions on site in the vicinity of the proposed power station and screen/buffer mound areas. Trees at the southern bank of the existing dam and to the south west of the dam will be retained where possible. A variety of eucalypt species have been identified, refer to Landscape Detail Design Planting Layout 1, Dwg 41-22282-L001, L002, L003 and L004, Rev A, prepared by GHD and the Detailed Ecological Assessment, Lot 191 CSH2361, Ford's Road Gatton, dated 21st April 2009, prepared by Conics. Existing vegetation will provide an amount of instant screening of the proposed power station stacks. This has been documented on Landscape Detail Design Planting Layout 1, Dwg 41-22282-L001, L002, L003 and L004, Rev A, prepared by GHD

Mistletoe Infestation

There was a visible infestation of mistletoe (*Amyema miquelii*) on the forest red gums (*Eucalyptus tereticornis*) present on site around the largest dam. Mistletoe is a native epiphytic parasitic shrub that, if occurring in high enough densities may kill its host tree. Mistletoe also provides a potential food source for birds, particularly mistletoebird (*Dicaeum hirundinaceum*) and provides roosting opportunities for other species. Although mistletoe was present in quite a few trees located around the dam, it does not appear to be having a detrimental effect on the host trees. Retained trees should be routinely inspected by a suitably qualified arborist to make an assessment and perform any treatment required.

3. Roles and Responsibility for Revegetation Works

All personnel are responsible for the environmental performance of their activities and for complying with their General Environmental Duty as outlined in the *Environmental Protection Act 1994* (EP Act).

Section 36 (1) on the EP Act states that "a person must not carry out any activity that causes, or is likely to cause, environmental harm, unless the person takes all reasonable and practicable measures to minimise that harm". The following roles and responsibilities relates to their obligations under the EP Act.

General Manager

The General Manager (GM) is responsible for the overall management of the project. This includes Environmental, Health and Safety management.

Project Manager

The Project Manager (PM), (Revegetation Contractor) is responsible for all project works and implementation of the work on location. This person reports to the GM.

The PM is also responsible for developing and maintaining a Compliance Register for the project. This includes managing compliance audits (environmental and safety) to ensure compliance.

Project Supervisor/s

The Supervisor is responsible for directing work in the field in compliance with the specifications documented in the specification for the Site Landscape and Revegetation Works. The Project Supervisors have the authority to 'stop the work' if, in their opinion, the work has the potential to harm people or damage the environment. This includes the incorporation of LMRP mitigation measures into work procedures, Job Hazard Analysis and Toolbox Meetings. The supervisor/s report to the PM.

The supervisor/s are also responsible for the implementation, monitoring and reporting in compliance with the LMRP. This includes the continuous improvement of environmental performance of people and equipment. The Project Supervisor is responsible for implementing all deliverables of the weed management plan outlined in the LMRP. This includes identification and control of all weeds species on site with a priority focus on declared weeds species using appropriate control techniques. The site supervisor is also required to prepare regular reports and records of all work activities. This person is responsible to the Project Manager.

Revegetation Contractor - Project Manager Role

- Supply of skilled and qualified Project Overseer to manage the project;
- Provision of providing site assessment of projects being undertaken;
- Overseeing staff/employees conducting labour intensive project and on site supervision/onsite training in general hand tools and small engine equipment;
- Setting daily tasks and meeting goals or work objectives;
- Community liaison;

- On site /council representation;
- Preparing or daily work reports/feedback to project coordinator;
- Project Design, planning and budgeting; and

- Meetings/presentations;
- Recruitment of employees/training;
- Provision of vehicle;
- All work cover/insurance wages and administration costs incurred by Revegetation Contractor; and
- Travelling expenses covered by Revegetation Contractor.

Revegetation Contractor - Project Supervisor Role

- Supply of skilled and qualified site supervisor to oversee project;
- Provision of providing site assessment of projects being undertaken;
- Overseeing staff/contractors intensive labour project;
- On site supervision/onsite training in general hand tools and small engine equipment;
- Setting daily tasks and meeting goals or work objectives;
- Community liaison / on site /council representation;
- Preparing or daily work reports/feedback to project coordinator; and
- Provision of vehicle and all work cover/insurance wages, travelling expenses and administration costs incurred by Rehabilitation contractor.

Weed Contractor

The Weed Contractor is responsible for implementing all deliverables in the weed management plan outlined in the LMRP. This includes identification and control of all weeds species on site with a priority focus on declared weed species using appropriate control techniques. The weed contractor is also required to prepare regular reports and records of all work activities. This person is responsible to the Environmental Site Manager.

Landscape Contractor

The landscape contractor is responsible for the implementation of all deliverables outlined in this LMRP. This includes identification and control of all weeds species on site, with a priority focus on declared weed species, using appropriate control techniques. The landscape contractor is also required to prepare regular reports and records of all work activities. This person is responsible to Environmental Site Manager.

Important: Roles of the weed and landscape contractor need to be determined as there is potential for one or the other to overlap in terms of their roles and responsibilities for project deliverables. For example, the weed contractor can maintain revegetation areas, which would relieve the landscape contractor of their maintenance duties. Preferably an organisation that can achieve and deliver all outcomes can alleviate this issue. Otherwise, clear and concise site specific work plans for the project will have to be produced for the contractors to delineate work activities.

4. Management of Risks for Flora and Fauna Revegetation Works

The revegetation works will be developed to effectively implement the following:

- Effective management of vegetation within the work area;
- Control and prevent re-establishment of weeds in the proposed restoration, revegetation areas and natural areas of the site;
- Maintain, enhance and promote the rejuvenation of native species on the site and surrounding areas; and
- Establish a monitoring program to effectively manage adverse weed infestation and its impact on the environmental values of the area.

Table 2 below outlines all management requirements for the operational and maintenance phase of the project and the responsibility for managing fauna, flora, monitoring and reporting requirements.

Table 2 Flora and Fauna Management – Operational & Maintenance of Rehabilitation Works

Flora and Fauna Management Operational & Maintenance Phase	
Objective	To minimise known and potential fauna and flora impacts in areas of high environmental sensitivity
Issues and Impacts	Minimisation of tree clearing (weed treatment) particularly in high value riparian habitat areas; Disturbance of ground cover vegetation; Destruction of fauna habitat Rehabilitation.

Control Measures	**Vegetation Treatment** In the event vegetation is required to be cleared a spotter/catcher is to inspect for and appropriately remove any fauna immediately prior to works. A Vegetation Management Indicator Code should be adopted to mark all individual trees on site. This is to be marked on trees (degradable paint or tie) to inform all operators on site the status of the trees. The following codes should be used: ◗ Red tape to indicate removal; ◗ Yellow and black tape to indicate significant tree; and ◗ Blue tape to indicate vegetation to be pruned. The extent or partial vegetation treatment within the site is to be clearly marked in each restoration zone (Monitoring Photographic Data Points are to be pegged and GPS for delineation). Tree protection devices or protection zones are to be used to minimise disturbance to existing vegetation on site that is to remain. These can vary from timber deflection braces attached to trees themselves in confined working spaces to wire strand star picket fences to protection tree root areas or groups of trees. In the event individual trees are to be removed from site they are to have mature seed collected (if in season) for direct seeding of disturbed areas and be mulched on site. Mechanical vegetation (hand) removal methods shall be favored over the use of herbicides where possible.
Control Measures	Where required by the landowner or relevant statutory authority, strips of vegetation or individual trees should remain to allow passage for animals between revegetation planting plots. Dead/injured wildlife during works or found on site shall be reported to the GM. Logs occurring in the proposed revegetation zones should be examined and their importance in terms of habitat value determined and assessed. Where they provide significant habitat values, logs should be left in their place of origin or relocated near or reinstated once weed removal treatment is completed. **Rehabilitation** Avoid the need for revegetation as much as possible by limiting vegetation clearing and/or site disturbance. Revegetation should only be considered where natural regeneration appears to have failed despite a period of suitable weather for colonisation and growth of vegetation. The site will be monitored during the works to ensure that the conservation and aesthetic value of the site are maintained. Areas proposed for rehabilitation will be supplemented with replacement plantings if any losses occur in the first 24-month period.
Monitoring	Maintenance personnel to monitor site during works and monthly through monthly maintenance inspections.

Reporting	Monthly monitoring operational works sheet are to be recorded and submitted to the general manager. Regular random on-site surveillance of tree and vegetation operational works to be conducted and onsite weed management surveillance report to recorded and submitted to site officer. Monthly progress rejuvenation monitoring records to be maintained on file by site officer. Monthly rejuvenation operational works sheet are to be recorded and submitted to site officer. Regular random on site surveillance of rejuvenation operational works to be conducted and onsite surveillance recorded and submitted to site officer. Annual rejuvenation management review including monitoring results of planting plots to be undertaken and submitted in an annual report.
Corrective Action	Areas undergoing rehabilitation shall be maintained as required. If soil erosion is still occurring in rejuvenation areas: ◗ review rejuvenation techniques conducted by project manager; ◗ assess the potential for disturbance to occur; and ◗ implement erosion and sediment control actions. If there is poor re-growth or regeneration of native plants occurring in rejuvenation, conservation and operational works zones: ◗ review rejuvenation and direct seeding management techniques conducted by project manager; ◗ assess the appropriate use and amounts of herbicides are being used in rejuvenation areas; ◗ assess the potential for weeds to occur in rejuvenation areas; and ◗ assess other potential sources or causes of weeds or limited re-growth of native plants to occur .i.e. plant pests and disease monitoring.
Responsibility	Revegetation Contractor

5. Management of Risks for Weed Management

Poor weed control accounts for most tree-planting failures, due to competition for light, moisture and nutrients. Weeds can reduce a planted species' early growth rates by up to 70% compared to weed free sites, and can decrease survival from an expected 90% of trees planted to as little as 10% survival rate. It is therefore vital that weed control is undertaken prior to planting.

The area around the footprint of the stacks and bunds has been diminished in the past due to historic landuses such as farming. Initial site investigations found tree species around the proposed power station site are largely made up of immature trees. The vegetation on site is presently providing habitat to native fauna species. For a list of fauna species recorded on Lot 191 CSH2361, refer to Detailed Ecological Assessment report, Appendix 4 of the original REF, Fauna Species Recorded on Lot 191 CSH2361 dated 21st April by Conics. Weed control activities and revegetation of the site should be staged such that suitable habitat for fauna species is maintained throughout the revegetation process and are afforded a degree of protection for as long as practicable.

Native plant species should be used in all landscaping or revegetation to provide habitat for native fauna.

Weed management requirements for operational works and maintenance for the re-vegetation works has been identified and listed in Table 2 below.

Table 2 Weed Management – Operation and Maintenance Rehabilitation Works

Weed Management and Maintenance	
Objective	To ensure that no existing weeds are spread or introduced during Project and ongoing maintenance.
Issues and Impacts	Ground disturbance, transfer and spreading of weeds.
Operational and Maintenance	

Control Measures	All weed technicians on site must be an accredited AC/DC Licensed operator. A pre-project weed audit and chemical treatment is to be undertaken before commencing works. All declared weeds (P1 -Priority 1 weeds) within the site are to be treated first before (P2 – Priority 2 weeds) before any revegetation works are to commence and are to continue throughout the duration of the 12 months maintenance project. All weed species located on site are to be identified and recorded. When applying weed management methods all due diligence will be used to maintain and preserve surrounding or existing native vegetation or communities. Woody weed species should have there stem cut close to ground level (50 mm) and be sprayed or swabbed with an approved herbicide e.g Roundup bioactive 20 ml/1 litre or concentrate, to prevent regrowth of unwanted weed species. The application of herbicidal dye should be used with the constituent herbicide to monitor the application kill rates of weed species. All broadleaf weeds in open space pasture areas are to be sprayed with Amicide 625 at a rate of 3 litres/400 litres of water. It is intended that any regrowth of weed seeds that may occur on site will be successfully controlled in the proposed maintenance program. Weekly, biweekly and monthly weed management practices will be applied to suppress and prevent re-growth of weeds species in all areas of the work site. Regularly monitoring and declared weed surveillance is to be conducted on a monthly basis of all areas. All weed removal techniques and chemicals used on site will be recorded and filed and made readily available to all relevant government agencies on request. Conduct follow up weed inspection during the growing season one year after hand over and arrange for the chemical eradication of any perceived weed occurrence. This will be outside existing contract conditions and will incur additional fees and services charges if required.
Monitoring	Weeds are to be visually monitored during routine monthly site inspections and maintenance visits. Technicians are to provide reports after maintenance patrols outlining the presence of weed infestations. Daily weed operational works sheet are to be recorded and submitted during operational works to Project Manager daily. Monthly site surveillance and maintenance report is to be submitted to the GM.

Corrective Action	Destroy localised infestations of weeds and conduct follow-up inspection to ensure that weed control has been effective. Train maintenance staff in weed identification and control measures. If weed infestations are still occurring in rejuvenation, conservation and operational works zones: • review weed removal and weed management techniques conducted by technicians; • assess the appropriate use and amounts of herbicides are being used; • assess the potential for weeds to occur; • assess other potential sources or causes of weeds to occur. Weeds to be sprayed by project manager using herbicides (approved low toxicity herbicides). Manual removal must be used adjacent to watercourses. Plant pathogens to be notified to DERM and QPI as appropriate and treated with approved chemicals in consultation with relevant statutory authority.
Reporting	Weeds and other pests shall be included in monthly maintenance reports.

- All species to be sourced from local seed provenance where possible;
- All schedule species to be provided in standard native tube plant sizes;
- All planting stock shall be true to schedule nomenclature, well formed and hardened off to suit their final location, disease free nursery stock. The root system should be firmly established without large roots extruded from the container tube; and
- Tube stock shall not be root bound.

Appropriate species that are to be reinstated in the re-vegetation program are to be species already existing on site. Canopy trees, small trees and shrubs, sedges and rushes should be planted where possible. A list of re-vegetation species to be considered when regenerating disturbed areas is provided in Table 4. All tube stock is to be inspected prior to planting out with any unacceptable or diseased stock is to be returned by the contractor.

6.1 Revegetation Techniques

Depending on site conditions and availability of resources, it is recommended that a combination of revegetation techniques be used to restore functioning vegetation throughout the site.

Plant Propagation

Plant propagation shall be handled by an appropriate wholesale nursery facility with experience in the propagation of native plants from provenance seed. Plants purchased on 'spec' should also be of provenance material only.

Hand Installation

For hand installation the planting hole will be a minimum of 25% larger than the planting container and its edges will be suitably 'roughed' prior to plant installation. The hole shall be excavated using a 'hamilton planter' or petrol auger, if ground conditions allow, or 'potti putki' if planting occurs in rip lines. The planting hole will then be backfilled with soil and firmly tamped down by hand and foot.

Hand Broadcasting / Natural Recruitment

To supplement the establishment of tube stock native trees, shrubs and lower storey species in restoration zones, it is suggested that during on-going maintenance if any existing native species on site is producing seed these adjacent species should be encouraged to self seed into the surrounding area or the seed should be collected and broad casted across the site. This will add further diversity to the site, particularly ground covers.

Direct seeding is a very 'cost effective' method of revegetation for species that are suitable for this kind of application. This includes local provenance seed such as wattles collected prior to construction. Wattles and other legumes fix nitrogen in the soil while growing and can therefore greatly improve soil condition. Many of these plants also flower heavily and are therefore very attractive to birds and insects. The addition of these pollinators into the revegetation work adds diversity and brings opportunities for natural regeneration.

6.2 Timing of Revegetation

In general, autumn and early winter are the best seasons for planting as summer temperatures can be

too high for young plants to establish and impede survival rates. Planting in all seasons can be effective as long as a suitable watering regime is implemented.

6.3 Topsoil/ Mulching requirements

Imported top soil in accordance with AS4419 is recommended for the site as per landscape drawing package 41-22282-L001- RA, ; 41-22282-L002- RA, 41-22282-L003- RA, 41-22282-L004- RA, 41-22282-L005- RA, and Soft Landscape Specification reference 400159, mulched material should be applied particularly to degraded open areas to aid in soil stabilising, weed control, moisture retention and nutrient sources. Mulch depth is to be inspected prior to planting out can commence and should be consistently 100 mm across the site.

6.4 Fertiliser Requirements

Planting areas should be fertilised with Terracottem with approximately 5-10 grams per native tube stock. Terracottem should be placed directly in the hole as composition allows for minerals to transverse downward to the bottom of the hole to encourage root growth away from the planting hole. All sections should be mulched. Fertilser is to be inspected during application and rates monitored.

6.5 Tree Guards

All plants installed manually will be suitably guarded with a protective sleeve 750 mm high with bamboo stakes.

6.6 Watering Requirements

To assist in the establishment of the rehabilitated areas, tube stock should receive a minimum of 5 litres of water per tree 3 times per week for 2 weeks during the initial planting period. Watering should occur once a week for the 12 week maintenance period. Ongoing watering should occur once a month at the same individual tree rate thereafter. Any tube stock replaced should be continually watered until it is established.

6.7 On-going Weed Management

An active weed control program should be maintained throughout all of the rehabilitated sections. The definition of a “weed” for the purposes of management is based on that of ‘environmental weed,’ namely a species that by virtue of fecundity and growth habit has the potential to establish large infestations without disturbances that dominate and eventually exclude the native vegetation.

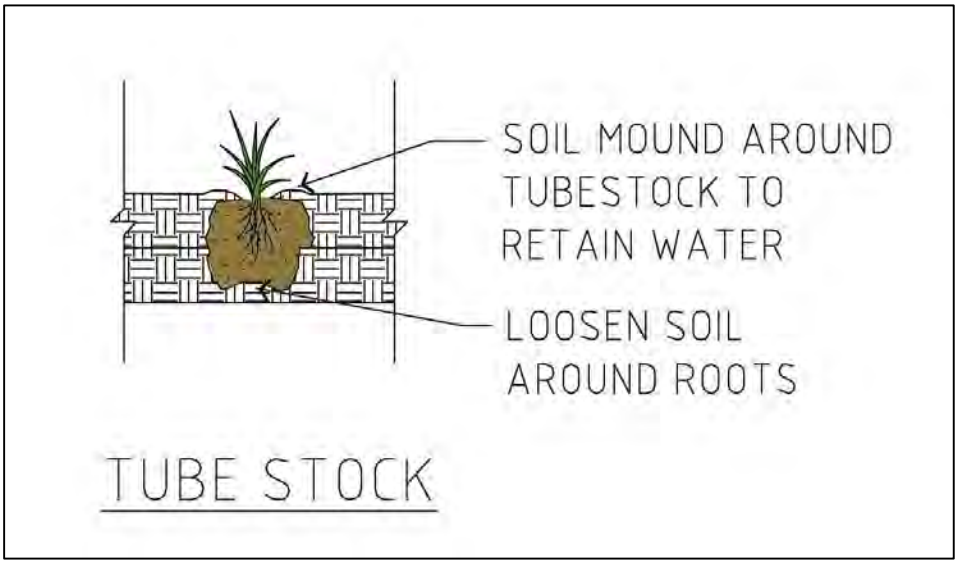
- Control programs to be carried out by personnel qualified in the recognition of target weeds and potential weed species; and
- Where possible maintain weed control within one metre of each plant to reduce competition to new revegetation for approximately 24 months.

7. Planting Techniques

The following techniques should be employed for revegetation of the site:

- Figure 1 and Figure 2 illustrate the recommended planting out techniques of nursery tube stock and mature plants that should be utilised.
- Where possible planting of tube stock should commence immediately after weed management activities, preferably the two activities should be concurrent within a management section.
- Plants should be obtained from local nurseries that specialise in endemic or provincial species.
- If plants are not available seed can be collected from appropriate species of trees, shrubs and groundcover from local provenances such as other reaches of the site. These can then be established as tube stock for planting.
- Drainage lines that follow the natural contours of the site should be included within the rehabilitation works.

Figure 1 Planting diagram for tube stock



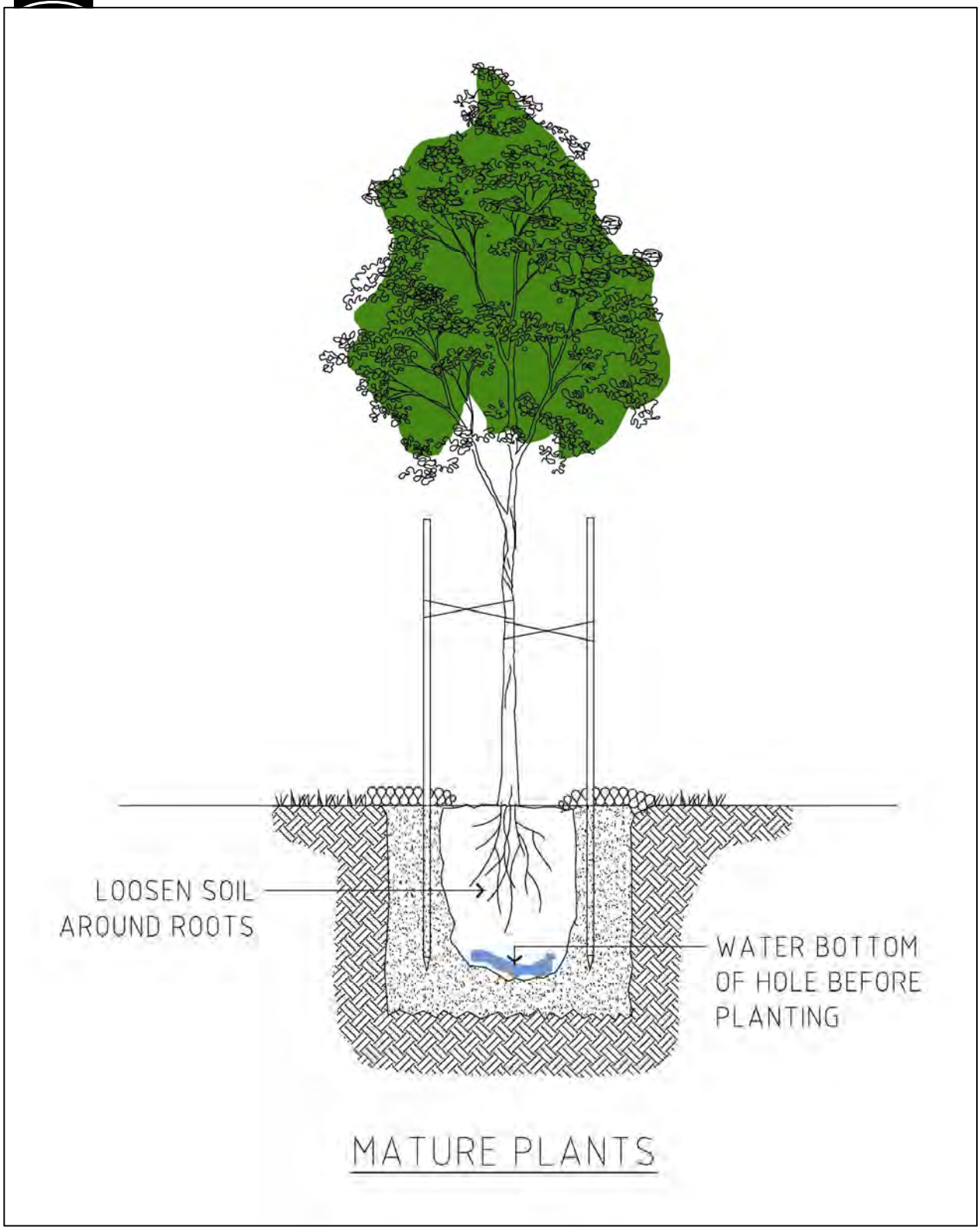


Figure 2 Planting diagrams for trees

7.1 Revegetation Areas

A cross-sectional view of a typical screen/buffer mound where the groups of trees are to be positioned within the site is provided in Figure 3. The planting structure includes a canopy layer; the local native species selected are estimated to reach a height of 25-30 m at maturity. The mid-story and understorey will assist in screening the power station from various viewpoints. Plant species used in the revegetation areas will provide habitats for local fauna and avifauna species.

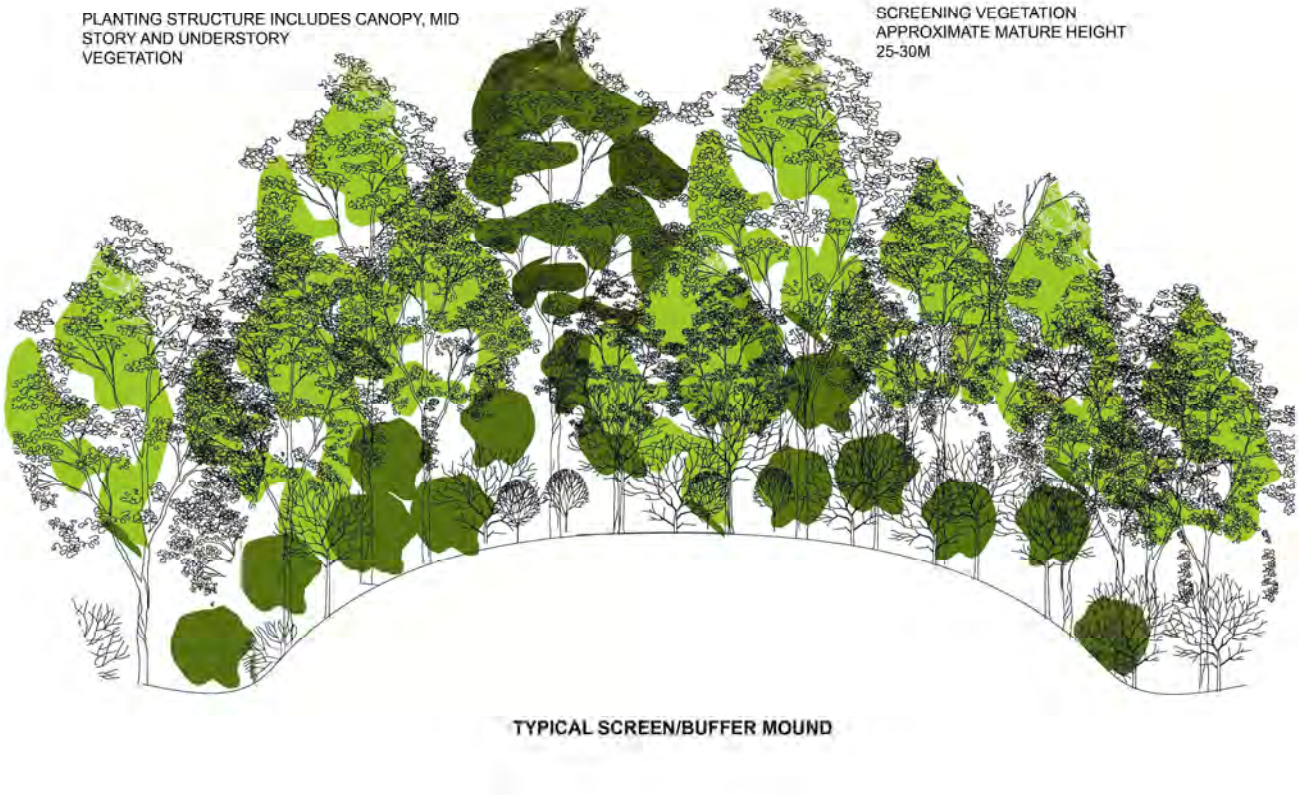


Figure 3 Cross sectional view of Typical Screen/Buffer Mound

7.2 Planting Densities

Planting densities for each tree size is provided in Table 3. A diversity of species in each habitat category should be planted out in accordance with the densities below.

Table 3 Planting Densities

Tree Form	Density
Large tree	1 tree every 10 m
Medium tree	1 tree every 7-8 m
Small tree	1 tree every 3-5m
Shrub	1 shrub every 2-3 m
Ground cover	Clumps every 1-2 m

7.3 Species list for rehabilitation

A list of species is to be used during the rehabilitation are those plants identified from onsite investigations of natural vegetation. Refer to 41-22282-L001 to L004 Landscape Planting Layout for placement of selected species.

Table 4 Species list for Revegetation Areas

Species	Type	Areas
ALLOCASUARINA inophloia	Tree	In both dam locations
CORYMBIA maculata	Tree	In both dam locations
CORYMBIA tessellaris	Tree	In both dam locations
EUCALYPTUS tereticornis	Tree	In both dam locations
LOPHOSTEMON suaveolens	Tree	In both dam locations
ACACIA juncifolia	Shrub	In both dam locations
DODONAEA viscosa	Shrub	In both dam locations
HOVEA acutifolia	Shrub	In both dam locations
JACKSONIA scoparia	Shrub	In both dam locations
PULTENAEA villosa	Shrub	In both dam locations
CYMBOPOGON refractus	Grass/Groundcover/ Native Grass Mix 1	In both dam locations
DIANELLA revoluta	Grass/Groundcover/ Native Grass Mix 1	In both dam locations
HARDENBERGIA violacea	Grass/Groundcover/ Native Grass Mix 1	In both dam locations

Species	Type	Areas
LOMANDRA longifolia	Grass/Groundcover/ Native Grass Mix 1	In both dam locations
THEMEDA australis	Grass/Groundcover/ Native Grass Mix 1	In both dam locations
DIANELLA caerulea	Grass/Groundcover/ Native Grass Mix 2	In both dam locations
ISOLEPIS nodosa	Grass/Groundcover/ Native Grass Mix 2	In both dam locations
LOMANDRA longifolia	Grass/Groundcover/ Native Grass Mix 2	In both dam locations
THEMEDA australis	Grass/Groundcover/ Native Grass Mix 2	In both dam locations
HARDENBERGIA violacea	Hydromulch Mix with Macmat Jute Matting	In both dam locations
LOMANDRA longifolia	Hydromulch Mix with Macmat Jute Matting	In both dam locations
MYOPORUM ellipticum	Hydromulch Mix with Macmat Jute Matting	In both dam locations
CYNODON dactylon	Hydromulch Grass Mix	In both dam locations

8. Maintenance Program for Revegetation Works

8.1 Revegetation Maintenance Actions

Table 5 Revegetation Maintenance Actions

	Time	Maintenance Action
Presence of Weeds	Fortnightly (12 weeks) Monthly (12 weeks) Quarterly (18 months)	Remove weed regrowth to ensure dominance of regenerating native plants. A weed exclusion zone of at least 2 m should be maintained around each revegetated area. Replenish mulch / weed matting where necessary. Problematic weeds listed in table 10 will be a specific focus for ongoing management.
Health of Plants	Fortnightly (12 weeks) Monthly (12 weeks) Quarterly (18 months)	Replace dead or dying plants. Sick plants may be an indication of stress or poor soil conditions. This may be a result of low nutrient levels or lack of water, it is imperative that a stringent watering regime is maintained.
Signs of Regeneration	Fortnightly (12 weeks) Monthly (12 weeks) Biennially (24 months)	Natural regeneration and new growth in previously weed infested areas is a good sign of recovery and indicates a healthy ecosystem.
Signs of Disturbance	Fortnightly (12 weeks) Monthly (12 weeks) Biennially (24 months)	If a disturbance (e.g. foraging by wildlife or insects, erosion, nutrient influx etc) is affecting >10% of a revegetation area it is considered a major threat and should be mitigated.
Habitat Values	12 months (annually for 2 years)	The site should be developing food sources, (e.g. nectar and seed) and habitat (e.g. leaf litter, nesting sites) for native fauna. Logs, rocks and nest boxes can be utilised to enhance fauna habitat.
Diversity & Structures	12 months (annually for 2 years)	The site should begin to represent a natural system. It should display a diversity of native species and a natural structure incorporating canopy, mid-layer and groundcover.
Density	24 months	A stem density of no greater than one (1) m centre between any two (2) plants to be achieved by end of maintenance period.

8.2 Proposed Maintenance Schedule

Table 6 Proposed Maintenance Schedule

MAINTENANCE SCHEDULE	
Responsibility	PM (Rehabilitation Contractor)
Maintenance Actions and Methodologies	**Initial Establishment** Initial 12-week establishment period applies to all vegetation works. During this period weekly maintenance is to occur that involves the following: • watering; • ongoing weeding; • fertilising; and • replacement of dead or damaged stock. **Ongoing Maintenance** After this period, it is recommended that the site be maintained on a monthly basis over a 24 month period to ensure that the revegetation has been successful. The following is to occur: ◗ Conduct weed spraying, tree watering, tree replacement of losses as necessary to maintain >90% survival rate. ◗ All proposed natural/conservation or landscape areas that are disturbed, will be revegetated at module planting rates. ◗ All revegetation species will be disease free and supplied from an accredited nursery supplier. **Long-term Maintenance** Annual report is required to determine the success of rehabilitation against the floristic and structural criteria provided above and contain recommendations by the PM to the GM in regard to issues affecting the ongoing success of the restoration works, and the possible need for additional activities that may be required outside the normal maintenance program.
Management Intervals	Weekly for first 12 weeks; Monthly for after 24 months; and Review with Biannual report.

Monitoring Program	The monitoring should address the following issues: • Plant growth, percentage cover and survival rates; • Plant losses through herbivores, disease, vandalism, storm damage or other factors; • Weed re-growth and control measures; • Plant replacement; • Guard repair and weeding inside guards; and • Maintenance watering regime. It is also essential to keep an accurate photo-record of the progress of the restoration works by setting up an appropriate number of representative fixed photo-points across the site. Photos should be taken by digital camera and recorded in the project file by date and discrete photo-point number. Photo-point locations should be clearly marked on site and mapped by a surveyor or by GPS. The site should be monitored on a monthly basis over 24 months

Corrective Actions	If soil erosion is still occurring in planting zones the following is to occur: • review rehabilitation techniques conducted by project manager; • review erosion and sediment control; • assess the potential for disturbance to occur; • assess other potential sources or causes of disturbance to occur; and • maintain planting regimes to a minimum of >90% survival rate. If weed infestations are still occurring in planting zones the following is to occur: • review weed removal and weed management techniques conducted by project manager; • assess the appropriate use and amounts of herbicides are being used; • assess the potential for weeds to occur; and • assess other potential sources or causes of weeds to occur. If there is poor re-growth or regeneration of native plants occurring in rejuvenation areas zones, the following is to occur: • review re-vegetation and direct seeding management techniques conducted by project manager; • assess the appropriate use and amounts of herbicides are being used in rejuvenation areas; • assess the potential for weeds to occur in rehabilitated areas; and • assess other potential sources or causes of weeds or limited re-growth of native plants to occur.i.e. plant pests and disease monitoring.

Reporting	Report prepared after each maintenance and monitoring visit documenting the following: • plant growth rate; • plant survival rate in each monitoring zone; • photos from monitoring zones; • areas of weed establishment including species; and • weed spraying, tree watering or tree replacement of losses completed. Annual report is required to determine success of rehabilitation against the floristic and structural criteria provided above and is to outline recommendations by the PM to the GM in regard to issues affecting the ongoing success of the restoration works, and the possible need for additional activities that may be required outside the normal maintenance program.

8.3 Photographic Monitoring Data Points

To aid in evaluating the success of the weed management and rehabilitation a number of photo points will be established along the restoration management area. Posts (timber) will be used to delineate the extent of the planting plot and each post will have a GPS coordinated for each post. Photographs will be taken at a post indicating a southern and northern aspect view of each planting plots. On a monthly basis, the same GPS posts will be used as a reference point to take photographs of the revegetation plots to monitor site establishment, tree growth and weed suppression. Periodic inspections are to be conducted every month for 24 months. Photographs are to be taken and included in the annual report to provide an indication of the survival and growth of vegetation and establishment of weeds over the maintenance period.

8.4 Preparation and submission follow up Monitoring Report

The objectives of the follow up report will be through site analysis and correlation of preliminary work activity reports will be to provide a maintenance report outlining:

- a comprehensive description of the existing environment after restoration works and mapping;
- establish plant identification of species located on site and a vegetation management plan;
- photographic record of site before and after of designated areas for revegetation/planting techniques to be applied;
- assessment of the potential impacts of weeds within the site and appropriate weed management practices to be implemented;
- review of vegetation management plan monitoring and maintenance program;
- review of description of project deliverables to meet guidelines;
- review of preparation of project schedule;
- description of safety measures used;

- review of methodologies; and
- conclusion and recommendation on long term maintenance of the revegetation works.

The Landscape Management and Revegetation Plan produced should establish a maintenance benchmark for the site. The revegetation areas would be required to be watered and weed free to maintain a planting threshold of 90% over a 24-month period. Any plant losses over this period of time should be replaced to maintain required planting regimes and to meet the 24-month maintenance conditions criteria outlined in Table 7 below.

Table 7 Site specific floristic and structural criteria – 24 month maintenance period

Criterion	24 Months	Comments
Plant survival (%)	90%	Provided follow-up maintenance is provided (i.e. watering, weeding and replacement planting). If maintenance is not provided then survival rate will be lower which is not acceptable. Failures must be replaced during maintenance and prior to handover. Failed hydro seeding areas are to be reapplied.
Diversity of species (% original planting ratio)	80%	A diversity of native species for each plant type (edge, pioneer, shrub, tree) should be present and one or two species should not dominate (i.e. wattle species). 80% must be achieved in the first 12 months.
Plant growth (cm)	> 1.00m growth	Average Height of tree to be >1 m.
Mean cover (%) excluding weeds	80%	Include trees, shrubs and ground covers must achieve 80% Hydro seeded areas must achieve 90%
Mean weed foliage cover (%)	<5%	Must be no greater than 5% in the first 12 months.
Presence of invading environmental weeds (%)	5%	In first 12 months 5% with evidence of dieback/ poisoning. 0%.
Evidence of self-generating	Evident	
Fauna habitat developing	Evident	

8.5 Mulching & Erosion Matting

All exposed soil surfaces are to be blanket mulched to a minimum depth of 100 mm mulched with a natural mix blend of organic matter (forest mulch) to aid in the retention of moisture and the reduction of weeds for the initial planting. In the event that mulch quantities are insufficient on site, mulch maybe required to be imported to site. All organic products delivered to site are required to be supplied by a quality supplier and be QPI certified red imported fire ant free.

In areas where embankment gradients are steep or the area shows signs of potential erosion, control devices such as coil logs or a bio degradable matting (Jute Matting Grade 3) should be used to line exposed areas batters/slopes.

Native seed can be hand sown under the matting if available or it can be planted into with tube stock.

The matting should be positioned parallel to the embankment gradient and be partially submerged into the soil at its highest and lowest point (both ends) and pinned at 1.5 m spacing over the matting coverage. Where matting is required to join another piece the matting should be slightly rolled so the joining mats are overlaid and then pinned through the centre at 1 m spacings. This will prevent slippage from water runoff and mats being dislodged from strong winds.

Once matting is in place, planting into the Jute mating is to be at 1 plant per 1 m^2, the matting is to cut using Jute matting scissors. The cut is to be made as an upside v pattern with the cut portion turned into and under the mat. This allows access to plant into the soil and acts as a device to catch and hold water to the new plant.

Re-vegetated areas are to be designated as lawn free maintenance zones. The combination of natural re-growth and leaf litter from plants will eventually allow the natural vegetation to maintain itself.

8.5.1 Stockpiling Areas for Mulch

It is recommended to establish any mulch stock piles at a distance of 40 m from a major watercourse and preferably on flat land. The stock pile is to have a sediment fence installed around its entire perimeter. It is best practice to ensure that any exposed surfaces should be covered within a 48 hour period after being cleared. Where blanket mulch meets embankments with steep slopes. Sediment fencing should be installed along the top of the embankment at 1.5 m from the edge of the slope to prevent mulch being potentially washed down embankments during heavy rainfall periods.

If embankments are mulched, sediment fences should be installed to run parallel along the embankment slope at top and toe of batter to prevent mulch slipping in heavy rainfall periods until plantings have stablised the slope.

9. Erosion and Sediment Control

Erosion and sediment requirements have been identified and listed in Table 8 below:

Table 8 Erosion and Sediment Control Plan

Erosion and Sediment Control	
Objective	To rehabilitate the site using all reasonable and practicable measures to minimise erosion and sedimentation.
Issues and Impacts	Locating structures, existing erosion problems, extensions/upgrade of access tracks Traffic movement on access tracks, vegetation clearing
Planning and design	
Control Measures	Locate structures in areas of low erosion potential, where possible. Where any widening of existing tracks or structures are to be located in areas of high erosion risk, design erosion control measures in accordance with Institute of *Engineers Australia Queensland Division (1996) Soil Erosion and Sediment Control – Guidelines for Queensland Construction Sites*. Utilise existing access tracks where possible. Design/schedule ameliorative measures for existing erosion areas including: ◗ Installation of whoa boys on access tracks if required; ◗ Backfill, resurface and install contour banks for existing rill and gully erosion, to provide erosion resistance and reduce overland flow velocity. ◗ Planning and design are to consider erosion and sediment control impacts and include into budgets
Monitoring	Not applicable to this stage of project
Reporting	Not applicable to this stage of project
Corrective Action	Review design of erosion and sediment control measures
Responsibility	Westlink
Construction	

Control Measures	***Access Tracks*** Limit construction of new access tracks by utilising existing tracks where possible. Limit construction of new access tracks where existing surface remains suitable for construction traffic and longer term 4WD maintenance vehicles. All access tracks to be located by GPS and shown on site route plans to avoid misunderstandings prior to detailed construction commencing.
Control Measures	No clearing of riparian vegetation or in any areas vulnerable to erosion unless at structure sites. Access tracks through easily erodable ground shall have endemic grass (or with a mixture of sterile annuals) seeds hand spread across the majority of the track on a regular basis to facilitate native grass germination and soil retention, even though the track may remain under irregular traffic use. Where access tracks become heavily disturbed, restrict movement by cordoning off with survey tape. Install additional drainage control measures (such as table drains, rock check dams and whoa boys) if required. Access tracks not required: to be cordoned off, re-profiled and rehabilitated, as such areas become available. Erosion controls shall remain in place and maintained until such time as a stable landform (>70% groundcover) has been achieved.

Control Measures	Any new access tracks or extensions to existing access tracks shall be constructed to control drainage and minimise erosion. Erosion and sediment control shall be undertaken in accordance with *Institute of Engineers Australia Queensland Division (1996) Soil Erosion and Sediment Control – Guidelines for Queensland Construction Sites*, a copy of which is with each Construction Manager and Project Environmental Officer. Where new or extended access tracks are required across creeks and gullies, earthworks should be minimised as far as practicable to minimise soil disturbance. Crossings should be constructed at right angles to the stream flow, if possible. Approaches to creeks may need stone lining to provide stable access and access clearings should be minimised to retain riparian vegetation. Whoa-boys should be constructed immediately upslope to prevent up-gradient runoff from causing rill erosion. The surface of the crossing should be finished at the original creek bed level. Streambeds may require stone lining for protection. New or extended access tracks shall be constructed at grades of less than 20%, as far as possible. Where previously constructed tracks traverse directly up steep ridge lines that are causing significant erosion, alternative flatter alignments should be investigated and the existing track rehabilitated. Erosion protection of access track lead off drains from whoa boys, dams or other drains shall be extended until a non-scourable 2% grade or less is achieved. Rehabilitate temporary access roads by deep ripping, replacing displaced topsoil and revegetating with endemic vegetation. ***Traffic Movement*** In the event of saturated soil conditions, works may be postponed until further notice to prevent disturbance and damage to access roads.

Control Measures	Structure footings and infrastructure within site. Disturbances associated with constructing structure footings require strategies to minimise the release of sediment to waters. These strategies shall include but not be limited to the construction of diversion banks/drains, where necessary, along the elevated perimeter of the works to prevent uncontaminated stormwater from contacting areas of disturbance and installation of temporary sediment fences below areas of earthworks. Erosion and sediment control measures at disturbed areas and on the approach corridors shall be implemented as per (Institute of Engineers Australia Queensland Division (1996) Soil Erosion and Sediment Control – Guidelines for Queensland Construction Sites).
Control Measures	Cleared vegetation should be windrowed on the low side of the clearing. Broad-scale clearing shall be undertaken with blades at least 100mm above ground level to minimise topsoil disturbance, unless earthworks are required. Deep rip and revegetate disturbed areas once construction has been completed and lay down areas or access tracks no longer required.
Monitoring	Regular inspections of all stormwater drains and erosion control measures for discharges of suspended solids to waters daily in response to significant rainfall events (>50 mm in 24 hours). The Contractors Site Foreperson or delegate shall immediately undertake any necessary maintenance works to prevent or minimise the release of contaminated runoff to any waterways. Such actions are to be audited by the Project Environmental Officer for compliance.
Reporting	Erosion and sediment control shall be included in monthly reports prepared by the Project Environmental Officer. The reports are to recommend appropriate controls to minimise erosion on site.

Corrective Action	The Construction Manager and the Project Environmental Officer are to be notified in the event of non-compliance. Corrective actions in the event of non-compliance include inspection of maintenance and erosion control measures and identification of sediment control deficiencies. Sediment fences and additional whoa boys (or rock check dams on drainage lines) may be installed to prevent transport of sediment to any waterway. Undertake revegetation works in areas of likely erosion. Some tracks may have to be temporarily closed to repair erosion damage and to prevent further sediment transport off site.
Responsibility	Construction Manager and Project Environmental Officer
Operation and Maintenance	
Control Measures	Access roads and structure sites will be regularly monitored (minimum annually) for evidence of erosion and sedimentation of gullies and creeks. Grading of tracks should be limited to those sections where erosion damage has occurred. Where ground cover exists and no erosion is occurring, access should be maintained by slashing with grading limited to clean-up of drainage control structures to allow dry weather 4WD vehicle drive access. ◗ The success of rehabilitation should determine the need for additional erosion control works.
Monitoring	Regular monitoring for erosion along the corridor during routine inspections.
Reporting	Corridor Maintenance to include erosion in reporting requirements.
Corrective Action	Where erosion has occurred, stabilise the area and implement appropriate controls (drainage, bunds, sediment devices etc) to prevent erosion from occurring again.
Responsibility	Environmental Officer and Maintenance Contractor

10. Weed Control and Management

Identification of Weeds on Site

During the field visit to the area proposed for the power station and buffer mound, one declared weed, listed under the *Land Protection (Pest and Stock Route Management) Act 2002* (LPA), was identified.

This was:

- *Optunia stricta* (prickly pear) – Class 2 Declared Plant.

For general site information on declared weeds, refer to section 3.4.1 of the Detailed Ecological Assessment, Lot 191 CHS2361, Ford's Road, Gatton, dated 21st April 2009 prepared by Conics.

Environmental Weeds

Table 10 contains species that are considered environmental weeds in South East Queensland. These species were identified during the site visit on 14/12/09 and located in the southeast corner of the site, in open grassland areas.

Table 9

Species Name	Common Name
Cirsium vulgare	spear thistle
Gomphocarpus physocarpus	Balloon cotton bush

Environmental weeds identified generally on the site by ecologist are listed in Table 10. Refer to section 3.4.1 Environmental Weeds of the Detailed Ecological Assessment, Lot 191 CHS2361, Ford's Road, Gatton, dated 21st April 2009 prepared by Conics.

Table 10

Species Name	Common Name
Paspalum dilatatum	paspalumgrass
Plantago lanceolata	lamb's tongue
Conyza bonariensis	flaxleaf fleabane
Melinis repens	red natal grass
Gomphrena celosioides	gomphrena weed
Bidens pilosa	cobbler's pegs
Lantana montevidensis	creeping lantana (Class 3 weed)
Verbena bonariensis	purple topped verbana

10.1 Control Methods and Species List

Weed Removal Methods

The following methods are the most common and user-friendly methods of applying appropriate weed management techniques to contain weeds on the property. The following types of weed management techniques are recommended to eradicate different types of weed species, and promote the regeneration of native species in the area.

Although weeds will be removed via machinery as part of the engineering works for the construction of the access track, certain responsibilities in maintaining this zone are required. Weeds reproduce in great numbers by effective methods of vegetative propagation or by setting great numbers of seeds. Seeds and other propagules are spread around by localised environmental elements and machinery. Most soils contain large numbers of dormant weed seeds that readily germinate when exposed to light and moisture. Bare and disturbed soil will be readily colonised by weeds and regular maintenance will be required.

The following methods are to be applied in managing weeds on site:

- direct contact spray; and
- cut stump method.

Direct Contact Spray

This method involves direct spraying of herbicide to the leaf surface of classified weed species. This method is particularly user friendly and time efficient if it is implemented on targeting weed species, which are of a herbaceous/succulent or young nature. The plant usually dies on site and will not require removal using this method. This will minimise the impact on the environment.

This method is excellent for targeting more invasive low growth species such as grasses and herbaceous weeds species, which may occur. Invasive weeds of this kind have a short rapid growth cycle producing regular flowers and seeds, and short reproduction cycles.

Timely direct spraying of these weeds can effectively minimise the reoccurrence of these weeds, disturbing the lifecycle by preventing the plant from producing seed.

Cut stump method

The cut stump method is applied to semi-hardwood species. This involves mechanically cutting the plants stem and then directly applying the herbicide to the cut stem. It recommended that a dye be added to the herbicide to assist in the application as a visual aid to monitor the use and success of the herbicide. For optimum results herbicide should be applied to the stem immediately to prevent plant cells from sealing and preventing herbicide from entering the plant. Mechanical treatment of woody weeds, such as lantana by reducing plant to 50 mm above ground is the most appropriate method. The cut stump method involves applying undiluted Glyphosate directly to the cut stem.

Type of herbicide

When applying weed control methods near waterways that require the use of chemical herbicides it is a requirement to use herbicide of a low residual composition. This will minimise the build up of herbicide levels in the surface soil and ecosystem. Roundup biactive is the preferred use herbicide as it has a low residual nature and is also effective in the control of weed species. The type of herbicide is preferred when in close proximity of waterways. Coloured dye should be added to chemical control of weeds to provide visual identification of herbicide application and the monitoring of success rates. In areas of intense weed infestation, particularly near creeks), removal of vegetation encourages erosion and further

opportunistic weed species. Revegetation of these areas is a priority.

Timing

The weed management techniques are to be applied in the early morning and/or late afternoon. If the herbicide is mixed with water and used in the direct contract spray, the herbicide may evaporate before it is absorbed into the plant tissue. It is a legal requirement that any department or contractor must be an approved licensed herbicide operator (AC/DC Applicators License) when using herbicide on state, commercial or public lands. It is a requirement to record and file a materials/herbicide spray checklist nominating Time/Date/weather conditions/ litres used (application rates) on every application and be made available to any government official if requested. Chemical control of weeds should have a minimum of 4 – 24 hrs of non-contact exposure to heavy rain.

All exposed soil surfaces are to be rehabilitated within 24 hrs of construction or landscaping completion and where necessary have temporary or permanent sediment control devices in place prior or during construction phase

Declared Plant Surveillance

When monitoring declared weeds it is a requirement to undertake monthly and annual site surveillance inspections to monitor weed and re-vegetation areas. This allows consultation between landowners and council to maintain awareness and education in relation to weed management on the site for the potential re-growth and occurrence of new invasive weeds. This surveillance is required to be undertaken by a suitably qualified person. Under the *Queensland Land Protection (Pest and Stock Route Management) Act 2002*, it is a required that the property owner, manage any declared plants on the property.

Table 11 Guide for weed species list and recommended control methods

Species Name	Common Name	Form	Control methods
Lantana camara Class 3	Lantana	Shrub	Refer to P1 General Control Methods
Opuntia stricta Class 2 Declared Pest P1	Prickly Pear	Cactus	Refer to P1 General Control Methods 1
Lantana montevidensis Class 3 Declared Pest P1	Creeping Lantana	Shrub	Refer to P1 General Control Methods
Bidens pilosa P2	Cobbler's Pegs	Annual Herb	P2 Control Method
Melinis repens P2	Red Natal Grass	Perennial grass	P1 Control Method 1

Verbena bonariensis	Purpletop	Perennial herb	P2 Control Method

11. Potential Impacts and Mitigation Measures for Revegetation Works

To ensure the most appropriate measures are implemented to mitigate potential negative impacts from the infestation by pest plants, the management of native vegetation and the stabilisation of a riparian zone, prior to, during construction and throughout the maintenance period of the project needs to be implemented. Site-specific mitigation measures have been developed and are to be applied on site as additional requirements to the standard guidelines of the LMRP.

Potential impacts from the proposed rehabilitation works on the surrounding vegetation communities include but not limited to the following:

- Vegetation loss and habitat fragmentation
- Gully erosion and sediment run-off; and
- Weed invasion.

These impacts are discussed in more detail below.

11.1 Vegetation loss and habitat fragmentation Mitigation Measures

- Vegetation to be retained is to clearly visible by barricade fencing or clearly marked or flagged;
- All appropriate permits and approvals to be gained;
- Prior to clearing vegetation or weeds on site, clearing zones need to be identified to all operational and construction personnel;
- Temporary fencing incorporating safety measures and sediment control devices should be installed to delineate limit of clearing permitted under the development application;
- Utilise existing tracks, disturbed areas and cleared lands for access only;
- Rehabilitate cleared area with appropriate local native species;
- Retain habitat features such as large fallen logs for reinstatement following construction and during rehabilitation;
- Vegetation required to be cleared should be mulched on site. The mulch should be used to assist in stabilising soil batters/disturbed areas or stockpiled to reinstate future proposed re vegetation areas after completion of works;
- Vegetation removed on embankments should be cut no less than 50 mm above ground level to maintain soil/riparian surface stability where possible. This will assist to maintain and improve the potential regeneration of the site from re-growth when construction is completed;
- Logs occurring in the proposed rehabilitation area should be examined and their importance in terms of habitat value determined and assessed. Where they provide significant habitat values, logs should be left in their place of origin or relocated near or reinstated once works are completed.
- A list of species is to be used during the revegetation are those plants identified from on site investigations of natural vegetation Table 4. Species have been grouped into the different categories based location of planting.
- Planting densities for each tree size is provided (refer to Table 3). A diversity of species in each habitat category should be planted out in accordance with the densities in Table 3. Re-vegetation is

required to mitigate against potential adverse impacts on vegetated and or exposed lands of the operation works.

Gully Erosion and Sediment Run-off

The embankments also show evidence of spoil and landfill waste used to stablise the embankments. Further clearing and disturbance to the soil structure and vegetation cover through this area would increase any erosion already present on the gully slopes through exposed soil surfaces, increased water run-off and disturbance to the banks.

Mitigation Measures

- Site is to be assessed prior to works to determine locations of stockpiles, diversion banks and requirements for other sediment retention devices. Appropriate devices to be installed to prevent turbid water from leaving site and entering surrounding surface waters. Water should be ponded until sediment has settled or water has receded.
- Sediment Control Devices to be used:
  - coil logs on formed swales, dry creek beds and slopes;
  - sediment fencing on boundaries and open surface run off areas;
  - silt curtains in water bodies; and
  - jute matting (grade 3) on all exposed slopes/batters greater than 1: 2.
- Revegetation should occur as by applying a direct seed mix of native ground covers, sedges and grasses or tubestock species to achieve a ground cover density of 1 plant 1 m ration. Utilise existing tracks, disturbed and cleared areas for pipeline easement;
- Install sediment fencing to protect surrounding creek lines, gullies and reduce run-off;
- Backfilling and rehabilitation of the alignment within 24 - 48 hrs is to occur immediately after pipe-laying is complete;
- Exposed soil surfaces are to be jute matted (grade 3) on slopes/batters and rehabilitated at 1 native plant per m^2 or direct seeded under matting or exposed surfaces at 7 kg per hectare; and;
- By reducing the need to clear vegetation, it will reduce the area required to regenerate.

11.2 Weed Invasion and Edge Effect

Increased disturbance within the site in time would allow weed species to penetrate further into this area if not managed accordingly. In time this may affect the integrity, biodiversity and habitat value of the native vegetation. Also, weeds may not provide good protection against erosion. Often the removal of one weed species allows another weed species type to takeover. The following mitigation measures are suggested.

Mitigation Measures

In addition to implementing the rehabilitation and revegetation in accordance with the overall VMRP the following site-specific requirements are to be implemented:

- All weeds throughout the site are to be sprayed and managed a minimum 1-month prior to any clearing or earthworks can commence;
- Direct contact spraying and cut stump method are the preferred weed control methods to be used throughout the proposed rehabilitation site;
- Herbaceous weeds are to be direct contact sprayed and woody weeds are to be cut 50 mm above to

ground level and have stumps sprayed or swabbed with an approved herbicid - e.g. Roundup Biactive 20 ml/1 litre with wetting agent, to prevent re-growth of unwanted weed species. The application of an herbicidal application dye should be used and applied with the constituent herbicide to monitor the application kill rates of weed species.

- Clean equipment prior to exiting and arriving on site. A leaf blower is sufficient to prevent the introduction of new weeds on site.
- Roundup bioactive is the preferred herbicide (applied with dye to monitor application) to be used on site;
- Landscape/weed contractor is to be a licensed and accredited commercial operator with approval from QPI;
- Initial 12-week establishment period applies to all vegetation works. During this period weekly weed maintenance is to occur that involves ongoing weeding and spot spraying; and
- Regular monthly ongoing maintenance of the rehabilitation works is to occur for a period of 24 months for weed suppression and re-vegetation areas.

12. Conclusions

As a result of the proposed landscape management and revegetation works the following has been determined:

- Selective removal of weeds will occur as a result of the project;
- All environmental weeds throughout the site are to be sprayed and managed in accordance of the LMRP;
- Trees, shrubs and ground covers must planted in accordance with the planting specification as outlined in the 41-22282-L001-L004, Landscape Planting Layout and associated Landscape Specification;
- Mean ground cover of weeds must be no greater than 5% in re-vegetation planting plots in the first 24 months;
- Regular monitoring and reporting is required for clearing, rehabilitation, weed management and re-vegetation of all areas;
- Regular ongoing maintenance of re-vegetation establishment, weed suppression areas, re-vegetation of areas is required to maintain and enhance the visual and dominant landscape in the region;
- Replacement of dead plants is required during the maintenance period.
- Successful survival of all re-vegetated species planted to a minimum of 90% survival rate after 24-month period;
- A follow-up quarterly maintenance program after the initial 12 months is highly recommended;
- The PM is responsible for implementing and achieving the deliverables outlined in Section 11 of this LMP (Weed Control and Management);
- PM is to be a licensed and accredited commercial operator with approval of from QPI;
- All declared weeds (P1 zone) are required to be controlled as a priority over all other weed species;
- Direct contact spraying and cut stump method are the preferred weed control method techniques to be used throughout the site;
- Initial 12-week establishment period applies to all vegetation works. During this period; weekly weed maintenance is to occur that involves ongoing weeding and spot spraying;
- Ongoing maintenance is to continue monthly for the 24 months;
- Roundup bioactive is the preferred herbicide to be used on site;
- PM and the EO are to visually monitor for the presence of weeds during routine patrols PM personnel are to provide reports after maintenance patrols outlining the presence of weed infestations.
- Monthly operational works sheet are to be recorded and submitted to GM monthly.
- An accurate photo-record of the progress of the weed control works and re-vegetation is required by setting up an appropriate number of representative fixed photo-points in the area. Photos should be taken by digital camera and recorded with a GPS coordinate. Photo-point locations should be clearly marked on site and mapped by a surveyor or by GPS.
- An annual report should be prepared documenting the monthly activities and reporting over the 24

months.

- The report completed by the PM to the GM should contain recommendations in regard to issues affecting the ongoing success of the LMRP works, and the possible need for additional activities that may be required outside the normal maintenance program.

Appendix A

Detailed Landscape Plan

ADJOINS 41-22282-L003

ADJOINS 41-22282-L002

ADJOINS 41-22282-L001

B
L005

DAM

Shed

Weather Board
Dwelling

mac

tes

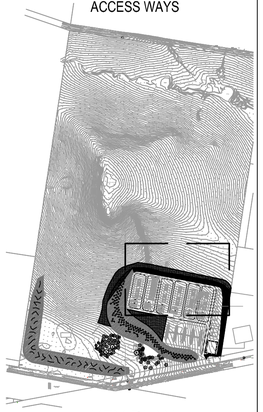
125 130 120 115

LEGEND

- EXISTING TREE TO BE RETAINED (INDICATIVE LOCATION ONLY)
- PROPOSED TREE
- PROPOSED SHRUB MIX
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 1
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 2
- PROPOSED HYDROMULCH MIX WITH MACMAT JUTE MATTING (REFER TO SPECIFICATION)
- PROPOSED HYDROMULCH GRASS MIX (TO BE APPLIED TO ALL DISTURBED AREAS. REFER SPECIFICATION)

NOTES:

1. REFER TO LMRP FOR WEED REMOVAL INFORMATION, STREAM ORDERS AND RIPARIAN / WILDLIFE CORRIDORS, STOCKPILE LOCATIONS AND DISPOSAL SITES, EROSION CONTROL AND LOCATION OF MACHINE ACCESS WAYS



KEY PLAN
NTS

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

DO NOT SCALE

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
LANDSCAPE PLANTING LAYOUT 4

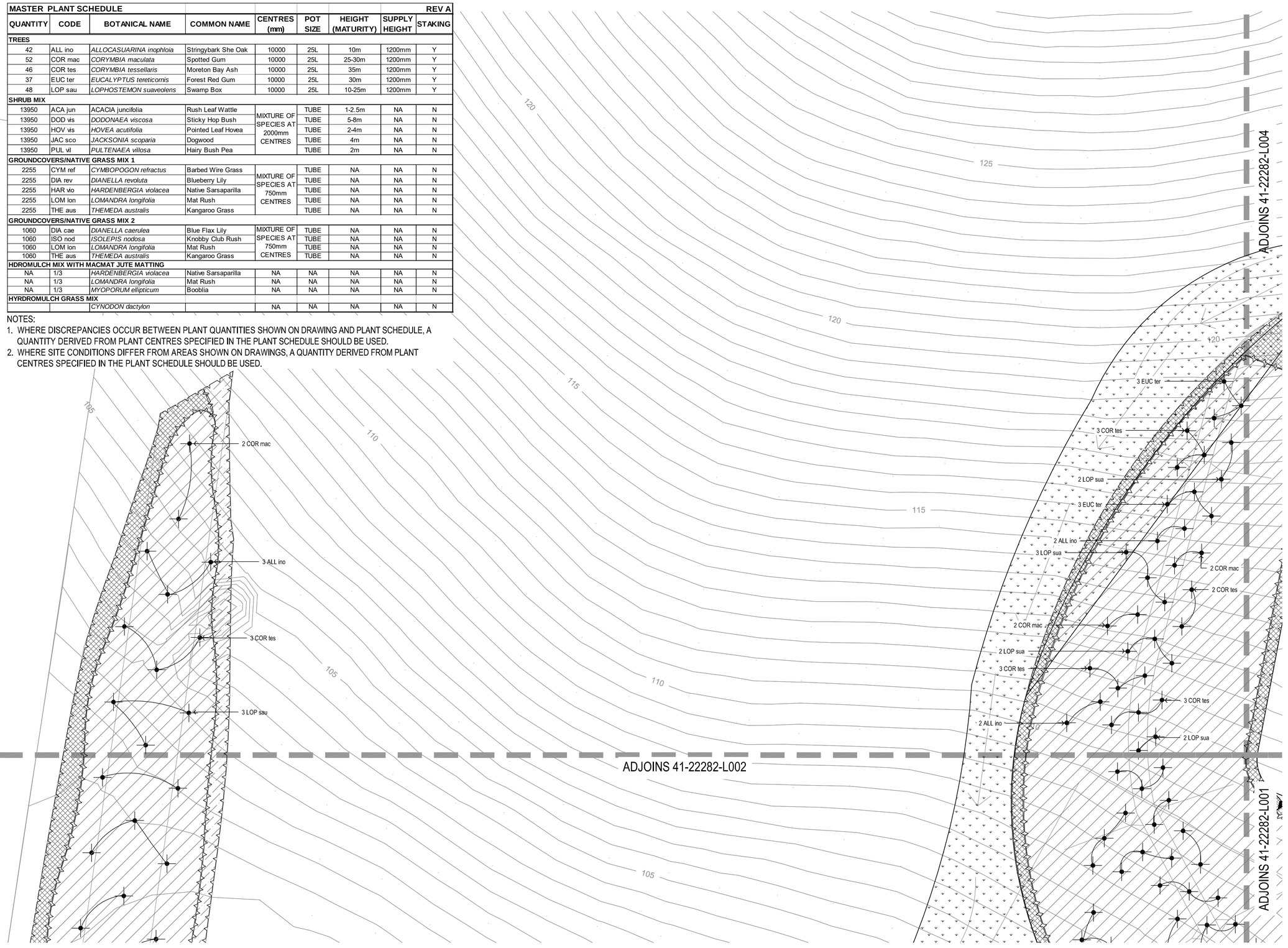
Original Size A1
Drawing No: 41-22282-L004
Rev: A

Plot Date: 23 December 2009 - 1:36 PM Plotted by: Claire Humphreys Cad File No: G:\41\22282\CADD\Drawings\41-22282-L004.dwg

MASTER PLANT SCHEDULE — REV A

QUANTITY	CODE	BOTANICAL NAME	COMMON NAME	CENTRES (mm)	POT SIZE	HEIGHT (MATURITY)	SUPPLY HEIGHT	STAKING
TREES								
42	ALL ino	*ALLOCASUARINA inophloia*	Stringybark She Oak	10000	25L	10m	1200mm	Y
52	COR mac	*CORYMBIA maculata*	Spotted Gum	10000	25L	25-30m	1200mm	Y
46	COR tes	*CORYMBIA tessellaris*	Moreton Bay Ash	10000	25L	35m	1200mm	Y
37	EUC ter	*EUCALYPTUS tereticornis*	Forest Red Gum	10000	25L	30m	1200mm	Y
48	LOP sau	*LOPHOSTEMON suaveolens*	Swamp Box	10000	25L	10-25m	1200mm	Y
SHRUB MIX								
13950	ACA jun	ACACIA juncifolia	Rush Leaf Wattle	MIXTURE OF SPECIES AT 2000mm CENTRES	TUBE	1-2.5m	NA	N
13950	DOD vis	*DODONAEA viscosa*	Sticky Hop Bush		TUBE	5-8m	NA	N
13950	HOV vis	*HOVEA acutifolia*	Pointed Leaf Hovea		TUBE	2-4m	NA	N
13950	JAC sco	*JACKSONIA scoparia*	Dogwood		TUBE	4m	NA	N
13950	PUL vil	*PULTENAEA villosa*	Hairy Bush Pea		TUBE	2m	NA	N
GROUNDCOVERS/NATIVE GRASS MIX 1								
2255	CYM ref	*CYMBOPOGON refractus*	Barbed Wire Grass	MIXTURE OF SPECIES AT 750mm CENTRES	TUBE	NA	NA	N
2255	DIA rev	*DIANELLA revoluta*	Blueberry Lily		TUBE	NA	NA	N
2255	HAR vio	*HARDENBERGIA violacea*	Native Sarsaparilla		TUBE	NA	NA	N
2255	LOM lon	*LOMANDRA longifolia*	Mat Rush		TUBE	NA	NA	N
2255	THE aus	*THEMEDA australis*	Kangaroo Grass		TUBE	NA	NA	N
GROUNDCOVERS/NATIVE GRASS MIX 2								
1060	DIA cae	*DIANELLA caerulea*	Blue Flax Lily	MIXTURE OF SPECIES AT 750mm CENTRES	TUBE	NA	NA	N
1060	ISO nod	*ISOLEPIS nodosa*	Knobby Club Rush		TUBE	NA	NA	N
1060	LOM lon	*LOMANDRA longifolia*	Mat Rush		TUBE	NA	NA	N
1060	THE aus	*THEMEDA australis*	Kangaroo Grass		TUBE	NA	NA	N
HDROMULCH MIX WITH MACMAT JUTE MATTING								
NA	1/3	*HARDENBERGIA violacea*	Native Sarsaparilla	NA	NA	NA	NA	N
NA	1/3	*LOMANDRA longifolia*	Mat Rush	NA	NA	NA	NA	N
NA	1/3	*MYOPORUM ellipticum*	Booblia	NA	NA	NA	NA	N
HYRDROMULCH GRASS MIX								
		CYNODON dactylon		NA	NA	NA	NA	N

NOTES:
1. WHERE DISCREPANCIES OCCUR BETWEEN PLANT QUANTITIES SHOWN ON DRAWING AND PLANT SCHEDULE, A QUANTITY DERIVED FROM PLANT CENTRES SPECIFIED IN THE PLANT SCHEDULE SHOULD BE USED.
2. WHERE SITE CONDITIONS DIFFER FROM AREAS SHOWN ON DRAWINGS, A QUANTITY DERIVED FROM PLANT CENTRES SPECIFIED IN THE PLANT SCHEDULE SHOULD BE USED.

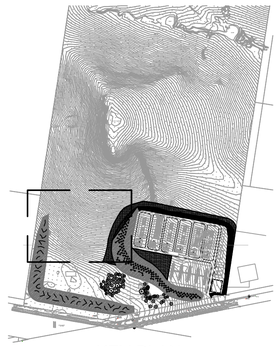


LEGEND

- EXISTING TREE TO BE RETAINED (INDICATIVE LOCATION ONLY)
- PROPOSED TREE
- PROPOSED SHRUB MIX
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 1
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 2
- PROPOSED HYDROMULCH MIX WITH MACMAT JUTE MATTING (REFER TO SPECIFICATION)
- PROPOSED HYDROMULCH GRASS MIX (TO BE APPLIED TO ALL DISTURBED AREAS. REFER SPECIFICATION)

NOTES:

1. REFER TO LMRP FOR WEED REMOVAL INFORMATION, STREAM ORDERS AND RIPARIAN / WILDLIFE CORRIDORS, STOCKPILE LOCATIONS AND DISPOSAL SITES, EROSION CONTROL AND LOCATION OF MACHINE ACCESS WAYS



KEY PLAN
NTS

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

DO NOT SCALE

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
LANDSCAPE PLANTING LAYOUT 3

Original Size A1 — Drawing No: 41-22282-L003 — Rev: A

Plot Date: 23 December 2009 - 1:36 PM Plotted by: Claire Humphreys Cad File No: G:\41\22282\CADD\Drawings\41-22282-L003.dwg

ADJOINS 41-22282-L003

ADJOINS 41-22282-L001

2 EUC ter
2 COR mac
2 LOP sua
2 COR tes
3 EUC ter
2 COR mac
2 ALL ino
3 COR tes
3 LOP sau
3 COR mac
3 LOP sua
3 ALL ino
3 COR tes
3 LOP sua
2 ALL ino
2 COR mac
2 COR tes
3 EUC ter
3 COR mac
3 LOP sau
3 COR tes
3 COR mac
2 EUC ter
2 EUC ter
2 LOP sau
2 ALL ino
2 COR mac
2 ALL ino
3 ALL ino
2 ALL ino
3 COR mac
3 LOP sua
3 EUC ter
3 COR tes
3 ALL ino
2 ALL ino
3 LOP sua

A L085
C L005

SWAMP
Gas Warning Sign
Conc Batter Protection
Conc Batter Protection
4x600 RCP
Gas Warning Sign
Gas Warning Sign

LEGEND

- EXISTING TREE TO BE RETAINED (INDICATIVE LOCATION ONLY)
- PROPOSED TREE
- PROPOSED SHRUB MIX
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 1
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 2
- PROPOSED HYDROMULCH MIX WITH MACMAT JUTE MATTING (REFER TO SPECIFICATION)
- PROPOSED HYDROMULCH GRASS MIX (TO BE APPLIED TO ALL DISTURBED AREAS. REFER SPECIFICATION)

NOTES:

1. REFER TO LMRP FOR WEED REMOVAL INFORMATION, STREAM ORDERS AND RIPARIAN / WILDLIFE CORRIDORS, STOCKPILE LOCATIONS AND DISPOSAL SITES, EROSION CONTROL AND LOCATION OF MACHINE ACCESS WAYS

KEY PLAN
NTS

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

DO NOT SCALE

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
LANDSCAPE PLANTING LAYOUT 2

Original Size A1
Drawing No: 41-22282-L002
Rev: A

Plot Date: 23 December 2009 - 1:37 PM Plotted by: Claire Humphreys Cad File No: G:\41\22282\CADD\Drawings\41-22282-L002.dwg

ADJOINS 41-22282-L004

ADJOINS 41-22282-L002

2 COR tes
2 ALL ino
3 COR tes
3 COR mac
3 COR mac
3 EUC ter
3 LOP sua
2 EUC ter
2 LOP sua
3 COR mac
3 ALL ino
3 EUC ter
2 LOP sua
3 ALL ino
2 COR mac
3 EUC ter
2 LOP sua
2 COR tes
3 ALL ino
2 COR tes
3 COR mac
3 COR tes
3 COR mac
3 COR mac
3 EUC ter
3 COR mac
3 ALL ino
2 LOP sua
3 COR tes
3 LOP sua
3 COR tes
2 EUC ter
ST

2242
375RCP
2243

LEGEND

- EXISTING TREE TO BE RETAINED (INDICATIVE LOCATION ONLY)
- PROPOSED TREE
- PROPOSED SHRUB MIX
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 1
- PROPOSED GROUNDCOVER/NATIVE GRASS MIX 2
- PROPOSED HYDROMULCH MIX WITH MACMAT JUTE MATTING (REFER TO SPECIFICATION)
- PROPOSED HYDROMULCH GRASS MIX (TO BE APPLIED TO ALL DISTURBED AREAS. REFER SPECIFICATION)

NOTES:

1. REFER TO LMRP FOR WEED REMOVAL INFORMATION, STREAM ORDERS AND RIPARIAN / WILDLIFE CORRIDORS, STOCKPILE LOCATIONS AND DISPOSAL SITES, EROSION CONTROL AND LOCATION OF MACHINE ACCESS WAYS

KEY PLAN
NTS

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD CLIENTS | PEOPLE | PERFORMANCE

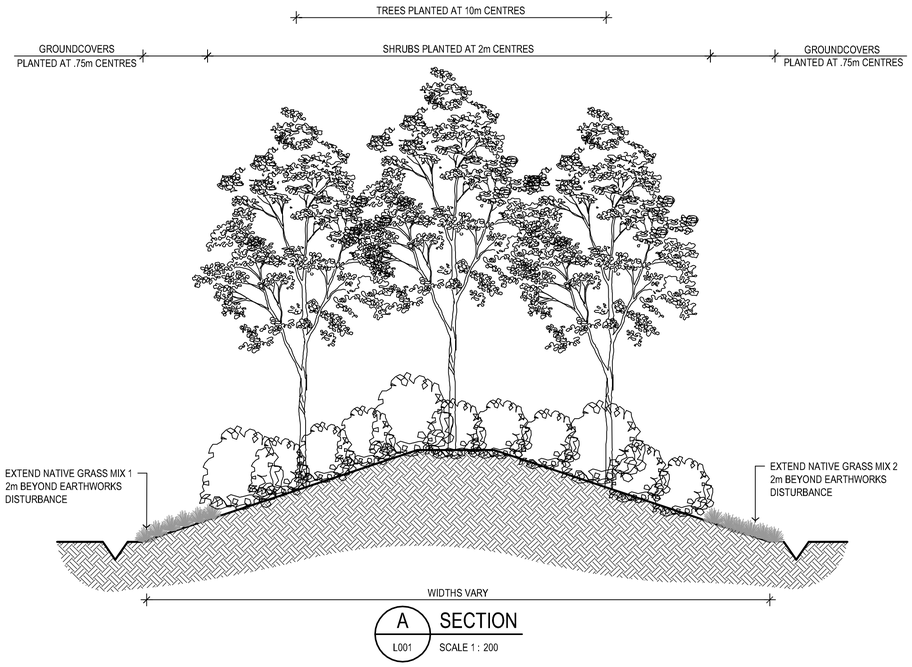
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

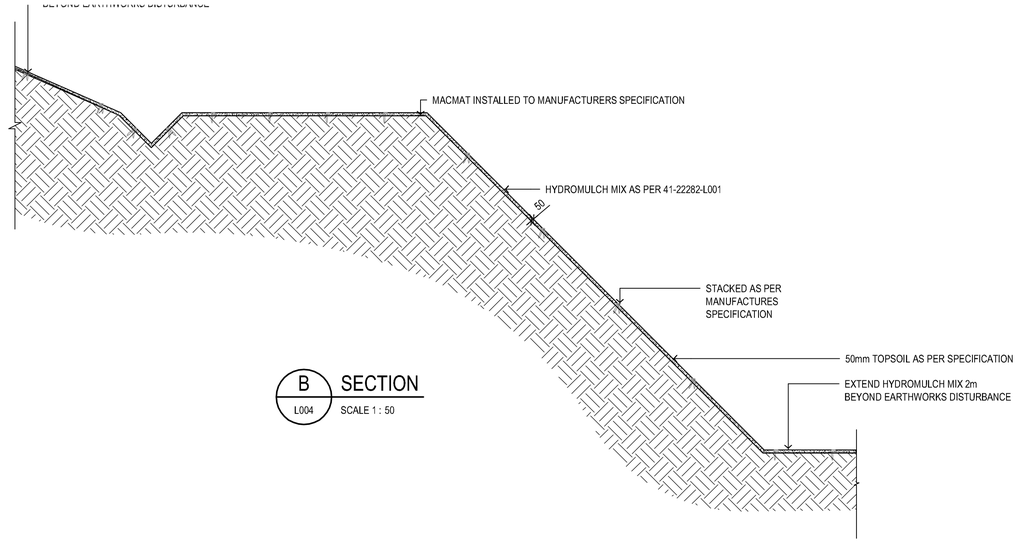
Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
LANDSCAPE PLANTING LAYOUT 1

Original Size A1
Drawing No: 41-22282-L001
Rev: A

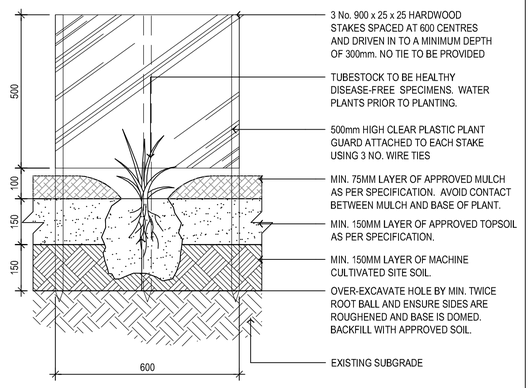
Plot Date: 23 December 2009 - 1:38 PM Plotted by: Claire Humphreys Cad File No: G:\41\22282\CADD\Drawings\41-22282-L001.dwg



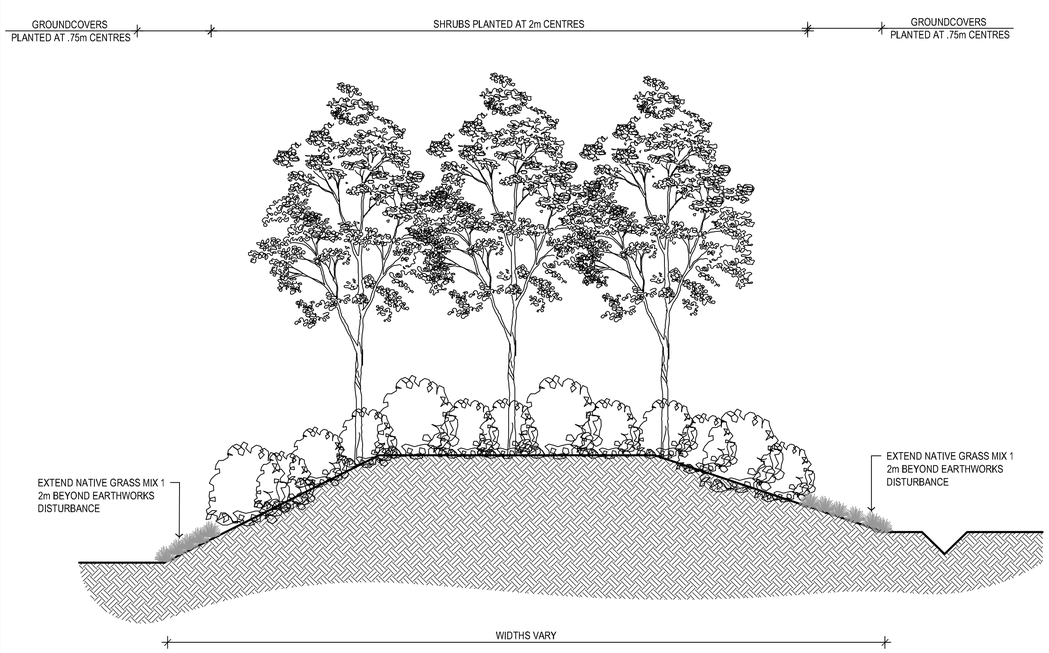
A SECTION
L001 SCALE 1 : 200



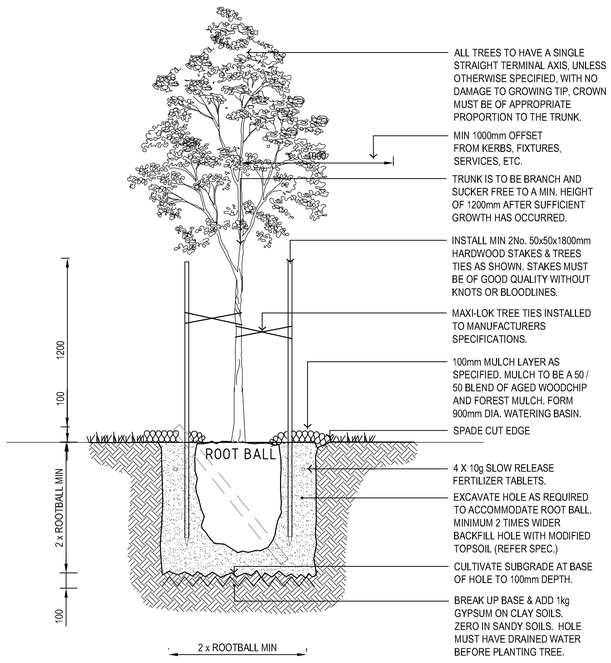
B SECTION
L004 SCALE 1 : 50



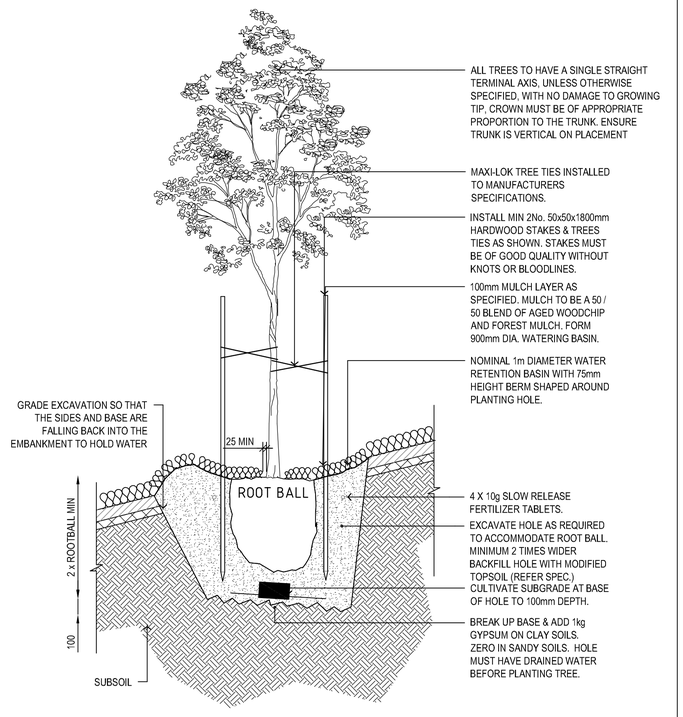
TYPICAL TUBE STOCK PLANTING DETAIL
SCALE 1:10



C SECTION
L002 SCALE 1 : 200



TYPICAL ADVANCED SIZE TREE PLANTING
SCALE 1:20



TYPICAL MATURE TREE PLANTING IN SLOPING GROUND
SCALE 1:20

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date
A	INITIAL ISSUE FOR CLIENT REVIEW		CH			

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:50 AT ORIGINAL SIZE

0 0.1 0.2 0.3 0.4 0.5m
SCALE 1:10 AT ORIGINAL SIZE

GHD CLIENTS | PEOPLE | PERFORMANCE
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia
GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 F 61 7 3316 3333
E bnemail@ghd.com W www.ghd.com

DO NOT SCALE

Drawn	C.HUMPHREYS	Designed	C.HUMPHREYS
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client WESTLINK PTY LTD.
Project WESTLINK POWERSTATION
Title LANDSCAPE DETAILED DESIGN
TYPICAL SECTIONS AND PLANTING DETAILS

Original Size A1
Drawing No: 41-22282-L005
Rev: A

Plot Date: 23 December 2009 - 1:00 PM Plotted by: Claire Humphreys Cad File No: G:\41\22282\CADD\Drawings\41-22282-L005.dwg

GHD

201 Charlotte Street Brisbane QLD 4000
GPO Box 668 Brisbane QLD 4001
T: (07) 3316 3000 F: (07) 3316 3333 E: bnemail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	C.O'Neill	A. Franks		P. Wootton		17/12/09
B	C.O'Neill	C.Humphreys*		P. Wootton		01/02/09

Attachment D

Detailed Landscape Specification

CLIENTS | PEOPLE | PERFORMANCE

WESTLINK Pty Ltd

Specification for Westlink Power Station Development

Landscape Specification

February 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

Appendices

1. General Requirements

1.1.1 Precedence

Requirements of subsequent worksections of the specification override conflicting requirements in this worksection.

1.1.2 Contractual relationships

Responsibilities and duties of the principal, contractor and contract administrator are not altered by requirements in the documents referenced in this specification.

1.1.3 Abbreviations

For the purposes of this worksection the abbreviations given below apply.

- AS: Australian Standard.
- BCA: Building Code of Australia.
- NATA: National Association of Testing Authorities.
- SSL: Scientific Services Laboratory.

1.2 Definitions

For the purposes of this worksection the definitions given below apply.

- Attendance: 'Attendance', 'provide attendance' and similar expressions mean 'give assistance for examination and testing'.
- Contract administrator: 'Contract administrator' has the same meaning as 'landscape architect' or 'superintendent' and is the person appointed by the 'owner' or 'principal' under the contract.
- Documented: 'Documented', 'as documented' and similar terms mean contained in the contract documents.
- Geotechnical site investigation: The process of evaluating the geotechnical characteristics of the site in the context of existing or proposed construction.
- Give notice: 'Give notice', 'submit', 'advise', 'inform' and similar expressions mean 'give notice (submit, advise, inform) in writing to the contract administrator'.
- Maintenance period: Synonymous with 'Defects Liability Period'.
- Obtain: 'Obtain', 'seek' and similar expressions mean 'obtain (seek) in writing from the contract administrator'.
- Principal: 'Principal' has the same meaning as 'owner', 'client' and 'proprietor' and is the party to whom the Contractor is legally bound to construct the works.

- Proprietary: ‘Proprietary’ means identifiable by naming manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
- Provide: ‘Provide’ and similar expressions mean ‘supply and install’. Installation shall include development of the design beyond that documented.
- Registered testing authority:
  - An organisation registered by the National Association of Testing Authorities (NATA) to test in the relevant field; or
  - An organisation outside Australia registered by an authority recognised by NATA through a mutual recognition agreement; or
  - An organisation recognised as being a Registered Testing Authority under legislation at the time the test was undertaken.
- Required: Means required by the contract documents, the local council or statutory authorities.
- If required: A conditional specification term for work which may be shown on the drawings or be a legislative requirement.
- Samples: Includes samples, prototypes and sample panels.
- Supply: ‘Supply’, ‘furnish’ and similar expressions mean ‘supply only’.
- Tests:
  - Pre-completion tests: Tests carried out before completion tests.
    - Type tests: Tests carried out on an item identical with a production item, before delivery to the site.
    - Production tests: Tests carried out on a purchased item, before delivery to the site.
    - Site tests: Tests carried out on site.
  - Completion tests: Tests carried out on completed installations or systems before the date for practical completion, to demonstrate that the installation or system, including components, controls and equipment, operates correctly, safely and efficiently, and meets performance and other requirements. The superintendent may direct that completion tests be carried out after the date for practical completion.
- Tolerance: The permitted difference between the upper limit and the lower limit of dimension, value or quantity.
- Verification: Provision of evidence or proof that a performance requirement has been met or a default exists.

1.3 Setting out

Ensure levels and dimensions of the site align with information shown on the landscape drawings, and record the results on a copy of the drawings.

Any discrepancies shall be reported to the Superintendent in writing, and instructions must be

obtained from the Superintendent before proceeding with the Landscape works.

1.3.1 Levels

Spot levels take precedence over contour lines and ground profile lines.

1.3.2 Services diagrammatic layouts

Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable.

Before commencing work:

- Obtain measurements and other necessary information.
- Coordinate the design and installation in conjunction with all trades.

2. Quality Control

2.1 General

2.1.1 Australian Standards

The Landscape Subcontractor shall familiarise themselves with the relevant Australian Standards pertaining to this Landscape Specification, and any subsequent revisions of such Standards.

2.1.2 Supervision

Landscape works are to be supervised.

A competent general foreman authorised to receive and carry out instructions from the Superintendent is to be provided.

2.1.3 Inspection

If notice of inspection is required in respect of any parts of the works, the part requiring inspection shall not have further work carried out, or be concealed without prior approval of the Superintendent.

A minimum of three (3) working days notice shall be given to the Superintendent prior to the inspection of Landscape works.

2.1.4 Authorities

If required, submit documents showing approval by the authorities whose requirements apply to the work.

Submit copies of correspondence and notes of meetings with authorities.

2.1.5 Compliance

Ensure all products, materials, goods and the like comply with the requirements set out in the project documents.

Where any supplied products are different from the requirements set out in the project documents, the Superintendent shall be notified. Approval of any alternative products is at the reasonable discretion of the Superintendent.

2.2 Tests

The Superintendent may require testing of materials, goods, or samples to ensure they meet the relevant Australian Standards.

Site tests: Use instruments calibrated by authorities accredited by a Registered testing

authority.

2.2.1 Testing authorities

Except for site tests, have tests carried out by a Registered testing authority and submit test reports.

- An organisation registered by the National Association of Testing Authorities (NATA) to test in the relevant field; or
- An organisation outside Australia registered by an authority recognised by NATA through a mutual recognition agreement; or
- An organisation recognised as being a Registered Testing Authority under legislation at the time the test was undertaken.
- Reports: Submit copies of test reports, including certificates for type tests, showing the observations and results of tests and conformance or non-conformance with requirements.

Where testing indicates relevant Australian Standards have not been met, the cost of testing, and any re-testing shall be borne by the Landscape Subcontractor.

2.2.2 Attendance

Provide attendance on tests where nominated in worksections.

2.3 Products

Ensure all products, materials, goods and the like are an overall consistent quality, size, and, overall appearance.

Check to ensure correct species, cultivars, pot sizes, heights, spreads, callipers, and the like have been supplied.

Where any supplied products are different from the requirements set out in the project documents, the Superintendent shall be notified. Approval of any alternative products is at the reasonable discretion of the Superintendent.

2.3.1 Samples

Submission: Submit nominated samples.

Incorporation of samples: If it is intended to incorporate samples into the works, submit proposals. Incorporate samples in the works that have been endorsed for incorporation. Do not incorporate other samples.

Allow adequate time for approval of samples.

2.3.2 Substitution

Performance: Equal or greater to that specified.

Alternatives: If alternatives to the documented products, methods or systems are proposed, submit sufficient information to permit evaluation of the proposed alternatives including the following:

- Samples.
- Reasons for the proposed substitutions.
- Statement of the extent of revisions to the contract documents.
- Statement of the extent of revisions to the construction program.
- Statement of cost implications including costs outside the contract.
- Statement of consequent alterations to other parts of the works.

Evidence: If the documented products are unavailable within the time constraints of the construction programme submit evidence, from the supplier.

Criteria: If the substitution covers unavailability or is for any other reason, submit evidence that the substitution:

- Is of nett enhanced value to the Proprietor.
- Is consistent with the contract documents and is as effectual as the identified proprietary item.

2.4 Materials and components

2.4.1 Consistency

General: For the whole quantity of each material or product use the same manufacturer or source and provide consistent type, size, quality and appearance.

2.4.2 Galvanizing

Severe conditions: Galvanize mild steel components (including fasteners) to AS 1214 or AS 4680 as appropriate, if:

- Exposed to weather.
- Embedded in masonry.
- Exposed to or in air spaces behind external leaf of masonry walls.
- In contact with chemically treated timber, other than CCA.

2.5 Proprietary items

2.5.1 Manufacturers' or suppliers' recommendations

Proprietary items: Provide, including select, if no selection is given, and transport, deliver, store, handle, protect, finish, adjust, prepare for use, and provide manufactured items in accordance with the current written recommendations and instructions of the manufacturer or supplier.

Proprietary systems/assemblies: Assemble, install or fix to substrate in accordance with the current written recommendations and instructions of the manufacturer or supplier.

Project modifications: Advise of activities that supplement, or are contrary to, manufacturers or suppliers' written recommendations and instructions.

Product certification: If products must comply with product certification schemes, provide them in accordance with the certification requirements.

2.5.2 Identified proprietary items

Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified, but indicates the necessary properties of the item.

2.6 Warranties

Name the Principal as warrantee in conformance with the Warranty schedule. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Commencement: Commence warranty periods at practical completion or at acceptance of installation, if acceptance is not concurrent with practical completion.

Approval of installer: If installation is not by manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm.

2.7 Completion

On completion of the Landscape works, restore all existing areas that have been disturbed or damaged through undertaking of the landscape works to its condition at the commencement of the Contract.

This excludes areas forming part of, or modified by the landscape works.

3. Landscape – Soils

3.1 General

3.1.1 Aims

Responsibilities

Selections: Conform to the Selections.

3.1.2 Cross References

General

General: Conform to the *General requirements* worksection.

3.1.3 Standards

Soils

General: To AS 4419.

3.1.4 Interpretation

Definitions

General: For the purposes of this worksection the definitions given below apply.

Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.

Site rock: Rocks selected for salvage.

Site topsoil: Soil excavated from the site which has the following characteristics:

- Contains organic matter.
- Supports plant life.
- Free from unwanted matter.

Unwanted matter (in topsoil):

- Stones over 25 mm diameter.
- Clay lumps.
- Weeds and tree roots.
- Sticks and rubbish.

- Material toxic to plants.

Imported topsoil:

- Fine: Clay loam, fine sandy loam, sandy clay loam, silty loam, loam.
- Medium: Sandy loam, fine sandy loam.
- Coarse: Sand, loamy sand.

Topsoil mixture: Topsoil and compost or other additives, thoroughly mixed before placing.

Top dressing: A soil which is suitable for surface application to lawn.

3.1.5 Geotechnical site investigation

Report

The geotechnical site investigation report provided is for information only. The geotechnical information and information on contaminants given is information on the nature of the ground at each tested part. It is not a complete description of conditions existing at or below ground level.

Notice

If the following are encountered, give notice immediately and obtain instructions before carrying out any further work in the affected area:

- Bad ground.
- Discrepancies.
- Rock.
- Springs, seepages.
- Topsoil > 100 mm deep.

3.1.6 Inspection

Notice

Inspection: Give notice so inspection may be made of the following:

- Setting out completed.
- Subgrades cultivated or prepared for placing topsoil.
- Topsoil spread before planting.
- Grassing bed prepared before turfing, seeding, or temporary grassing.

3.1.7 Tests

Soil tests

Sampling: As recommended in AS 4419 Appendix A.

Phosphorous content testing:

Any soil described as being suitable for phosphorus-sensitive plants shall have an extractable phosphorus content as follows:

- Organic soils and low density soils: Less than 3 mg/L total phosphorus in a 1:1.5 v/v extract.
- Soil blends and natural soils: Less than 5 mg/kg phosphorus for very sensitive plants and less than 20 mg/kg for moderately sensitive plants when extracted by the Olsen sodium bicarbonate procedure as described in the Australian laboratory handbook of soil and water chemical methods.

3.1.8 Submissions

Samples

General: Submit representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Bulk materials: Submit a 5 kg sample of each type specified. Submit bulk material samples, with required test results, at least 5 working days before bulk deliveries.

Suppliers

Statements: Submit statements from suppliers of soils and other materials, giving the following, where applicable:

- Particulars of the supplier's experience in the required type of work.
- Production capacity for material of the required type, sizes and quantity.
- Lead times for delivery of the material to the site.

Materials

Supplier's data: Submit supplier's data including the following:

- Material source of supply for topsoil, filling, stone and filter fabrics.

Compost: Submit a certificate of proof of compost pH value.

Execution

Program: Submit a work program in the form of a bar chart, for the landscape works.

3.2 Products

3.2.1 Topsoil

Source

General: Import topsoil to the Selections unless the topsoil type can be provided from material recovered from the site.

Additives

Compliance: If using additives to raise topsoil to the required standard, ensure compliance with the relevant test criteria.

3.2.2 Fertiliser

Provide proprietary fertilisers, delivered to the site in sealed bags marked to show manufacturer or vendor, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

Fertiliser schedule

Fertiliser key	Location	N:P:K ratio	Application rate
GBF	Garden Beds	Ratio as per manufacturer's recommendations	Slow release to manufacturer's recommendations
TPF	Tree Planting	Ratio as per manufacturer's recommendations	Slow release to manufacturer's recommendations
GRF	Grassed Areas	120:0:0	100kg/Ha

3.3 Execution

3.3.1 Preparation

Vegetative spoil

Remove vegetative spoil from site. Do not burn.

Earth mounds

Place clean filling in layers approximately 150 mm thick compacted to 85% of the dry density ratio of the surrounding soil as determined by AS 1289.5.4.1. Minimise slumping and further internal packing down. Construct changes in grade over a minimum width of 500 mm to smooth, gradual and rounded profiles.

Embankment stabilisation

General: Where necessary to prevent erosion or soil movement, stabilise embankments.

Method: Either matting overlay or hydromulching.

Matting generally: Biodegradable fibre reinforced with lightweight polymer mesh. Provide lightweight material for seeding, medium or heavy weight material for planting.

Matting in high erosion zones: Flexible carbon black UV stabilised interwoven nylon mesh.

Matting installation: Sow before matting is installed, where sowing is required. Plant after matting is installed, where planting is required. Peg the matting into 300 x 300 mm anchor trenches at top and bottom, backfill the trenches with soil and compact.

Matting pegs: U-shape galvanized steel, at 1000 x 1000 mm intervals generally, 250 mm at overlaps.

3.3.2 Rockwork

Rock work

General: Place rocks while ground formation work is being carried out. Provide site rock, otherwise provide imported rock. Bury rock two thirds by volume, with weathered faces exposed. Protect the weathered faces from damage.

Site rock: Stockpile for future placement and accessibility for lifting. Dispose of other rock off site.

Imported rock: Provide rock which has been selected before delivery.

Rock outcrops

General: Protect existing rock, rock shelves and rock outcrops from mechanical damage and surface defacement.

3.3.3 Subsoil

Ripping

General: Rip parallel to the final contours wherever possible. Do not rip when the subsoil is wet or plastic. Do not rip within the dripline of trees and shrubs to be retained.

Ripping depths: Rip the subsoil to the following typical depths:

- Compacted subsoil: 300 mm.
- Heavily compacted clay subsoil: 450 mm.
- Ripline planting areas: 300mm.

Planting beds

Excavated: Excavate to bring the subsoil to at least 300 mm below finished design levels.

Shape the subsoil to fall to subsoil drains where applicable. Break up the subsoil to a further depth of 100 mm.

Unexcavated: Remove weeds, roots, builder's rubbish and other debris. Bring the planting bed to 75 mm below finished design levels.

Cultivation

Minimum depth: 100 mm.

Cultivation depths (mm):

- Grassed areas (seeded, turf, strip turf): 100mm.
- Hydroseeded or hydromulched areas: 100mm.
- Planting areas: 150mm.

Services and roots: Do not disturb services or tree roots; if necessary cultivate these areas by hand.

Cultivation: Thoroughly mix in materials required to be incorporated into the subsoil. Cultivate manually within 300 mm of paths or structures. Remove stones exceeding 25 mm, clods of earth exceeding 50 mm, and weeds, rubbish or other deleterious material brought to the surface during cultivation. Trim the surface to design levels after cultivation.

Additives

General: Apply additives after ripping or cultivation and incorporate into the upper 100 mm layer of the subsoil.

Gypsum: Incorporate at the rate of 0.25 kg/m^2.

3.3.4 Topsoil

Placing topsoil

General: Spread the topsoil on the prepared subsoil and grade evenly, making the necessary allowances to permit the following:

- Required finished levels and contours may be achieved after light compaction.
- Grassed areas may be finished flush with adjacent hard surfaces such as kerbs, paths and mowing strips.

Contamination: Where diesel oil, cement or other phytotoxic material has been spilt on the subsoil or topsoil, excavate the contaminated soil, dispose of it off the site, and replace it with site soil or imported topsoil to restore design levels.

Spreading: On steep batters, if using a chain drag, ensure there is no danger of batter disturbance.

Finishing: Feather edges into adjoining undisturbed ground.

Consolidation

General: Compact lightly and uniformly in 150 mm layers. Avoid differential subsidence and excess compaction and produce a finished topsoil surface which has the following characteristics:

- Finished to design levels.
- Smooth and free from stones or lumps of soil.
- Graded to drain freely, without ponding, to catchment points.
- Graded evenly into adjoining ground surfaces.
- Ready for planting.

Topsoil depths

Spread topsoil to the following typical depths:

- Excavated planting areas: 300 mm below finished mulch level.
- Irrigated grassed areas generally: 150 mm.
- Non-irrigated grass areas: 100 mm.

Surplus topsoil

General: Spread surplus topsoil on designated areas on site, if any; otherwise, dispose off site.

3.4 Selections

3.4.1 Topsoil

Table 1 Topsoil Particle Size Table (% passing by mass)

AS sieve aperture	Soil textures		
	Fine	**Medium**	**Coarse**
2.36	100	100	100
1.18	90 – 100	95 – 100	95 – 100
0.60	75 – 100	75 – 100	70 – 90
0.30	57 – 90	55 – 85	30 – 46
0.15	45 – 70	38 – 55	10 – 22
0.075	35 – 55	25 – 35	5 – 10
0.002		2 – 15	2 – 8

Topsoil properties schedule

Property	Type	Amount
Nutrient levels	Phosphorus (P) (mg/L)	0.7 – 4
	Potassium (K) (mg/L)	35 – 250
	Sulfur (S) (mg/L)	> 40
	Calcium (Ca) (mg/L)	50 – 350
	Nitrogen (N) (mg/L)	≤ 100
	Manganese (Mn) (mg/L)	1 – 15
	Nitrogen drawdown	If NDI_{150} is less than 0.9 soluble nitrogen is to be added as per manufacturer's specified rate
Additives	Gypsum (% by volume)	Min 80% by volume
	Compost	Min 10% by volume
Other properties	Organic matter (% by mass)	20% maximum
	Wettability	>5mm/min
	Soil reaction (pH)	6 – 7
	Electrical conductivity (dS/m)	<1.2 dS/m
	Dispersibility	Emerson class number Class 3 or greater
	Soluble salts (% by mass)	<500mg/L
	Toxicity index	to AS 3743
	Permeability	2 – 100 cm/hr

4. Landscape – Soft Surfaces

4.1 General

4.1.1 Cross References

General

General: Conform to the *General requirements* worksection.

Associated worksections

Associated worksections: Conform to the following:

- *Landscape - soils.*

4.1.2 Interpretation

Definitions

General: For the purposes of this worksection the definitions given below apply.

Site topsoil: Soil excavated from the site which has the following characteristics:

- Contains organic matter.
- Supports plant life.
- Free from unwanted matter.

Unwanted matter (in topsoil):

- Stones over 25 mm diameter.
- Clay lumps.
- Weeds and tree roots.
- Sticks and rubbish.
- Material toxic to plants.

Imported topsoil:

- Fine: Clay loam, fine sandy loam, sandy clay loam, silty loam, loam.
- Medium: Sandy loam, fine sandy loam.
- Coarse: Sand, loamy sand.

Topsoil mixture: Topsoil and compost or other additives, thoroughly mixed before placing.

Top dressing: A soil that is suitable for surface application to lawn.

4.1.3 Inspection

Notice

Inspection: Give notice so inspection may be made of the following

- Clearing completed.
- Setting out completed.
- Grassing bed prepared before turfing, seeding, or temporary grassing.
- Grassing or turfing completed.

4.1.4 Submissions

Samples

General: Submit representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Samples schedule

Item	Quantity
1. Imported topsoil with test results to AS4419	1 x 5 kg bag
2. Site soil intended for Horticultural uses	1 x 5 kg bag
3. Blended site soil intended for Horticultural uses	1 x 5 kg bag

Suppliers

Statements: Submit statements from suppliers, giving the following, where applicable:

- Particulars of the supplier's experience in the required type of work.
- Production capacity for material of the required type and quantity.
- Lead times for delivery of the material to the site.

Materials

Supplier's data: Submit supplier's data including the following:

- Material source of supply.

Execution

Program: Submit a work program in the form of a bar chart, for the landscape works.

Maintenance program: Submit a proposed planting maintenance program.

Material storage on site: Submit proposal.

4.2 Products

4.2.1 Grass Seed

Seed

Mixtures: Provide seed mixtures which are thoroughly pre-mixed with a bulking material such as safflower meal. Deliver to the site in bags marked to show weight, seed species and supplier's name. Provide fresh, clean, uncoated new seed. Do not provide wet, mouldy, or otherwise impaired seed.

Purity (minimum): 98%.

Germination viability (minimum): 86%.

Age (maximum) from date of harvest: 2 years.

4.2.2 Fertiliser

Fertiliser

General: Provide proprietary fertilisers, delivered to the site in sealed bags marked to show manufacturer or vendor, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

Before seeding: To improve organic content of existing subgrade apply either approved chicken manure additive such as Dynamic Lifter, or other approved complete fertiliser.

After seeding during the Establishment Period: Apply Nitrogen fertiliser in the last week of the Establishment Period, and after mowing. Lightly water after application.

Fertiliser schedule

Fertiliser key	Location	N:P:K ratio	Application rate
Before Seeding	All turf areas	14:15:10 as per manufacturer's recommendations or approved chicken manure additive such as Dynamic Lifter as per manufacturer's recommendations.	100 kg/ha or as per manufacturer's recommendations

Fertiliser key	Location	N:P:K ratio	Application rate
After Seeding (Establishment Period)	All turf areas	20:0:0 (Ammonium Sulphate only) or other approved Nitrogen fertiliser as per manufacturer's recommendations	120 kg/ha or as per manufacturer's recommendations

4.3 Execution

4.3.1 Preparation

Weed eradication

Herbicide: Eradicate weeds using environmentally acceptable methods, such as a non-residual Glyphosate herbicide in any of its registered formulae, at the recommended maximum rate.

Manual weeding: Regularly remove, by hand, rubbish and weed growth throughout grassed, planted and mulched areas. Remove weed growth from an area 750 mm diameter around the base of the trees in grassed areas. Continue eradication throughout the course of the works and during the planting establishment period.

Weed eradication schedule

Weed type	Eradication method or treatment	
	Acceptable	**Unacceptable**
Refer to Weed Management Plan		

Vegetative spoil

Disposal: Remove vegetative spoil from site. Do not burn.

4.3.2 Grass Seeding

Preparation

General: Prepare the areas to be sown. Spread the fertiliser evenly over the cultivated bed within 48 hours before sowing, and rake lightly into the surface. If a prepared area becomes compacted from any cause before sowing can begin, rework the ground surface before sowing.

Sowing

Conditions: Do not sow if frost is likely before the plant has reached an established state, or in periods of extreme heat, cold or wet, or when wind velocities exceed 8 km/h. Provide even

distribution. Lightly rake the surface to cover the seed.

Sowing schedule

Mix designation	Seed species	Location	Sowing Season	Sowing Method	Application rate (kg/ha)	Mowing height (mm)
35%	STERILE Japanese Millet (*Echinochloa esculenta*)	All	**October to March**	Hydroseeding or other approved method	20 kg/ha	No lower than 30 mm
35%	STERILE Wimmera Rye (*Lolium rigidum)*	All	**April to September**	Hydroseeding or other approved method	20 kg/ha	No lower than 30 mm
65%	Green Couch (*Cynodon dactylon*)	All	Winter and Summer	Hydroseeding or other approved method	40 kg/ha	No lower than 30 mm

Rolling

General: Roll the seed bed immediately after sowing.

Roller weight (maximum):

- Clay and packing (heavy) soils: 90 kg/m width.
- Sandy and light soils: 300 kg/m width.

Watering

Before germination: Water the seeded area with a fine spray until the topsoil is moistened to its full depth. Continue watering until germination to keep the surface damp and the topsoil moist but not waterlogged.

After germination: Water to maintain a healthy condition, progressively hardened off to the natural climatic conditions.

Germination

General: Maintain sown areas until the attainment of a dense continuous sward of healthy grass over the whole of the seeded area, evenly green and of a consistent height.

Reseeding: If germination has not been attained within one month, reseed the sown areas.

Weeding

Removal: Remove weeds that occur in sown areas.

Spraying: Where necessary spray with a selective herbicide for broad leafed weeds. Do not spray grass seeded areas within 3 months of germination.

Protection

General: Protect the newly sown areas against traffic until well established.

Fertilising after germination

Six weeks after germination: Spread fertiliser evenly over the sown area and then water in. Do not apply the fertiliser to wet grass.

Ten weeks after grass germination: If the planting establishment period carries through the summer months, spread pelleted sulphate of ammonia at the rate of 250 kg/ha.

Mowing

Height: Mow to maintain the grass height within the required range. Do not remove more than one third of the grass height at any one time. Carry out the last mowing within 7 days before the end of the planting establishment period. Remove grass clippings from the site after each mowing.

4.3.3 Hydroseeding and hydromulching

Seed pretreatment

General: Place in a calico bag those species of seed to be pretreated, and immerse for 10 minutes in water kept at a temperature between 80°C and 95°C. Do not boil. Allow to cool, soak for 24 hours, then apply immediately.

Seed species to be pretreated as per approved application method.

Hydroseeding mixture

General: A slurry of seed mixture, fertiliser, and water.

Hydromulching mixture

General: A slurry of seed mixture, fertiliser, mulch and water.

Hydroseeding and hydromulching schedule

Location	Seed mix and type	Mulch type	Slurry type	Water application rate (L/ha)	Binder type and rate
As per drawing	As per drawing	Approved contractor submittal	Approved contractor submittal	Suitable for the site conditions, sufficient to assist in seed, fertiliser, mulch distribution	250L/ha

Fertiliser

Type and application rate: Approved contractor submittal, application rate as per manufacturer's

instructions.

Mixing

Mixer: Thoroughly mix the slurry in a purpose-made mechanical mixer.

Application rates

Seed mixture: The rate applicable to the mix type.

Mulch: At least 2.5 t/ha with seed, or 5 t/ha without seed.

Bitumen emulsion binder: 2000 L/ha of residual bitumen.

Polymer binder: 250 L/ha.

Water: Suitable for the site conditions, and sufficient to assist in the distribution of the seed, fertiliser and mulch.

Preparation

Bed: For cultivation purposes machine scarify the area to be seeded to provide a firm friable seed bed. For slopes greater than 1:3 50mm of imported topsoil to be added prior to scarifying. For slopes less than 1:3 75mm of imported topsoil is to be added prior to scarfying.

Application

General: Moisten the topsoil to its full depth before applying the slurry. Apply the slurry using high pressure pumping equipment operated by trained personnel. Spray the mixed slurry under pressure, maintaining a thoroughly mixed supply, operating on a front so that the mixture is evenly distributed over the area. Complete each front before commencing the next.

Watering

Before germination: Water the seeded area with a fine spray until the topsoil is moistened to its full depth. Continue watering until germination to keep the surface damp and the topsoil moist but not waterlogged.

After germination: Water to maintain a healthy condition, progressively hardened off to the natural climatic conditions.

Turfing

Turf

Supplier: Obtain turf from a specialist grower of cultivated turf. Provide turf of even thickness, free from weeds and other foreign matter.

Supply

Elapsed time: Deliver the turf within 24 hours of cutting, and lay it within 36 hours of cutting. Prevent it from drying out between cutting and laying.

Fertilising

General: Mix the fertiliser thoroughly into the topsoil before placing the turf. Apply lawn fertiliser at the completion of the first and last mowings, and at other times as required to maintain healthy grass cover.

Laying

General: Lay the turf in the following manner:

- In stretcher pattern with the joints staggered and close butted.
- Parallel with the long sides of level areas, and with contours on slopes.
- To finish flush, after tamping, with adjacent finished surfaces of ground, paving edging, or grass seeded areas.

Strip turf laying: Close butt the end joints and space the strips 300 mm apart. Apply a layer of top dressing between the strips of turf. Finish with an even surface.

Tamping

General: Lightly tamp to an even surface immediately after laying. Do not use a roller.

Pegging

Stabilising: On steep slopes peg the turf to prevent downslope movement. Remove the pegs when the turf is established.

Watering

General: Water immediately after laying until the topsoil is moistened to its full depth. Continue watering to maintain moisture to this depth. Keep the grass in a healthy condition.

Mowing

Height: Mow to maintain the grass height within the required range. Do not remove more than one third of the grass height at any one time. Carry out the last mowing within 7 days before the end of the planting establishment period. Remove grass clippings from the site after each mowing.

Turfing schedule

Turf key	**Species or variety**	**Minimum thickness (mm)**	**Turf roll size**	**Location**	**Mowing height (mm)**
TURF (Standard treatment)	*Cynodon dactylon "Green Couch"*	25 mm (10 mm soil; 1.5 or greater of grass mat)	A Grade - Half a square metre or to approved manufacturer's specifications	All turf areas as per drawing	No lower than 30 mm

Maintenance

General: Maintain turfed areas until the attainment of a dense continuous sward of healthy grass over the whole turfed area, evenly green and of a consistent height.

Failed turf: Lift failed turf and relay with new turf.

Levels: Where levels have deviated from the design levels after placing and watering, lift turf and regrade topsoil to achieve design levels.

Top dressing

General: When the turf is established, mow, remove cuttings and lightly top dress to a depth of 10 mm. Rub the dressing well into the joints and correct any unevenness in the turf surface.

4.3.4 Temporary grassing

Location

Refer to Section 4.2.1

Seed mix type

Refer to Section 4.2.1

Preparation

General: Prepare the areas to be sown. Spread fertiliser evenly over the cultivated bed within 48 hours before sowing, and rake lightly into the surface. If a prepared area becomes compacted before sowing begins, rework the ground surface before sowing.

Sowing

General: Provide even distribution. Lightly rake the surface to cover the seed.

Watering

General: Immediately after sowing, water to a depth of 100 mm. Thereafter water to obtain germination and establish grasses. After establishment water only as necessary.

Maintenance

General: Maintain temporary grassing areas until no longer required.

Existing grass

General: Where existing grass or planting is within the landscape contract area, maintain it as for the corresponding classifications of new grass or planting.

Grassed areas

Maintenance: Commence grass maintenance works at the completion of sowing, hydroseeding and turfing. Maintain healthy weed-free growth.

Log book

Records: Keep a log book recording when and what maintenance work has been done and what materials, including toxic materials, have been used. Make the log book available for inspection on request.

4.3.5 Geotextiles

Select geotextile to suit application and submit to Landscape Architect for approval. Selection shall be appropriate biodegradable solution using manufacturer's specifications and recommended application only.

5. Landscape – Plants

5.1 General

5.1.1 Cross References

General

General: Conform to the *General requirements* worksection.

Associated worksections

Associated worksections: Conform to the following:

- *Landscape – soils*.
- *Trees supply*.

5.1.2 Interpretation

Definitions

General: For the purposes of this worksection the definitions given below apply.

Site topsoil: Soil excavated from the site that has the following characteristics:

- Contains organic matter.
- Supports plant life.
- Free from unwanted matter.

Unwanted matter (in topsoil):

- Stones over 25 mm diameter.
- Clay lumps.
- Weeds and tree roots.
- Sticks and rubbish.
- Material toxic to plants.

Imported topsoil:

- Fine: Clay loam, fine sandy loam, sandy clay loam, silty loam, loam.
- Medium: Sandy loam, fine sandy loam.
- Coarse: Sand, loamy sand.

Topsoil mixture: Topsoil and compost or other additives, thoroughly mixed before placing.

5.1.3 Inspection

Notice

Inspection: Give notice so inspection may be made of the following:

1. Setting out completed.
2. Plant holes excavated and prepared for planting.
3. Plant material set out before planting.
4. Planting, staking and tying completed.
5. Completion of planting establishment work.

5.1.4 Submissions

Suppliers

Statements: Submit statements from suppliers of plants and other materials, giving the following, where applicable:

- Particulars of the supplier's experience in the required type of work.
- Production capacity for material of the required type, sizes and quantity.
- Lead times for delivery of the material to the site.

Materials

Supplier's data: Submit supplier's data including the following:

- Material source of supply.

Compost: Submit a certificate of proof of compost pH value.

Execution

Program: Submit a work program in the form of a bar chart, for the landscape works.

Maintenance program: Submit a proposed planting maintenance program.

Planting machine: If a planting machine is to be used as an alternative to hand planting, submit proposal.

Spraying: Submit proposal.

Plants – open rooted stock: If open rooted stock is to be used, submit proposal.

Material site storage: Submit proposal.

Samples

General: Submit representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Plant materials - quantity: Submit one plant sample for each 100 of each species or variety, in

the condition in which it is proposed to supply that plant to the site.

Samples schedule

Item	Quantity
As per Master Plant Schedule on drawing	1 sample for each 100 of each species

Soil – type tests

Evidence: Submit test results as follows:

- Sampling: As recommended in AS 4419 Appendix A.
- Phosphorous content testing: Refer to Section 3.1.7

5.2 Products

5.2.1 Plants

Plants

Characteristics: Provide plants with the following characteristics:

- Large healthy root systems, with no evidence of root curl, restriction or damage.
- Vigorous, well established, free from disease and pests, of good form consistent with the species or variety.
- Hardened off, not soft or forced, and suitable for planting in the natural climatic conditions prevailing at the site.

Trees: Provide trees that, unless required to be multi-stemmed, have a single leading shoot.

Replacement: Replace damaged or failed plants with plants of the same type and size.

Plant containers

General: Supply plants in weed-free containers of the required size.

Open rooted stock: If trees are to be supplied as open rooted stock, ensure this is appropriate to the species, variety, size, and time of year for planting.

Potting-on: Do not carry out potting-on.

Plant schedule

Plant key	Plant species	Roots	Number required	Plant size (mm)		
				Container size	Minimum trunk caliper	Plant height
As per Master Plant Schedule on drawing.						

Labelling

Tag: Label at least one plant of each species or variety in a batch with a durable, readable tag.

Storage

Timing: Deliver plant material to the site on a day to day basis, and plant immediately after delivery.

5.2.2 Mulch

Mulch

General: Provide mulch that is free of deleterious and extraneous matter such as soil, weeds and sticks.

Standard: To AS 4454.

Organic mulches: Free of stones.

Mulch material: Brush chippings and leaf litter recovered from site clearing, if available; otherwise, pine bark.

Organic mulch types

Brush chippings and leaf litter: Vegetative material processed through a chipper to pieces not larger than 75 x 50 x 15 mm.

- Material permitted: Leaf matter and tree loppings from Eucalyptus, Tristania and Pinus species.
- Material not permitted: Leaf matter and tree loppings from privet, camphor laurel, coral tree, poplar, willow, and noxious weeds.

Pine bark: From mature trees, graded in size from 50 x 50 x 25 mm to 25 x 15 x 15 mm, free from wood slivers.

Pine flake: Pinus species sapwood slivers of size range 250 x 25 mm to 30 x 3 mm, including fragments of pine bark.

Straw: Cereal straw, wood fibre, or other suitable vegetative material (but not meadow hay) free from weeds and seeds, applied in conjunction with a bitumen emulsion or polymer binder.

Inorganic mulch types

Washed river pebble: Uniform size or graded material in the size range 6 – 10 mm.

Decomposed granite gravel: Uniform size or graded material in the size range 5 – 20 mm, of uniform colour and low plasticity. Keep clear of plant stems.

Crushed quartz: Uniform size or graded material in the size range 5 – 20 mm, of uniform colour.

Marble chip gravel: Uniform size or graded material in the size range 5 – 20 mm, of uniform colour.

Slate: Plum slate slivers in the size range 5 – 25 mm.

Shale: Uniform size or graded material, no particles smaller than 0.1 mm diameter.

Scoria: Uniform size or graded material.

5.3 Execution

5.3.1 Preparation

Weed eradication

Herbicide: Eradicate weeds using environmentally acceptable methods, such as a non-residual Glyphosate herbicide in any of its registered formulae, at the recommended maximum rate.

Removal: Regularly remove, by hand, rubbish and weed growth throughout grassed, planted and mulched areas. Remove weed growth from an area 750 mm diameter around the base of the trees in grassed areas. Continue eradication throughout the course of the works and during the planting establishment period.

Weed eradication schedule

Weed type	**Eradication method or treatment**	
	Acceptable	**Unacceptable**
As per Weed Management Plan		

Vegetative spoil

Disposal: Remove vegetative spoil from site. Do not burn.

5.3.2 Planting

Individual plantings in grassed areas

Method: Excavate a hole to twice the diameter of the root ball and at least 100 mm deeper than the root ball. Break up the base of the hole to a further depth of 100 mm, and loosen compacted sides of the hole to prevent confinement of root growth.

Ripline planting

Method: Rip the row and excavate a plant hole for each plant large enough to accept the root ball plus 0.1 m³ of backfilling with topsoil. Clear weeds and other vegetative material within 300 mm radius of the plants. If planting holes are excavated by mechanical means increase the hole size by 100 mm and loosen compacted sides to prevent confinement of root growth.

Locations

General: If it appears necessary to vary plant locations and spacings to avoid service lines, or to cover the area uniformly, or for other reasons, give notice.

Planting conditions

Weather: Do not plant in unsuitable weather conditions such as extreme heat, cold, wind or rain. In other than sandy soils, suspend excavation when the soil is wet, or during frost periods.

Watering

Timing: Thoroughly water the plants before planting, immediately after planting, and as required to maintain growth rates free of stress.

Placing

Method: Remove the plant from the container with minimum disturbance to the root ball, ensure that the root ball is moist and place it in its final position, in the centre of the hole and plumb, and with the topsoil level of the plant root ball level with the finished surface of the surrounding soil.

Fertilising

Pellets: In planting beds and individual plantings, place fertiliser pellets around the plants at the time of planting.

Application rate (kg/ha): Slow release fertiliser such as Osmocote to manufacturer's specification.

Backfilling

General: Backfill with topsoil mixture. Lightly tamp and water to eliminate air pockets. Ensure that topsoil is not placed over the top of the root ball, so that the plant stem remains the same height above ground as it was in the container.

Watering basins for plants in grass

Method: Except in irrigated grassed areas and normally moist areas, construct a watering basin around the base of each individual plant, consisting of a raised ring of soil capable of holding at least 10 L.

5.3.3 Transplanting

Notice

General: Give notice before transplanting.

Conditions

Timing: Select a time for transplanting having regard to the appropriate season, time of actual operation, root ball diameter and depth, lifting methods, weather conditions and the like.

Lifting

Method: Two days before transplanting of each specimen, thoroughly irrigate it to the full depth of the root ball. Minimise the cutting of roots. Cut roots with sharp tools. Do not fracture the ball of soil around the root system, but maintain it in firm condition during transplanting by wrapping in appropriate open weave material (e.g. hessian), securely tied.

Planting

Disturbance: Avoid disturbance to the root ball and plant. Remove the root ball wrapping and ties by cutting.

Pruning

General: Prune as directed where selective pruning of branches or canopy is necessary.

Standard: To AS 4373.

Watering

General: At the completion of transplanting, water the root ball thoroughly and continue to water until established.

5.3.4 Mulching

Placing mulch

General: Place mulch to the required depth, clear of plant stems, and rake to an even surface flush with the surrounding finished levels. Spread and roll mulch so that after settling, or after rolling, it is smooth and evenly graded between design surface levels sloped towards the base of plant stems in plantation beds, and not closer to the stem than 50 mm in the case of gravel mulches.

In mass planted areas: Place after the preparation of the planting bed but before planting and other work.

In smaller areas (e.g. planter boxes): Place after the preparation of the planting bed, planting and other work.

Extent: To surrounds of plants planted in riplines and grass areas, provide mulch to 750 mm diameter.

Depths: Spread organic mulch to a depth of 75 mm, and gravel mulch to a depth of 50 mm.

5.3.5 Spraying

Notice

General: Immediately give notice of evidence of insect attack or disease amongst plant material.

Spraying

Product: Where required, spray with insecticide, fungicide or both.

5.3.6 Stakes and Ties

Stakes

Material: Hardwood, straight, free from knots or twists, pointed at one end.

- Installation: Drive stakes into the ground at least one third of their length, avoiding damage to the root system, **ties are to be positioned at half the height of the main stem**, to stabilise the plant.

Stake sizes:

- For plants ≥ 2.5 m high: Three 50 x 50 x 2400 mm stakes per plant.
- For plants 1 – 2.5 m high: Two 50 x 50 x 1800 mm stakes per plant.
- For plants < 1 m high: One 38 x 38 x 1200 mm stake per plant.

Ties

General: Provide ties fixed securely to the stakes, **ties are to be positioned at half the height of the main stem**, to stabilise the plant.

Tie types:

Maxi-Lok or approved long lasting UV stabilised re-joinable polyethylene chain lock. Use soft sleeve around tree trunks

- For plants ≥ 2.5 m high: Two strands of approved tie neatly twisted together, passed through reinforced rubber or plastic hose, and installed around stake and stem in a figure of eight pattern. **Ties are to be positioned at half the height of the main stem**, to stabilise the plant.
- For plants < 2.5 m high: 50 mm hessian webbing stapled to the stake. **Ties are to be positioned at half the height of the main stem**, to stabilise the plant.

Marker stakes

Material: Timber offcuts 25 x 25 x 1200 mm. Dip the top 200 mm in white paint.

Installation: Drive firmly into the ground at least 300 mm from the plant. Do not tie to the plant.

Location of marker stakes:

- Trees in grass: Mark each tree.
- Ripline planting areas: Mark each ripline at every fifth plant along the line.

5.3.7 Earth anchors

Requirement

Support: Provide temporary support where necessary to trees, root balls or stakes using galvanized steel cables attached to proprietary aluminium anchors or drive rods, which have been hand or power driven at an angle into the ground.

5.3.8 Tree Surgery

Notice

General: Give notice before commencing tree surgery.

Qualifications

General: Employ suitably qualified persons to carry out tree surgery work in a safe and progressive manner.

Pruning

Standard: To AS 4373.

The following are deemed to be unacceptable pruning practices. See AS4373 for further information.

- Lopping and topping: No lopping or topping is to occur.
- Wound painting: No wound painting is to occur.
- Flush cutting: No flush cutting is to occur.

Operations

General: Remove dead and decayed wood or limbs that have been broken. Make cuts into live wood. If the trees show signs of deterioration after the work has been done, carry out a program of feeding or soil amelioration such as soil aeration, irrigation or incorporation of organic material. Continue this program until the end of the planting establishment period.

Precautions

Damage: Avoid damage to trees being treated or to nearby trees and surroundings. Do not use trees as anchors for winching operations or bracing. Provide bracing as necessary before cutting to prevent uncontrolled breakages and damage to surroundings.

Dressing

Treatment: Prevent incursion of rot or disease after cutting.

Root pruning

Disturbance: Do not unduly disturb the remaining root system.

5.3.9 Planting Establishment

Period

Commencement: The planting establishment period commences at the date of practical completion.

Required period: 12 Weeks.

Existing planting and grass

Maintenance: Where existing grass or planting is within the landscape contract area, maintain it as for the corresponding classifications of new grass or planting.

Recurrent works

General: Throughout the planting establishment period, carry out maintenance work including, watering, mowing, weeding, rubbish removal, fertilising, pest and disease control, reseeding, returfing, staking and tying, replanting, cultivating, pruning, hedge clipping, aerating, reinstatement of mulch, renovating, top dressing, and keeping the site neat and tidy.

Replacements

Plants: Continue to replace failed, damaged or stolen plants.

Grassed areas

Maintenance: Commence grass maintenance works at the completion of sowing, hydroseeding and turfing. Maintain healthy weed-free growth.

Log book

Records: Keep a log book recording when and what maintenance work has been done and what materials, including toxic materials, have been used. Make the log book available for inspection on request.

5.3.10 Completion

Product warranty

Certification: Submit the supplier's written statement certifying that plants are true to the required species and type, and are free from diseases, pests and weeds.

Maintenance manual

General: Submit recommendations for maintenance of plants.

Cleaning

Stakes and ties: Remove those no longer required at the end of the planting establishment period.

Temporary fences: Remove temporary protective fences at the end of the planting establishment period.

6. Trees Supply

6.1 General

6.1.1 Aims

Responsibilities

General: Provide trees that have been grown to a standard that allows them to establish rapidly and grow to maturity.

Selections: Conform to the Selections.

6.1.2 Cross References

General

General: Conform to the *General requirements* worksection.

6.1.3 Standard

General

Guidance: Follow the guidance given in *NATSPEC Guide: Specifying Trees – a guide to assessment of tree quality* (Clark R. 2003).

6.1.4 Interpretation

Definitions

General: For the purposes of this worksection the definitions given below apply.

Calliper: The stem or trunk diameter at a nominated point. Generally measured at 300 mm above ground.

Size Index: Product of height (m) x calliper (mm).

Tubes or plant cells: Trees grown in small containers or cells in trays with a height:diameter ratio > 3:2, typically < 0.75 L.

Small trees: Trees grown in containers < 20 L (other than tubes or plant cells), and ex-ground trees of Size Index < 35.

Large trees: Trees grown in containers ≥ 20 L, and ex-ground trees of Size Index ≥ 35.

External inspection: Tree inspection without washing away of soil from the rootball, and assesses the following:

- The tree's ability to be self-supporting.

- Its balance.
- Its root development.

Investigative inspection: Any method of root inspection that involves the washing away of all or portions of the soil from the rootball to expose a section or all the roots.

- Destructive inspection: The washing away of all soil from a rootball to allow inspection of rootball development.
- Partial inspection: A method of exposing a section of a root system to enable inspection of root development by washing the soil away in a wedge-shaped section from the stem to the extremity of the rootball. This soil can be gently replaced so the tree is not damaged.

6.1.5 Precompletion Tests

Production tests

External inspection:

- Frequency: Inspect trees before shipment.
- Inspector: Supplier.
- Sampling: To the External inspection sampling table for each batch of trees. Select sample trees at evenly distributed intervals within each batch.

Table 2 External Inspection Sampling Table

Number of trees per batch	Number of trees to sample
0 – 20	4
21 – 50	8
51 – 100	15
101 – 500	15 for the first 100 + 5% of the balance of the order
501 – 2000	35 for the first 500 + 2% of the balance of the order
2001+	65 for the first 2000 + 1% of the balance of the order

Investigative inspection:

- Frequency: Inspect trees before shipment.
- Inspector: Qualified person authorised by contract administrator.
- Destructive inspection: Use for trees with rootballs/containers ≤ 200 mm.

- Allowance: Allow for sample trees in addition to quantity ordered.
- Partial inspection: Use for trees with rootballs/containers > 200 mm.
- Sampling: To the Investigative inspection sampling table for each batch of trees. Select sample trees at evenly distributed intervals throughout each batch.

Table 3 Investigative Inspection Sampling Table

Number of trees per batch	Number of trees to sample
0 – 20	1
21 – 50	2
51 – 100	4
101 – 500	4 for the first 100 + 2% of balance of order
501 – 2000	12 for first 500 + 1% of balance of order
2001+	27 for the first 2000 + 0.5% of balance of order

6.1.6 Submissions

Test results

General: Complete and return the Tree inspection form for each batch inspected.

Rejection: Non-compliance may lead to rejection of the entire batch.

Corrective action: Comply with corrective action procedures for each order as instructed.

Substitution: If non-complying trees are proposed, submit a proposal in writing.

Authentication: Supply a copy of the written approval of substitution with any non-complying trees.

Forward order contracts

Reports: Complete regular reports using the pro forma Tree inspection form. Include checks against specification requirements.

- Photographs: Provide current colour copies with date verification.
- Submissions: To the contract administrator.
- Inspection: Complete and return the attached pro-forma Tree inspection form before despatch of every batch, and at the following frequencies:
  - Inspections: At 3 monthly intervals.

– Reports: At time of inspections.

6.2 Products

6.2.1 Balance

Small trees

Conformance at inspection: To Balance (small trees) assessment requirements.

Balance (small trees) assessment requirements:

- Tubes or plant cells: height above soil level must be between 1.5 and 2.5 times the height of the tube or plant cell.
- Trees in containers < 20 L (other than tubes or plant cells) or ex-ground trees of Size Index < 35 (e.g. 1.4 m high x 25 mm calliper); height must fall within the range indicated for the container size in the Small container-grown trees table.
- Containers/rootballs (other than tubes or plant cells) must remain flat on the ground when the stem, held at 80% of height above ground, is deflected 30º from the vertical, side to side.

Exempt: Species that naturally produce hard inflexible wood in the early stages of their development.

Table 4 Small Container-Grown Trees Table

Tubes or plant cells	**Tree height between 1.5 and 2.5 x the height of the container**	
Container size or minimum rootball diameter	**Height range (m)**	
	Thin-stemmed species	**Thick-stemmed species**
150 mm (1.8 L)	0.4 – 0.6	0.3 – 0.5
170 mm (2.6 L)	0.5 – 0.7	0.4 – 0.6
200 mm pot (4 L)	0.7 – 0.9	0.6 – 0.8
200 mm bag (5 L)	0.8 – 1.0	0.7 – 0.9
250 mm (8 L)	1.0 – 1.2	0.8 – 1.0
300 mm (15 L)	1.2 – 1.5	1.0 – 1.2

Large trees

Conformance at inspection: To Balance (large trees) assessment requirements.

Balance (large trees) assessment requirements:

- For trees grown in containers ≥ 20 L, the Size Index must lie within the range for the nominal container size shown in the Common container volumes table.
- Ex-ground trees with a Size Index ≥ 35 (e.g. 1.4 m high x 25 mm calliper) must have rootball diameters ≥ the minimum rootball diameters shown in the Ex-ground trees table.

Table 5 Common Container Volumes Table

Size Index	Nominal container volume (L)	Size Index	Nominal container volume (L)
26-33	20	371-480	450
32-41	25	412-518	500
45-58	35	453-587	550
57-74	45	495-640	600
77-99	60	533-716	700
83-107	75	632-818	800
111-143	100	711-921	900
154-200	150	791-1023	1000
194-251	200	842-1089	1100
227-314	250	918-1188	1200
273-353	300	1148-1485	1500
289-373	350	1530-1980	2000
330-427	400	1913-2475	2500

Table 6 Ex-ground Trees Table

Size Index	Minimum rootball diameter (mm)	Size Index	Minimum rootball diameter (mm)
36–55	350	341–383	850
56–72	400	384–429	900
73–106	450	430–530	1000
107–131	500	531–642	1100
132–156	550	643–732	1200
157–173	600	733–859	1300
174–228	650	860–1144	1500
229–249	700	1145–1507	1750

250–299	750	1508–1968	2000
300–340	800	1969–3075	2500

For trees outside the ranges shown in the Common container volumes table and the Ex-ground trees table, refer to the master planting schedule for details.

Photographs: Provide current colour copies with date verification.

6.2.2 Above-ground

Labelling

General: Clearly label individual trees and batches.

- Label type: To withstand transit without erasure or misplacement.

Health and vigour

Health: Supply trees with foliage size, texture and colour at time of delivery consistent with the size, texture and colour shown in healthy specimens of the nominated species.

Vigour: Supply trees with extension growth consistent with that exhibited in vigorous specimens of the species nominated.

Freedom from pests and disease

Pests and disease: Supply trees with foliage free from attack by pests or disease.

Native species with a history of attack by native pests: Restrict evidence of previous attack to < 15% of the foliage and ensure absence of actively feeding insects.

Supply

Supply only trees that:

- Are free from injury.
- Are self-supporting.
- Have the calliper at any given point on the stem greater than the calliper at any higher point on the stem.

Pruning

In accordance with AS 4373.

Specific form: N/A

Clean stem height: < 40% of total tree height.

Pruning wounds

Extent: Restrict fresh (i.e. recent, non-calloused pruning wounds) to < 20% of total tree height.

Type: Ensure a clean-cut at the branch collar.

Diameter of wound: < 50% of the calliper immediately above the point of pruning.

Apical dominance

Species with an excurrent form: Supply trees with a defined central leader and the apical bud intact.

Crown symmetry

Crown distribution: Difference on opposite sides of the stem axis < 20%.

Stem structure

Species with excurrent form: Supply trees with a single stem roughly in the centre of the tree with any deviation from vertical < 15º.

Species with decurrent form: Supply trees where the central stem is not divided at any point lower than the clean stem height nominated, and that the stem junction at the point of division is sound.

All species: Ensure that branch diameter is less than or equal to one-half of the calliper immediately above the branch junction.

Included bark

General: Supply trees where the branch/stem bark ridges at junctions between stems and branches and between co-dominant stems are convex, except for species prone to include bark that are known to remain strong.

Trunk position

General: Supply trees with the distance from the centre of the trunk to the extremity of the rootball not varying by > 10%.

Compatibility of graft unions

General: Supply trees where the union between the scion and rootstock is sound for the entire perimeter of the graft, and the diameter of the scion immediately above the graft is equal to the diameter of the rootstock immediately below the graft (± 20%).

Indication of north

Trees in containers > 100 L or of Size Index > 140: Indicate the northerly aspect during growth in the nursery to withstand transit without erasure or misplacement.

6.2.3 Below-ground

Root division

Trees in containers ≤ 45 L or ex-ground trees with a Size Index ≤ 70: Primary division of roots at < 100 mm intervals.

Trees in containers > 45 L or ex-ground trees with a Size Index > 70: Primary division of roots within the outer 50% of the rootball at < 100 mm intervals.

Root direction

General: Ensure that roots, from the point of initiation, generally grow in an outwards (radial) or downwards direction, and that any deviation from the established direction < 45º.

Trees with a calliper at ground level < 40 mm: Ensure that the diameter of any nonconforming roots at the extremity of the rootball < 25% of the calliper.

Trees with a calliper at ground level ≥ 40 mm: Ensure that the diameter of any nonconforming roots at the extremity of the rootball < 10 mm.

Rootball occupancy

Soil retention: On shaking or handling the unsupported rootball at least 90% of the soil volume to remain intact.

Rootball depth

Rootball depth assessment for containers/rootballs ≥ 45 L or larger:

- Depth: ≤ maximum depth specified and no rootball (regardless of size) > 550 mm in depth.
- Diameter: ≥ depth.

Height of root crown

General: Ensure that root crown is at the surface of the rootball.

Non-suckering rootstock

Grafted cultivars/varieties: Supply trees grafted onto non-suckering rootstock.

6.3 Selections

6.3.1 Schedules

Plant schedule – as per the Master Planting Schedule

Plant species	Number	Rootball or container volume (L)	Height (m)	Calliper (mm)
As per the Master Planting Schedule				

Plant species	Number	Rootball or container volume (L)	Height (m)	Calliper (mm)

6.3.2 Tree Inspection Form (Typical Example Only)

General

Date		Reference	
Purchaser			
Supplier		Inspected by (supplier/purchaser/agent)	
Species		Batch identification	
Number of trees in batch		Container/rootball size	
Height range		Calliper range	
Special requirements			

Above ground

Labelling	❑	
Health and vigour	❑	
Freedom from pests/disease	❑	
Freedom from injury	❑	
Self-supporting	❑	
Stem taper	❑	
Pruning	❑	
Apical dominance	❑	
Crown symmetry	❑	
Stem structure	❑	
Included bark	❑	
Trunk position	❑	

Compatibility of graft unions	❑	
Indication of north	❑	

Below ground

Inspection method used	❑	External only
	❑ ❑	External plus investigative destructive ❑ partial
Number of trees in sample	❑	
Root division	❑	
Root direction	❑	
Diameter nonconforming roots at rootball extremity	❑	
Rootball occupancy	❑	
Rootball depth	❑	
Height of root crown	❑	
Non-suckering rootstock	❑	

Balance

Balance	❑	

Conformance with specification

Conforming	❑ Yes ❑ No

Comments	
Name and signature (inspector)	

7. Landscape – Swales

7.1 General

7.1.1 Cross References

General

General: Conform to the *General requirements* worksection.

Associated worksections

Associated worksections: Conform to the following:

- *Landscape - soils.*

7.2 Products

7.2.1 Grass Seed

Seed

Mixtures: Provide seed mixtures which are thoroughly pre-mixed with a bulking material such as safflower meal. Deliver to the site in bags marked to show weight, seed species and supplier's name. Provide fresh, clean, uncoated new seed. Do not provide wet, mouldy, or otherwise impaired seed.

Purity (minimum): 98%.

Germination viability (minimum): 86%.

Age (maximum) from date of harvest: 2 years.

7.2.2 Erosion Control Matting (MacMat)

Refer to **Appendix B** for Manufacturer's Specification

7.3 Hydroseeding and hydromulching

Seed pretreatment

General: Place in a calico bag those species of seed to be pretreated, and immerse for 10 minutes in water kept at a temperature between 80°C and 95°C. Do not boil. Allow to cool, soak for 24 hours, then apply immediately.

Seed species to be pretreated as per approved application method.

Hydroseeding mixture

General: A slurry of seed mixture, fertiliser, and water.

Hydromulching mixture

General: A slurry of seed mixture, fertiliser, mulch and water.

Hydroseeding and hydromulching schedule

Location	Seed mix and type	Mulch type	Slurry type	Water application rate (L/ha)	Binder type and rate	Sowing Season
As per drawing	STERILE Japanese Millet (*Echinochloa esculenta*) 35%	Approved contractor submittal	Approved contractor submittal	Suitable for the site conditions, sufficient to assist in seed, fertiliser, mulch distribution	250L/ha	**October to March**
As per drawing	STERILE Wimmera Rye (*Lolium rigidum)* *35%*	Approved contractor submittal	Approved contractor submittal	Suitable for the site conditions, sufficient to assist in seed, fertiliser, mulch distribution	250L/ha	**April to September**
As per drawing	Green Couch (*Cynodon dactylon*) 65%	Approved contractor submittal	Approved contractor submittal	Suitable for the site conditions, sufficient to assist in seed, fertiliser, mulch distribution	250L/ha	Winter and Summer

Fertiliser

Type and application rate: Approved contractor submittal, application rate as per manufacturer's instructions.

Mixing

Mixer: Thoroughly mix the slurry in a purpose-made mechanical mixer.

Application rates

Seed mixture: The rate applicable to the mix type.

Mulch: At least 2.5 t/ha with seed, or 5 t/ha without seed.

Bitumen emulsion binder: 2000 L/ha of residual bitumen.

Polymer binder: 250 L/ha.

Water: Suitable for the site conditions, and sufficient to assist in the distribution of the seed, fertiliser and mulch.

Preparation

Bed: Scarify the area to be seeded to provide a firm friable seed bed. If the area is to have added topsoil, place it before scarifying.

Application

General: Moisten the topsoil to its full depth before applying the slurry. Apply the slurry using high pressure pumping equipment operated by trained personnel. Spray the mixed slurry under pressure, maintaining a thoroughly mixed supply, operating on a front so that the mixture is evenly distributed over the area. Complete each front before commencing the next.

Watering

Before germination: Water the seeded area with a fine spray until the topsoil is moistened to its full depth. Continue watering until germination to keep the surface damp and the topsoil moist but not waterlogged.

After germination: Water to maintain a healthy condition, progressively hardened off to the natural climatic conditions.

7.4 Weed Management

Weed eradication

Herbicide: Eradicate weeds using environmentally acceptable methods, such as a non-residual Glyphosate herbicide in any of its registered formulae, at the recommended maximum rate.

Manual weeding: Regularly remove, by hand, rubbish and weed growth throughout grassed, planted and mulched areas. Remove weed growth from an area 750 mm diameter around the base of the trees in grassed areas. Continue eradication throughout the course of the works and during the planting establishment period.

Spraying: Where necessary spray with a selective herbicide for broad leafed weeds. Do not spray grass seeded areas within 3 months of germination.

Vegetative spoil

Disposal: Remove vegetative spoil from site. Do not burn.

8. Landscape – Establishment and Maintenance

8.1 General

8.1.1 Cross References

General

General: Conform to the NATSPEC *General requirements* worksection.

8.2 Establishment and Maintenance Periods

The establishment and maintenance periods commence at the date of practical completion, or other identified fixed period, as set out by the Superintendent in a written certification to the Landscape Subcontractor.

8.2.1 Planting establishment period

The establishment period for soft landscape works is: **12 Weeks**

8.2.2 Planting maintenance period

The maintenance period for soft landscape works is: **52 Weeks**

8.3 Establishment and Maintenance Requirements

The Landscape Subcontractor is required to maintain all landscaped areas in accordance with all clauses within the Landscape Specification in order to ensure optimum plant growth is achieved. Plant establishment works include, but are not limited to:

- Pest and disease control;
- Weeding and spraying;
- Watering and fertilising;
- Mowing and edging;
- Top dressing of turf; and
- Replanting and remulching.

The Landscape Subcontractor is expected to undertake regular site visits throughout the maintenance period in order to ensure optimum plant growth is achieved.

8.3.1 Use of Watertube to Trees and Shrubs in Bags of 25L and Greater

Trees and shrubs in bags of 25L and greater shall be installed on site within a Watertube. The Watertube is installed in a similar fashion to that of a traditional tree guard however provides a

trickle fed source of water, and protection for young saplings from the elements. This ensures healthy growth is achieved at a significantly faster rate during the establishment period than through a traditional watering regime, as well as minimising the loss of plants due to drought intolerance.

8.4 Defects Liability Period

The Defects Liability period for soft and hard landscape works is 52 weeks from Practical Completion or other identified fixed period, as set out by the Superintendent in a written certification to the Landscape Subcontractor. The Defects Liability Period will run concurrently with the Establishment and Maintenance Period specified timeframes.

The Landscape Subcontractor is responsible for the replacement of all hardscape elements of the landscape works, due to defective materials or workmanship, however excluding acts of vandalism.

The Principal is responsible for the supply costs of replacement landscape materials where such materials are deemed to have failed, or have been damaged due to circumstances beyond the control of the Landscape Subcontractor, such as through vandalism, and include but are not limited to:

- Irrigation;
- Mulch; and
- Plant stock.

The Defects Liability period for hard landscape works is: **52 weeks**

Where the duration of the plant maintenance period differs from the defects liability period, the defects liability period for soft landscape works shall be: **52 weeks**

8.5 Establishment and Maintenance Log Book

A logbook detailing the landscape establishment and maintenance tasks, hours required to perform each task, materials used, and outcomes shall be submitted to the Superintendent, from commencement through to final inspection.

8.6 Inspection

Give sufficient notice so that inspection may be made at the following stages unless required otherwise by the Superintendent:

- Sub grades cultivated or prepared for placing topsoil;
- Grassing bed prepared before turfing, seeding, or temporary grassing;
- Plant holes excavated and prepared for planting;
- Plant material set out before planting;

- Clearing Completed;
- Plant materials delivered to the site;
- Planting, staking and tying completed;
- Grassing or turfing completed;
- Paving trim, fixtures and furniture completed;
- Tree holes excavated and prepared for planting;
- Trees before arboriculture works.

8.7 Completion

Product warranty

Certification: Submit the supplier's written statement certifying that plants are true to required species and type, and are free from diseases, pests, and weeds.

Maintenance manual

General: Submit recommendations for maintenance of plants.

Cleaning

Clean substrate and signage, removing excess adhesive, burrs and temporarily identification marks and labels from any items supplied as part of the Landscape scope of works.

Stakes and ties: Remove those no longer required at the end of the planting establishment period.

Temporary fences

Remove temporary protective fences at the end of the planting establishment period.

Appendix A

Master Plant Schedule

MASTER PLANT SCHEDULE								REV A
QUANTITY	**CODE**	**BOTANICAL NAME**	**COMMON NAME**	**CENTRES (mm)**	**POT SIZE**	**HEIGHT (MATURITY)**	**SUPPLY HEIGHT**	**STAKING**
TREES								
42	ALL ino	*ALLOCASUARINA inophloia*	Stringybark She Oak	10000	25L	10m	1200mm	Y
52	COR mac	*CORYMBIA maculata*	Spotted Gum	10000	25L	25-30m	1200mm	Y
46	COR tes	*CORYMBIA tessellaris*	Moreton Bay Ash	10000	25L	35m	1200mm	Y
37	EUC ter	*EUCALYPTUS tereticornis*	Forest Red Gum	10000	25L	30m	1200mm	Y
48	LOP sau	*LOPHOSTEMON suaveolens*	Swamp Box	10000	25L	10-25m	1200mm	Y
SHRUB MIX								
13950	ACA jun	ACACIA juncifolia	Rush Leaf Wattle	MIXTURE OF SPECIES AT 2000mm CENTRES	TUBE	1-2.5m	NA	N
13950	DOD vis	*DODONAEA viscosa*	Sticky Hop Bush		TUBE	5-8m	NA	N
13950	HOV vis	*HOVEA acutifolia*	Pointed Leaf Hovea		TUBE	2-4m	NA	N
13950	JAC sco	*JACKSONIA scoparia*	Dogwood		TUBE	4m	NA	N
13950	PUL vil	*PULTENAEA villosa*	Hairy Bush Pea		TUBE	2m	NA	N
GROUNDCOVERS/NATIVE GRASS MIX 1								
2255	CYM ref	*CYMBOPOGON refractus*	Barbed Wire Grass	MIXTURE OF SPECIES AT 750mm CENTRES	TUBE	NA	NA	N
2255	DIA rev	*DIANELLA revoluta*	Blueberry Lily		TUBE	NA	NA	N
2255	HAR vio	*HARDENBERGIA violacea*	Native Sarsaparilla		TUBE	NA	NA	N
2255	LOM lon	*LOMANDRA longifolia*	Mat Rush		TUBE	NA	NA	N
2255	THE aus	*THEMEDA australis*	Kangaroo Grass		TUBE	NA	NA	N
GROUNDCOVERS/NATIVE GRASS MIX 2								
1060	DIA cae	*DIANELLA caerulea*	Blue Flax Lily	MIXTURE OF SPECIES AT 750mm CENTRES	TUBE	NA	NA	N
1060	ISO nod	*ISOLEPIS nodosa*	Knobby Club Rush		TUBE	NA	NA	N
1060	LOM lon	*LOMANDRA longifolia*	Mat Rush		TUBE	NA	NA	N
1060	THE aus	*THEMEDA australis*	Kangaroo Grass		TUBE	NA	NA	N
HDROMULCH MIX WITH MACMAT JUTE MATTING								
NA	1/3	*HARDENBERGIA violacea*	Native Sarsaparilla	NA	NA	NA	NA	N
NA	1/3	*LOMANDRA longifolia*	Mat Rush	NA	NA	NA	NA	N
NA	1/3	*MYOPORUM ellipticum*	Booblia	NA	NA	NA	NA	N
HYRDROMULCH GRASS MIX								
		CYNODON dactylon		NA	NA	NA	NA	N

Appendix B

Macmat Jute Matting - Manufacturers Specification

Jute Mesh

Geomat – Erosion Control Netting

Technical characteristics:

Jute Mesh Soil Saver is made from unbleached, undyed, and loosely-twisted yarn 100% woven jute fiber to form an open weave mesh.

Physical properties

Yarn Thickness	mm		5
Mass per unit area	g/m^2	2387 : 1969	545
Aperture Size	mm		13 x 20
Width	Warpings/m		60-75
Length	Warpings/m		40-45
Color			Light Brown/ Grey
Fiber			100% Jute
Contaminants	%		≤5
Living organisms			Nil
Fumigation Certificate			Yes
Longevity	years		≤ 1

Mechanical properties

Longitudinal tensile strength	kN/m	IS 1969 : 1980	10.4
Elongation at break	%	Warpway	11
Transversal tensile strength	kN/m	IS 1969 : 1980	7.9
Elongation of break	%	Weftway	15
Water Retention		5x	3kg/m2

Bale presentation

Width	m		1.22
Length	m		549
Area (nominal)	m^2		670
Dimensions	mm		1300 x 550 x 800
Weight	kg		345

GHD 201 Charlotte Street Brisbane QLD 4000
GPO Box 668 Brisbane QLD 4001
T: (07) 3316 3000 F: (07) 3316 3333 E: bnemail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	C. O'Neill	E.Nicholaou		P. Wootton		17/12/09
B	Claire Humphreys	C. O'Neill*		P. Wootton		01/02/10

Attachment E

Queensland DPI Hardwoods Advice

Hardwoods advice
Plantation species profiles

Spotted gums

(*Corymbia maculata, Corymbia citriodora* subsp. *variegata*, *Corymbia citriodora* subsp. *citriodora*, *Corymbia henryi).*

David Lee, Simon Lawson, Matt Armstrong and Geoff Dickinson

Much of this information is generated from the results of research conducted by Hardwoods Queensland. The publication of supporting material is in progress.

Taxonomy and natural distribution of the spotted gums

Over the last few years there have been significant changes to the taxonomy of the spotted gum group. Prior to 1995 they were placed in the genus *Eucalyptus* with *E. maculata* occurring along the coast from Orbost, Victoria to Maryborough and inland to Carnarvon Gorge in Queensland and *E. citriodora* found from Maryborough, north into the southern part of Cape York Peninsula. Since then, taxonomic revision has placed the spotted gums in the genus *Corymbia.*

Natural populations of *Corymbia citriodora* subsp*. variegata* (spotted gum) occur in the Springsure-Maryborough region in central eastern Queensland to Coffs Harbour in New South Wales.*Corymbia citriodora* subsp. *citriodora* (spotted gum; lemon-scented gum) is found north from the Springsure-Maryborough region (overlapping with *C. citriodora* subsp*. variegata*) to the Atherton Tableland. *Corymbia henryi* (spotted gum; large-leaved spotted gum) is found on relatively infertile soils from the Brisbane area, to south of Grafton in New South Wales. *Corymbia maculata* (spotted gum) is the southernmost of the group and occurs from Orbost to south of Coffs Harbour[1,2]. All the spotted gums except *C. maculata* are under consideration for plantation development in Queensland.

Properties and uses of spotted gum

All the spotted gums are recognised by the timber trade name 'spotted gum'. The series Timber Species provides a detailed description of the timber properties and uses of spotted gum timber[3].

Spotted gum is a hard, durable timber and highly resistant to decay, although untreated wood is susceptible to lyctid borer attack. It can be dried satisfactorily and machines and finishes well. The heartwood colour varies between light brown and dark red-brown. The grain is moderately textured and variable and a wavy grain can produce an attractive fiddle back figure.

Spotted gum has a range of possible uses including as a sawn or round timber in engineering works; as an unseasoned timber in general framing and construction, joinery and fencing; fine and outdoor furniture, parquetry and turnery. Spotted gum plantings also play a significant role in land rehabilitation and management.

Current market value of spotted gum

Spotted gum timber is currently sourced from native regrowth forests on state and private land and it will be a number of years before plantation spotted gum is available on the market. The market value figures below are based on wholesale prices from a number of Queensland timber merchants, and should only be used as approximate figures.

Average current market value of spotted gum timber for 2001

Product	Price / m^3
Tongue and Groove Flooring	$1,250 - $1,300
Seasoned Structural (F17)*	$950 - $1,050
Unseasoned Structural (F14)*	$550 - $650

*stress grades[10]

Why is spotted gum recommended as a plantation species?

Spotted gum is a very high quality timber. Currently, spotted gum is the highest volume native hardwood harvested in Queensland, equivalent to 60% of the total. In plantations, spotted gum has good growth rates, and adapts well to a wide range of site types. Future, commercial volumes of plantation grown spotted gum timber are expected to be available

from most regions in central and southern Queensland on suitable soils and where the rainfall is between 600 and 1200 mm per year. Spotted gum copes with soils that have low to high fertility, with good to moderately impeded drainage, low to medium salinity and low to moderately high pH and sites that experience a moderate frequency of non-severe frosts[9].

Spotted gum as a plantation timber

Measurements of air-dry density demonstrate that the density of young, plantation grown spotted gum timber is only slightly less than that of mature (forest grown) timber. An average air dry density of 11- and 41-year-old *Corymbia citriodora* subsp. *variegata* has been measured at 87% and 108% of that of mature timber, respectively. For three-year-old trees of *Corymbia citriodora* subsp. *citriodora*, air-dry density was 71% that measured for mature timber[3]. This range is comparable to the range of timber densities found in natural forests. Tests of timber shrinkage also demonstrate similarity between plantation and forest grown timbers[3].

Spotted gum as a pulp species

In South Africa spotted gum is now considered a potential pulp species on the Zululand coast where disease and drought have previously limited forestry development. A pulping study of seven-year old trees indicated that spotted gum has good growth potential and pulp yields, when compared to highly selected *E. grandis* hybrid controls[4]. This finding has been verified in subsequent studies in Australia, indicating that spotted gum has potential as a dual-purpose species for both sawlogs and pulp[5].

Early age growth in plantation spotted gum

Spotted gum has been grown in numerous Hardwoods Queensland field trials, especially in southeast Queensland. The current assessment of early age growth performance and potential productivity for spotted gum is summarised below.

Different provenances (specific geographical areas from which individual seed stocks originate) vary in their growth performance. This is due mainly to the effects of Ramularia Shoot Blight (RSB), a fungal disease that can severely damage trees by killing the growing points. Differential resistance to this disease is the basis for a tree improvement program for this *Corymbia* group. For trees that show tolerance to RSB, good early growth can exceed 4 m per year over the first three years.

Growth of spotted gum over a range of rainfall conditions and on soil types to which it is well adapted.

Site	Mean annual rainfall (mm)	Growth rate
High rainfall area (Tiaro)	1050	4.0 m/yr (10 m height at age 2.5 yrs)
Medium rainfall area (Gatton)	833	3.3 m/yr (10 m height at age 3 yrs)
Low rainfall area (Warwick)	650	2.5 m/yr (5 m height at 2 yrs)

Where is spotted gum expected to reach these growth rates and productivity levels?

Spotted gum is a suitable plantation species in areas of Queensland and northern New South Wales where the mean annual rainfall is between 700 and 1200 mm. Provided local site conditions are favorable and management is appropriate, it can be grown in 9 of the 10 regions defined by the Hardwoods Queensland project (below). Although provenance selection in spotted gum has been made primarily on the basis of superior tolerance to RSB, some of these provenances may also be suitable for lower rainfall regions.

Suitable regions for the development of spotted gum plantations

Hardwoods Queensland Region		Extent	Mean annual rainfall
2	North Qld - Dry tropics	North Qld - Dry tropics	700-1200 mm
3	Mackay coast and hinterland	Mackay coast and hinterland	>1200 mm
4	Central Queensland - Coastal	Rockhampton to Gympie	>900 mm
5	Central Queensland - Inland	Fitzroy/Dawson Valley	600-900 mm
6	Burnett	Burnett South, North and Central	600-900 mm
7	Sunshine Coast	Gympie to Brisbane	>1100 mm
8	Moreton	Lockyer/Brisbane/Logan Valleys	800-1100 mm
9	Downs	Eastern/Darling Downs (inc. Warwick and Dalby)	600-800 mm
10	Northern NSW	Northern/Central coast and New England Tableland	>600 mm

To see the location of Hardwoods Queensland's plantation development regions go to: Regions map.

Choosing appropriate spotted gum species and provenances

"Provenance" in a tree species is the geographical area from which seed is collected. Provenances often grow well outside their natural area of origin. Hardwoods Queenslands' extensive field trials have established that different provenances of spotted gum perform differently in different locations. For example, several provenances are particularly well suited to drier regions. Coupled with the fact that some provenances are genetically more tolerant of specific diseases, the choice of provenance or seed source is a significant consideration in establishing a spotted gum plantation. Sources of spotted gum seed or planting stock are

available from the Department of Primary Industries and Fisheries and some private companies. The appropriate provenance will depend on the location of the plantation. The impact of site conditions on the health and growth performance of different spotted gum provenances is the subject of current Hardwoods Queensland research.

Corymbia citriodora subsp*. variegata*

Provenance	Characteristics
High rainfall, coastal -eg provenances from the Gympie region.	These provenances have the highest level of tolerance to RSB and grow very well on red soils. They may be drought susceptible.
Sub-coastal provenances -eg provenances from west of Gympie in the Burnett region.	Tolerance to RSB is intermediate. Provenances should be well adapted to areas with 700 to1000 mm rainfall.
Inland -eg Carnarvon.	Highly susceptible to RSB. Currently not recommended for plantation establishment.

Corymbia citriodora subsp *citriodora*

Provenance	Characteristics
High rainfall, coastal -eg provenances from the Kirrama and Herbeton regions.	These provenances have a high level of tolerance to RSB although they may be drought susceptible.
Low rainfall, inland -eg Biloela	Moderately to highly susceptible to RSB. Currently not recommended for plantation establishment.

Corymbia henryi

Highly susceptible to RSB. Currently not recommended for plantation establishment.

Seed availability

Seed orchard seed *(C . citriodora* subsp*. variegata)*

Source	Availability
Department of Primary Industries and Fisheries Horticulture and Forestry Science Contact Dr. David Lee, Ph: 07 54820885.	Potentially from 2003-4

Forestry Plantations Queensland Tree Seed Sales	Potentially from 2003-4

Natural stand seed (all species).

Source	Availability
Forestry Plantations Queensland Tree Seed Sales	Now
Australian Tree Seed Centre, CSIRO, Canberra www.ffp.csiro.au/tigr/atscmain.htm	Now
Private seed collectors	Now

Sites best suited to spotted gum

Site conditions can constrain productivity, even within a region with adequate rainfall. Here we present a summary of the soil types for which spotted gum has proven to reach a reasonable level of productivity in a limited time. Note that the relative resistance to diseases and pests will also have an impact on on-site performance.

MAR: mean annual rainfall

Soil type	Ferrosols (eg Krasnozems, refs 12 & 13)	Example of good productivity:	Average height of 10 m in 3 years at Blackbutt (950 mm MAR)

Notes and constraints

These are free-draining, deep soils and generally do not require mounding.

If previously cultivated, these soils are often compacted at depth (plough pan) and need to be deep ripped.

These soils are well-drained and have a low water-holding capacity, so the effects of drought can be severe. It is important to plant hardy nursery stock and to water trees often after planting if dry conditions prevail.

Potential nutritional problems may include acidity (apply lime) and boron deficiency.

Soil type	Kandosols (eg Red & Yellow earths)	Example of good productivity:	Average height of 12 m in 3 years at Tiaro (1050 mmMAR)

Notes and constraints

Use standard techniques[9].

Soil type	Dermosols (eg Prarie soils)	Example of good productivity:	Average height of 5 m in 2 years at Monto (730 mm MAR)

Notes and constraints

Use standard techniques[9]

Soil type	Chromosols (eg Red & Yellow Podzolics) and some Sodosols (eg Soloths & Solodized Solonetz)	Example of good productivity:	Average height of 7 m in years at Gatton (800 mm MAR)

Notes and constraints

Deep ripping and mounding is highly recommended to improve drainage and root penetration in heavy clay sub-soils.

Avoid planting spotted gum in the following site conditions:

Soil type and/or condition	Comments
Poorly-drained sites	Extended waterlogging will result in a large reduction in growth and moderate mortality.
Frosty sites	Although mildly frost tolerant, spotted gum will suffer high mortality in heavy frost areas. While provenances from western Queensland are the most frost-tolerant, they are also more susceptible to RSB.
Vertosols (eg Black Earths and Grey Clays)	The surface roots of spotted gum do not appear to tolerate the regular cracking characteristics of this soil type.

Spotted gum silviculture - managing plantations for high value timber

Successful plantation establishment and management depends on appropriate site preparation and stocking rate, early and maintained weed management, early fertiliser treatment and appropriate pruning and thinning practices. General advice about good silvicultural practices for producing spotted gum solid wood products is given on the Hardwoods Queensland website[9] Managing hardwood plantations.

Managing site limitations

Some site conditions may compromise plantation productivity. In such cases, management practices can ameliorate site conditions such as difficult soil types, multiple frosts, drought at

planting or inappropriate planting time and vertebrate browsing. Suggested management of these site limitations can be found on the Hardwoods Queensland website[9] Managing hardwood plantations.

Diseases affecting growth of spotted gum

Ramularia Shoot Blight. Spotted gum is susceptible to Ramularia Shoot Blight (RSB), which is a fungal pathogen that damages young shoots, often resulting in the loss of the affected leader or side branches. For more information about this disease, see the DPI&F Note: Shoot blight of spotted gums in Queensland[6].

Extensive testing of several provenances of spotted gum has shown that some are highly tolerant to RSB over a range of site conditions. Also, tolerance of provenances to RSB varies between planting locations. Early research results have provided greater confidence regarding the decision-making process in the establishment of spotted gum plantations. The best resistance to RSB has been found in provenances of *C. citriodora* subsp. *variegata* from the Gympie region. Field trials on Red Ferrosol soils in the Central Burnett region (Hardwoods Queensland Region 6) demonstrate that at age three years Gympie provenances of *C. citriodora* subsp. *variegata* can attain 80% greater diameter and 66% greater height than more susceptible provenances.

Pests - Insects affecting growth of spotted gum

Erinose mite (*Rhombacus* sp. Acarina: Eriophyidae). Sporadic outbreaks of this mite were observed in young spotted gum plantations (usually less than 18 months old) in the early summers of 1999/00 and 2001/02.

The mites are microscopic but produce highly visible blisters on the leaves. These blisters gradually become necrotic and the trees eventually drop badly affected leaves. Up to 90% of foliage can be affected on some trees.

Spotted gum leaves showing blisters caused by erinose mite.

Symptoms are most obvious from October/November to January/February. Dry conditions appear to promote the growth of mite populations. Trees usually recover, but early seasonal growth may be severely affected. Early research results indicate that there may be some differences in susceptibility between spotted gum provenances.

Management practices that promote vigorous growth, such as appropriate site selection, good weed control and fertilisation, will help to minimise the effects of this pest. However, unpredictable environmental factors, such as long dry periods, may be more important in promoting a population increase of the mite while decreasing the ability of the tree to outgrow its effects. Chemical spraying is not advised unless the infestation is severe and new growth is being affected consistently . Products containing dimethoate (400 g/L) are registered for use against erinose mite in eucalypt/*Corymbia* plantations in Queensland but these products have not yet been tested specifically in spotted gum plantations, so recommendations can not yet be made. However, it is the user's responsibility to ensure that registered agricultural chemicals are used in accordance with legal requirements. *Always read the label*. (Note: This information was correct at the time of publication). For some information about the assessment of damgae in one spotted gum trial, see Research Update 504.

Swarming scarabs (*Automolus* species). These small beetles attack young plantations in swarms during late spring to early summer, particularly following rainfall. The beetles feed on the growing tips and can have severe effects tree growth and form early in the growing season. Severe attack on very young seedlings can result in tree death. Plantations established on ex-pasture sites and/or are close to significant areas of pasture are most at risk. This is because the beetle larval stages live in the soil and feed on grass roots and soil organic matter. See the DPI&F Note: Swarming Scarab beetles [7] for more information on the biology and management of these pests.

Christmas beetles (*Anoplognathus porosus*, *A. boisduvali*). These large beetles attack young plantations in early to mid- summer, usually following rainfall. Spotted gums are moderately susceptible to attack by Christmas beetles. They are voracious feeders and can defoliate trees quickly if numbers are high. Leaves fed on by these beetles have a characteristic jagged edge with the beetles not feeding on either the midribs or leaf margins. As with swarming scarabs, plantations that are established on or near ex-pasture sites are most at risk because the beetle larval stages live in the soil. See the DPI&F Note: Christmas beetles [8] for more information on the biology and management of these pests.

Pests - Insects affecting timber quality

Longicorn beetles (*Phoracantha solida, P. mastersi*). Spotted gums generally show high levels of resistance to stem borers, although there are two species of longicorn beetle that can cause damage.

1. Young trees. The two-hole longicorn (*Phoracantha solida*) has attacked young spotted gums at a low incidence (range 0-9.5%) in some trial plantations.Current attack can be recognised by the cracking and swelling of bark associated with kino (resin) bleeds. 'Air' holes in the affected area indicate the presence of larger larvae. The bark around the affected area is shed exposing the sapwood and one or more oval-shaped holes that are formed when larvae tunnel into the heartwood to pupate. Holes not plugged with frass indicate that adults have already emerged.

The incidence of attack by these borers can increase if the trees become stressed due to drought, poor site selection or poor plantation management. Minimising the effects of these insects can best be achieved by promoting tree vigour through good site matching, fertilisation and thinning practices. Pruning, ideally, should be conducted during the winter months when these insects are inactive.

Bark cracking and resinosis associated with longicorn attack.

2. Older trees may be susceptible to attack by the ringbarking longicorn,(*Phoracantha mastersi*). This species has caused considerable death of spotted gums in native forest in the Dalby area (Hardwoods Queensland Region 9). However, to date, it has not been observed attacking trees in any research trial plantations in the State. Management practices that will minimise its impact are as for *P. solida*, above.

References

[1] Hill, K.D. and Johnson, L.A.S. (1995). Systematic studies in the eucalypts. 7. A revision of the bloodwoods, genus *Corymbia* (Myrtaceae). Telopea 6: 185-504.

[2] McDonald, M.W. and Bean, A.R. (2000). A new combination in *Corymbia* 'section Politaria': *C. citriodora* subsp. *variegata* (Myrtaceae). Austrobaileya 5(4): 735-736.

[3] Spotted gum. Revised timber species series. DPI&F.

[4] Gardner, R.A. (2000). Alternative species for Zululand: Seven year results of site:species interaction trials in the region. In Forest Genetics for the Next Millenium; IUFRO working Party 2.08.01: Tropical Species Breeding and Genetic Resources, Durban, South Africa, pp.118-126.

[5] Hicks C.C. and Clark, B. (2001). Pulpwood quality of 13 eucalypt species with potential for farm forestry. RIRDC/ Land & Water Australia/ FWPRDC Joint Venture Agro-forestry Program.

[6] Ivory, M.H., Pegg, G.S. and Brown, B.N. (2002). Shoot blight of spotted gums in Queensland. DPI&F Note For0049 . DPI&F.

[7] Lawson, S. (2002). Swarming scarab beetles. DPI&F Note For0048 DPI&F.

[8] Lawson, S. (2002). Christmas beetles. DPI&F Note For0047 DPI&F.

[9] The Hardwoods Queensland website provides information, publications and advice about growing hardwood species, their timber properties and uses.

[10] Kynaston, W.T. (1992). Strength Grouping and Stress Grading of Structural Timber. Timber Note 21. DPI&F.

[12] Isbell, R.F. (1996). The Australian soil classification. CSIRO, Melbourne.

13 Stace, H.T.C., Hubble, G.D., Brewer, R., Northcote, K.H., Sleeman, J.R., Mulchay, M.J. & Hallsworth, E.G. (1969). A Handbook of Australian Soils. Relim. Tech. Pub. Glenside, S.A.

Last updated 13 November 2006

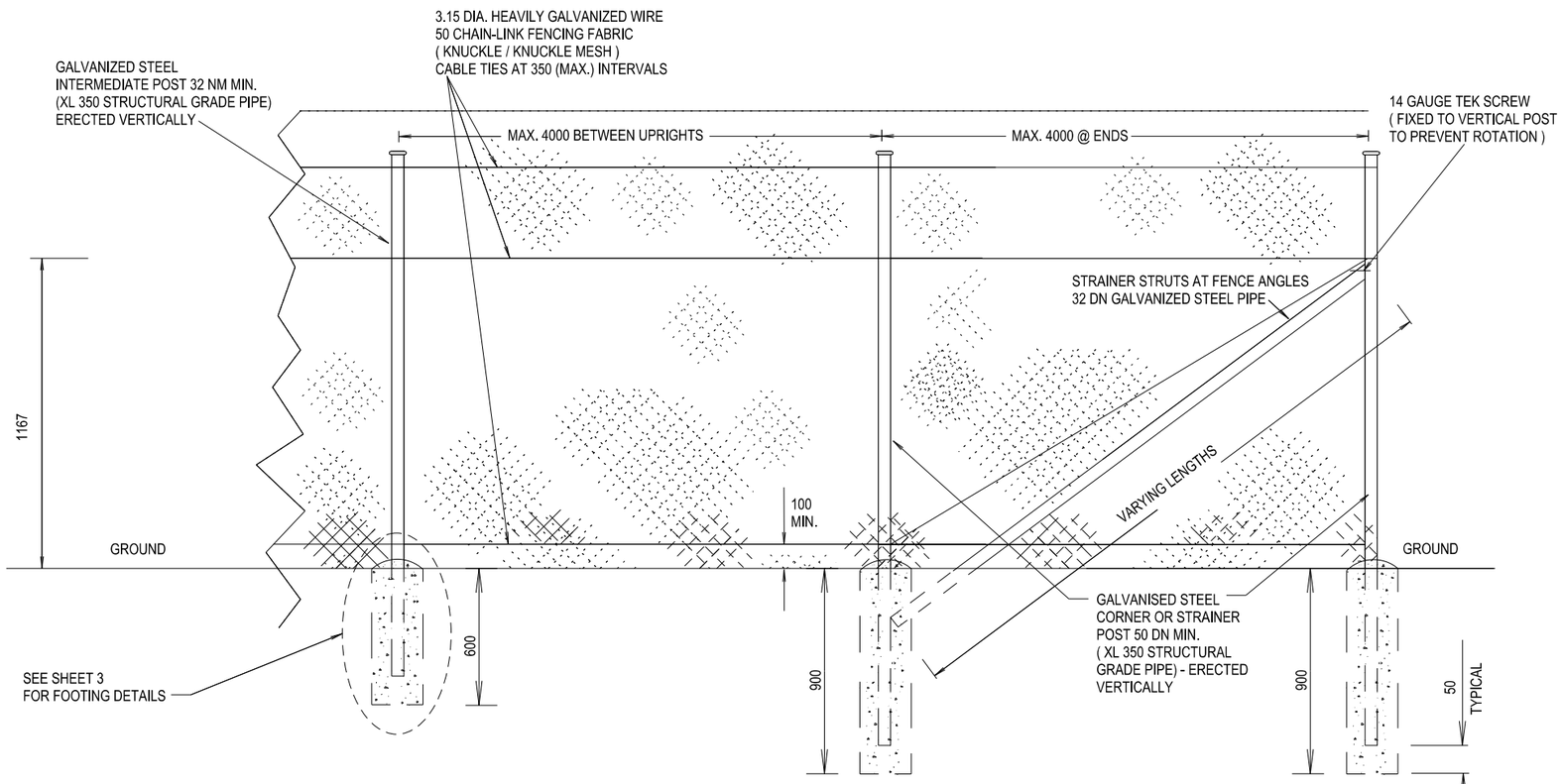
GHD

201 Charlotte Street Brisbane QLD 4000
GPO Box 668 Brisbane QLD 4001
T: (07) 3316 3000 F: (07) 3316 3333 E: bnemail@ghd.com.au

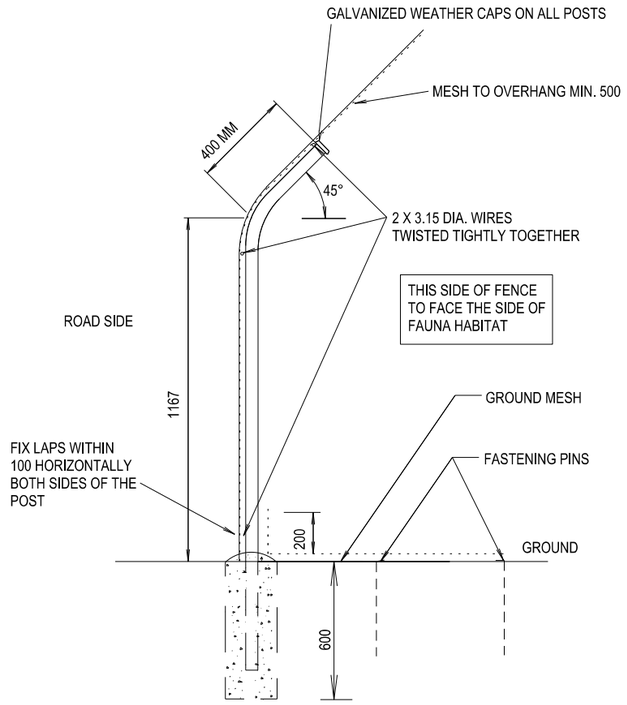
Document Status

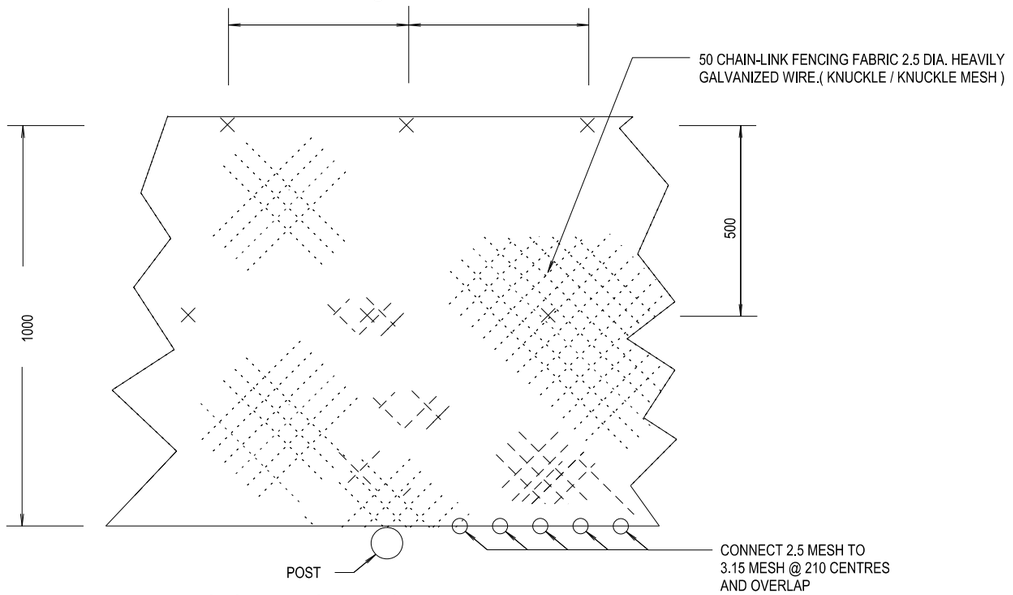
Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	Bradley Wood	Eleas Nicholoau		P. Wootton		24/12/09
B	Bradley Wood	Eleas Nicholoau		P. Wootton		02/02/09

APPENDIX 14: KOALA EXCLUSION FENCING

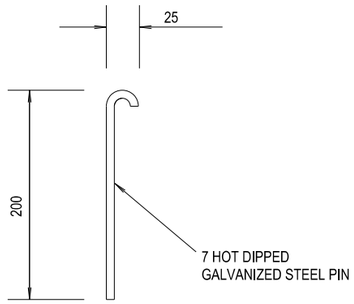


ELEVATION



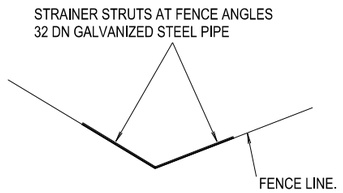


GROUND MESH FIXING DETAIL



FASTENING PIN DETAIL

NOTE:
FOR LOOSE OR SANDY SOILS 350 (MIN.)
GALVANISED FASTENING PINS MUST BE USED.



PLAN OF FENCE ANGLE

NOTE:
MIN INTERNAL ANGLE 135°

NOTES

SPECIAL REQUIREMENTS MAY APPLY TO THE ERECTION PROCEDURES FOR FENCES INSTALLED NEAR HIGH VOLTAGE TRANSMISSION LINES.
THE RELEVANT ELECTRICITY AUTHORITY SHOULD BE CONTACTED PRIOR TO THE INSTALLATION OF THE FENCE.

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN

QR CODE / SCAN TO CHECK DOCUMENT VER.	REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL

SCALES ON A3 SIZE DRAWING

CONTACT DETAILS
SEND FEEDBACK ON THIS STANDARD DRAWING TO :
technologystandards@rms.nsw.gov.au

ISSUED
SFR
MANAGER ROAD POLICY, SPECIFICATIONS & TECHNOLOGY
DATE 20.01.17

NSW GOVERNMENT Transport Roads & Maritime Services

PREPARED BY
ENGINEERING SERVICES
ROAD POLICY, SPECIFICATIONS AND
AND TECHNOLOGY

STANDARD DRAWING

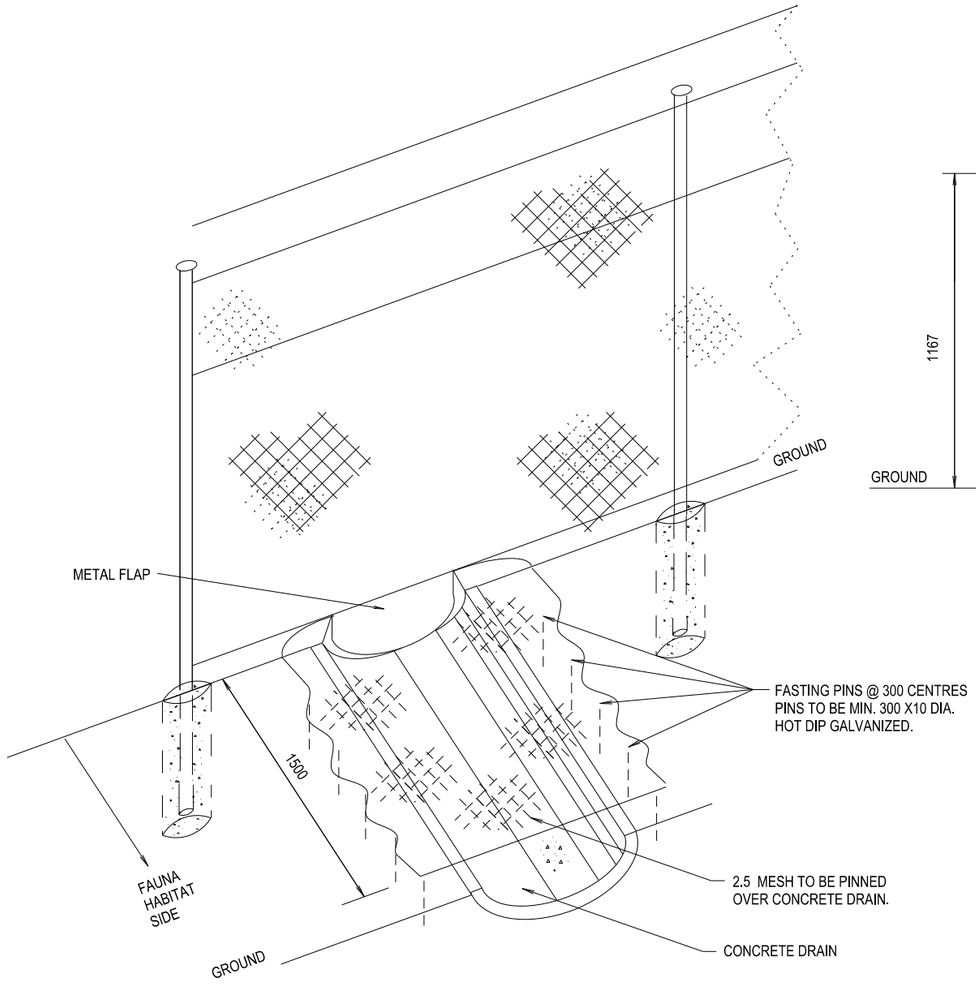
ROAD DESIGN ENGINEERING
R0800 FENCING SERIES
FAUNA EXCLUSION FENCE

A3

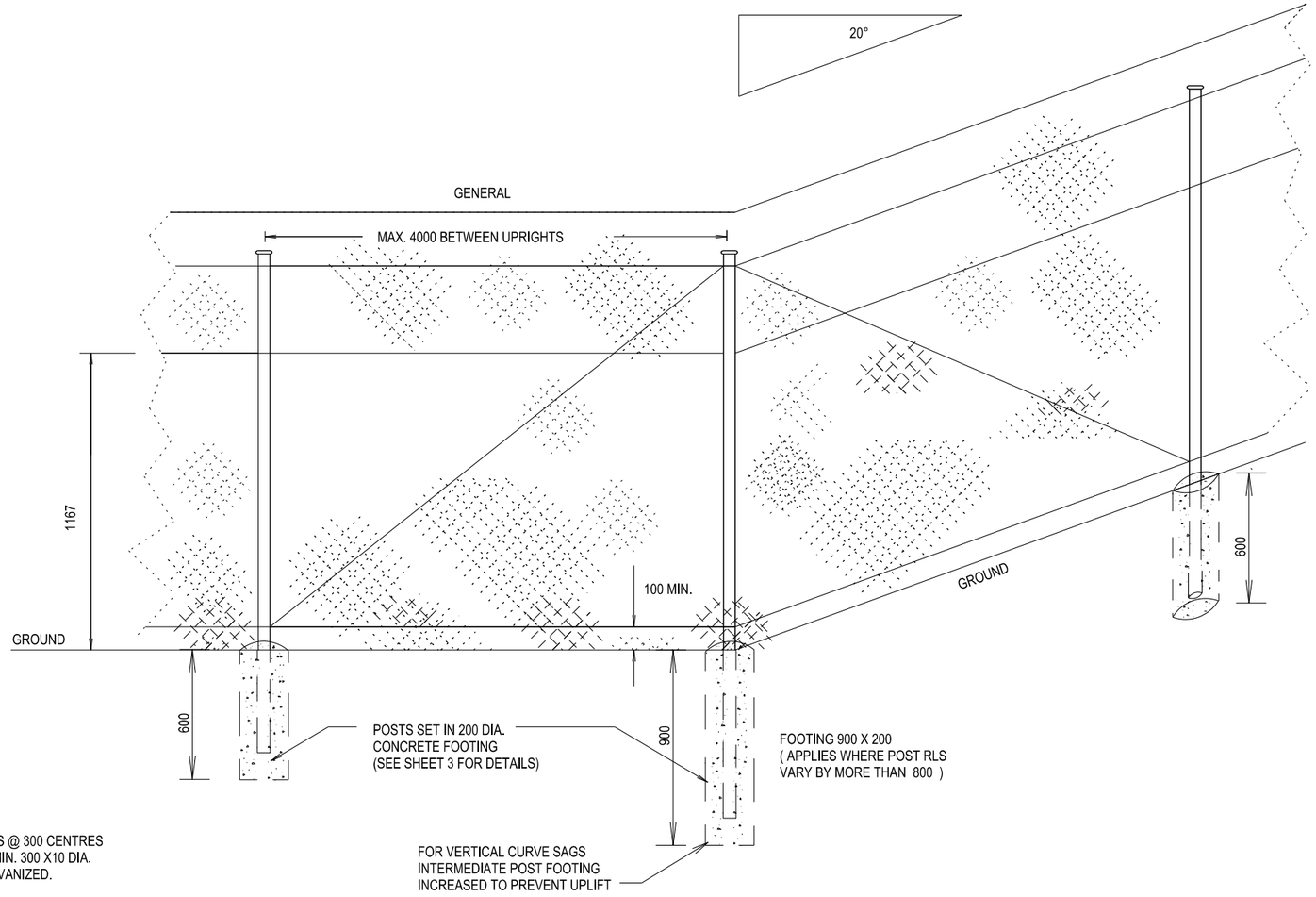
SHEET 1 OF 3

STANDARD DRAWING No.	REV.
R0800-31	-

STATUS	EDMS No.	ORIGINAL ISSUE DATE
ISSUED	DS2014/006018	JANUARY 2017



FAUNA PROTECTION DRAINAGE DETAILS



ELEVATION
INTERMEDIATE POST AT LOW POINT

NOTES

1. AT DRAINAGE LINES AND GATES LIGHT CORROSION - RESISTANT METAL FLAP TO BE INSTALLED WITH LESS THAN 50 GAP.
   FLAP TO BE DESIGNED TO SUIT HYDRAULIC FLOWS AND DRAIN SHAPE IN STORMWATER FLOW PATHS.
   METAL FLAP TO BE CONNECTED TO FENCE ON DOWNSTREAM SIDE OF FENCE.
2. SPECIAL REQUIREMENTS MAY APPLY TO THE ERECTION PROCEDURES FOR FENCES INSTALLED NEAR HIGH VOLTAGE TRANSMISSION LINES. THE RELEVANT ELECTRICITY AUTHORITY SHOULD BE CONTACTED PRIOR TO THE INSTALLATION OF THE FENCE.

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED
0 5 10 15 20 25 30 35 40 45 50mm ON A3 SIZE ORIGINAL

QR CODE / SCAN TO CHECK DOCUMENT VER.		REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN

SCALES ON A3 SIZE DRAWING

CONTACT DETAILS

SEND FEEDBACK ON THIS STANDARD DRAWING TO :
technologystandards@rms.nsw.gov.au

ISSUED
SFR
MANAGER ROAD POLICY, SPECIFICATIONS & TECHNOLOGY
DATE 20.01.17

NSW GOVERNMENT Transport Roads & Maritime Services

PREPARED BY
ENGINEERING SERVICES
ROAD POLICY, SPECIFICATIONS AND AND TECHNOLOGY

STANDARD DRAWING

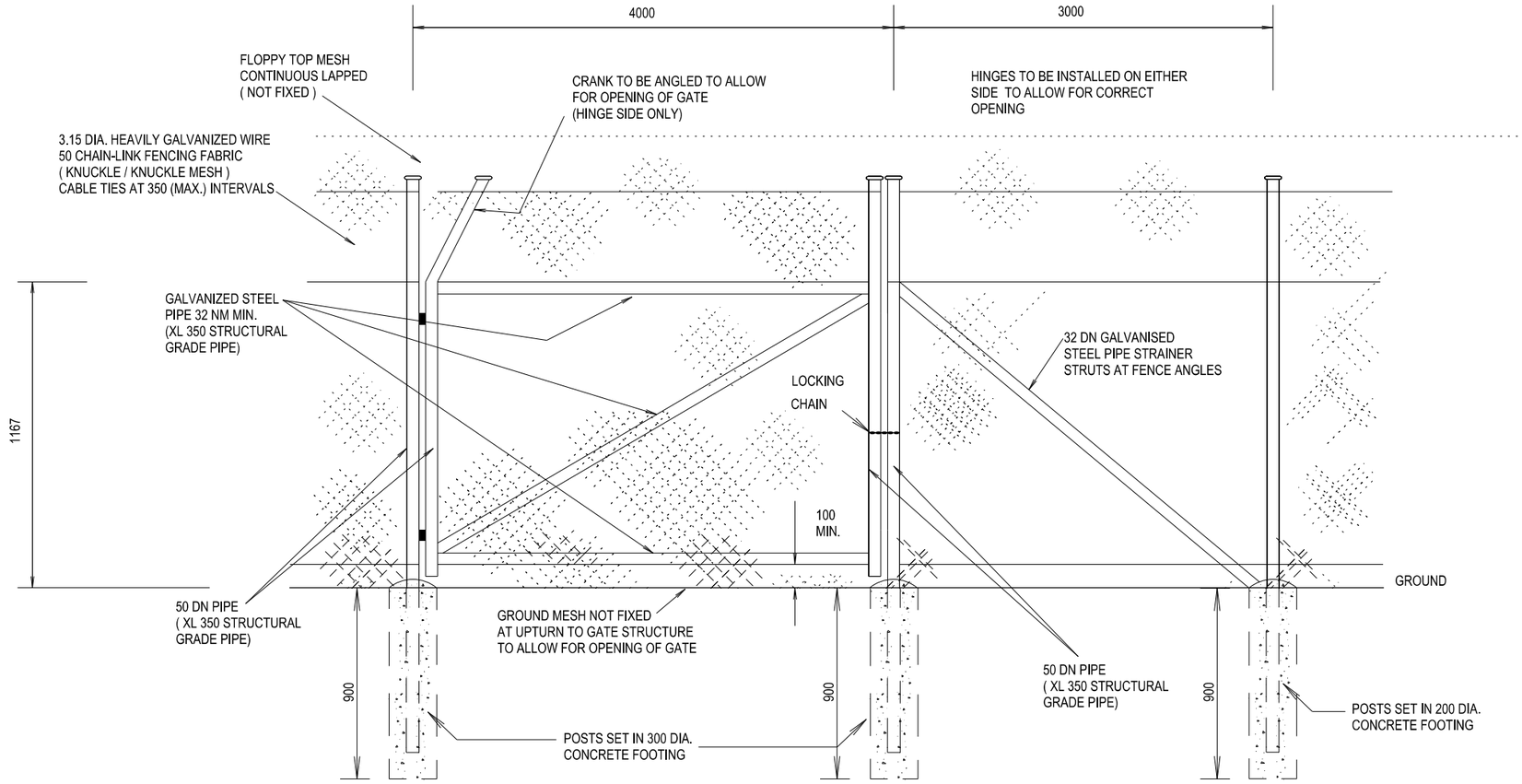
A3

ROAD DESIGN ENGINEERING
R0800 FENCING SERIES
FAUNA EXCLUSION FENCE

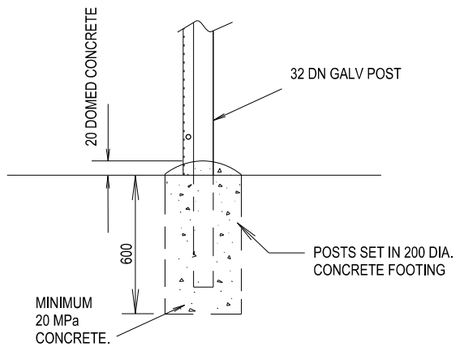
SHEET 2 OF 3

STANDARD DRAWING No. R0800-31 | REV. -

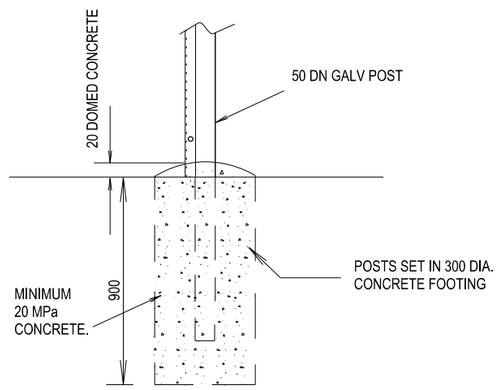
STATUS ISSUED | EDMS No. DS2014/006018 | ORIGINAL ISSUE DATE JANUARY 2017



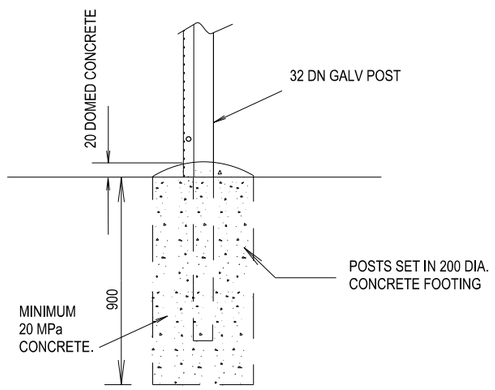
MAINTENANCE GATE DETAILS



INTERMEDIATE POSTS FOOTING DETAILS



STRAINER & CORNER POSTS FOOTING DETAILS



INTERMEDIATE POSTS FOOTING DETAILS AT LOW POINT

NOTES

1. SPECIAL REQUIREMENTS MAY APPLY TO THE ERECTION PROCEDURES FOR FENCES INSTALLED NEAR HIGH VOLTAGE TRANSMISSION LINES. THE RELEVANT ELECTRICITY AUTHORITY SHOULD BE CONTACTED PRIOR TO THE INSTALLATION OF THE FENCE.

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED

50mm ON A3 SIZE ORIGINAL

QR CODE / SCAN TO CHECK DOCUMENT VER.	REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN

SCALES ON A3 SIZE DRAWING

CONTACT DETAILS

SEND FEEDBACK ON THIS STANDARD DRAWING TO :
technologystandards@rms.nsw.gov.au

ISSUED

SFR

MANAGER ROAD POLICY, SPECIFICATIONS & TECHNOLOGY

DATE 20.01.17

NSW GOVERNMENT Transport Roads & Maritime Services

PREPARED BY
ENGINEERING SERVICES
ROAD POLICY, SPECIFICATIONS AND
AND TECHNOLOGY

STANDARD DRAWING

A3

ROAD DESIGN ENGINEERING
R0800 FENCING SERIES
FAUNA EXCLUSION FENCE
WITH GATE

SHEET 3 OF 3

STANDARD DRAWING No. R0800-31

REV. -

STATUS ISSUED

EDMS No. DS2014/006018

ORIGINAL ISSUE DATE JANUARY 2017

APPENDIX 15: WESTLINK POWER PROJECT STORMWATER MANAGEMENT PLAN

CLIENTS | PEOPLE | PERFORMANCE

Westlink

Report for Westlink Post DA Assistance

Stormwater Management Plan

February 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

Figure Index

Appendices

1. Introduction

1.1 The Project

In response to rapidly growing demand for electricity, Westlink Pty Ltd (Westlink) is proposing a staged development of a natural gas-fired power station at a site north of Gatton in South-East Queensland, referred to as the Westlink Power Project (WPP).

The proposed WPP is to be located on a parcel of land near the township of Gatton; approximately 90 km west of Brisbane and approximately two kilometres north of Gatton, immediately north of the Warrego Highway on Fords Rd, Adare.

On the 4th of September 2009, Westlink lodged with the Lockyer Valley Regional Council (LVRC) a Development Application (DA) complete with a detailed Review of Environmental Factors (REF) for the WPP. Specifically, the DA is over Lot 191 on Crown Plan CSH2361 situated in the County of Cavendish, Parish of Lockyer contained in Certificate of Title, Title Reference 17000028 and is seeking a:

- Development Permit for a Material Change of Use (MCU) for the Electricity Generation Infrastructure;
- Development Permit for Environmentally Relevant Activity (ERA) No.14; and
- Development Permit for Operational Work (OW) for Vegetation Clearing.

The proposed use is more specifically defined as a natural gas-fired power station, consisting of the following elements:

- Staged installation of six open-cycle gas turbines;
- An electrical switchyard;
- A gas receiving unit;
- An operations building, workshop, administration building and car park; and
- Associated safety and monitoring equipment.

The proposed WPP is to be built in stages, in line with growing demand for electricity. Subject to development approval, the first stage of the project is expected to consist of 200 to 300 MW of generating capacity, with future expansion leading to a total project comprising up to 1,000 MW of open cycle gas turbines.

1.2 Purpose

The purpose of this Stormwater Management Plan is to provide a response to Lockyer Valley Regional Council (LVRC) and/or the Department of Environment and Resource Management (DERM) with information requested as part of this application process. This Management Plan specifically address request item no. 5 of the LVRC information request outlined in correspondence dated 9 October, 2009.

1.3 Information Requested

The following requests for information in relation to Stormwater Management have been received for the application and are addressed in this report as follows:

DERM Information Request - EPA (Project Reference Number 341117) Item 1(b)

Provide a Stormwater Management Plan in accordance with the DERM information sheet: "Information to be provided with an application for an environmentally relevant activity (ERA)".

Response:

This Stormwater Management Plan has been prepared generally in accordance with the aforementioned factsheet.

LVRC Information Request – Item 4 & 5 Stormwater Management Plan

Provide a preliminary Stormwater Management Plan which addresses the following issues:

1. *Confirmation that peak flow mitigation shall be achieved at all ARI flow events (i.e. Q2. Q10, Q20, Q100) and outline the proposed method of achieving this;*
2. *Outline the proposed method of meeting water quality objectives; and*
3. *Identifies the legal point of discharge for stormwater runoff and demonstration that any flow concentration will not be detrimental to downstream property or public infrastructure.*

Response:

Responses to the above queries are as follows:

1. *ARI peak flow events have been quantified in Section 3.2. Confirmation of how peak flow mitigation can be achieved for this development can be found in Section 3.2 of this report;*
2. *Section 4.4 of this report outlines the way in which this development will meet industry standard quality objectives; and*
3. *Section 3.3 of this report identifies a lawful point of discharge for stormwater runoff and Section 4.4 of this report outlines mitigation measures to achieve water quality which will prevent damage downstream property or public infrastructure.*

2. Review of Previous Work

Previous hydrological investigations were carried out as part of the Review of Environmental Factors (GHD 2009) for the WPP. These were:

- Existing environment – topography and climate;
- Groundwater – hydrogeological and geological environment, site hydrogeology, groundwater quality and aggressivity, groundwater mobility and surface water interaction, and groundwater recharge;
- Hydrology – regional flooding, flow monitoring gauges and regional water quality;
- Stormwater management – stormwater quantity, proposed drainage works and stormwater quality;
- Potential impacts and mitigation measures; and
- Ongoing monitoring

This report will use and build upon the information in the areas of hydrology and stormwater management to fulfil the information request made by LVRC to complete their Development Application. No additional information was sourced for this report.

3. Stormwater Quantity & Attenuation Requirements

The following objectives provide the basis for management of stormwater quantity on the site:

- There is no increase in peak flow rates post-development compared to pre-development peak flow rates;
- Reuse of water on site should be maximised by adopting rainwater tanks with first flush devices; and
- All stormwater that is discharged from the site (except during flood events) should be treated prior to release by filtration and/or infiltration.

Attenuation of peak flow rates can be achieved through the use of structures such as a detention basin. Infiltration trenches can be used to help manage surface runoff volumes.

Reuse of collected roof water can be performed by collecting water in tanks (above or below ground). Uses for this water include, but not limited to, toilet flushing and/or landscaping irrigation.

3.1 Hydrological Modelling

3.1.1 XP-RAFTS

Hydrologic modelling of the catchment was undertaken using the XP-RAFTS rainfall runoff routing model. RAFTS is based on the RSWM model developed by the Snowy Mountains Engineering Corporation (SMEC).

RAFTS is an industry standard rainfall runoff routing analysis package capable of modelling changes in development for both rural and urban sub-catchments.

RAFTS estimates the runoff hydrograph from an individual sub-catchment based on rainfall intensities and temporal patterns, and the definition of a series of parameters that describe the sub-catchment characteristics. These parameters include the sub-catchment area, slope, roughness and fraction of impervious area.

Sub-catchment outflow hydrographs are routed downstream through the model via links. In RAFTS, links take the form of either lag links or routing links. Lag links delay the hydrograph by a user specified time interval representing the time it takes for the flow to travel downstream to the next node. Routing links perform Muskingum-type channel routing calculations and require channel cross sectional dimensions and the slope, roughness and the length of the channel.

3.1.2 Rainfall data

Design Intensity Frequency Duration (IFD) rainfall data used for this study was calculated using methods described in Australian Rainfall and Runoff (AR&R, 1987). This IFD data was used in RAFTS to generate storm patterns for the system analyses. The IFD data is contained in Appendix A.

3.1.3 Design Storm Average Recurrence Intervals (ARI)

A range of ARIs were modelled for the investigation, these being;

- 2 year
- 5 year
- 10 year
- 20 year
- 50 year
- 100 year

Typically a detention basin is designed to a 100 year ARI design event; hence larger events were not modelled.

3.1.4 Design Storm Durations

Due to the size, extents, land use, and catchment slopes within the site, flows were simulated using a range of storm durations from 15 to 360 minutes in order to identify the critical stormwater flows at the outlet of the catchment.

3.1.5 Catchment Delineation

In establishing the hydrologic model for the existing scenario (pre-construction of the WPP), the site was treated as a single catchment. For the developed model (post-construction of the WPP) the site was divided into a number of sub-catchments as indicated in Appendix B. These sub-catchments were based on contour information obtained from a detailed site survey. The outlet of the catchment is in the south-west corner of the property.

3.1.6 Catchment and Hydrological Parameters

The following parameters were used in the RAFTS model.

Table 1 Catchment Parameters

Catchment ID	Area (ha)	Slope (%)	% Impervious[1]
A	8.17	1.80	0
B	0.96	3.37	0
C	8.07	1.00	100[2]

Catchment ID	Area (ha)	Slope (%)	% Impervious[1]
D	6.13	10.48	0
E	1.57	3.03	0
F	5.47	0.66	0

1. 0% impervious is equivalent to 100% pervious.

2. The power station pad has been assumed to be 100% impervious, however in the RAFTS model 70% has been adopted as the percentage impervious. Catchment storage is represented in the RAFTS model as a function of the fraction impervious. The fraction impervious in the model is assumed to be equivalent to 100% urbanised based a study of six catchments used to develop the catchment storage relationship. The RAFTS manual extrapolates the urbanised value to 100% for a 100% impervious area. However, adopting this relationship results in the available catchment storage reducing to approximately 10% of the pre-development storage, which is significantly lower than other similar models such as URBS (where the available catchment storage is reduced by around 25%). It was assumed that adopting 70% fraction impervious for the power station pad was a reasonable representation of catchment storage in this area.

Table 2 lists the adopted loss rates. For the impervious catchment C, an initial loss rate of 0 mm was used for all events.

Table 2 Loss Rates - WPP

Event ARI (years)	Initial Loss (IL) (mm)	Continuing Loss (CL) (mm/h)
2	40	2.5
5	20	2.5
10	10	2.5
20	5	2.5
50	0	2.5
100	0	2.5

A Manning's roughness coefficient (n) of 0.025 has been used for sub-catchments A, B, D, E and F, as this value represents grassed floodplains. For sub-catchment C a coefficient of 0.015 has been adopted. A lower roughness coefficient was chosen for the impervious area to account for the decrease in energy loss caused by the smoother properties of the flow surfaces.

3.2 Hydrological Model Results

3.2.1 Existing Conditions

The model was run for all nominated durations and ARI events mentioned previously. The maximum peak flow from the catchment for the nominated durations analysed are presented in Table 3.

Table 3 Peak Discharges – Existing Conditions

Catchment ID	Peak Discharge @ Outlet (m^3/s)					
	2 year	5 year	10 year	20 year	50 year	100 year
Exist	0.76	3.20	5.35	7.67	9.32	10.73

The critical durations for the above events are given in Table 4.

Table 4 Critical Duration

Design Event ARI (years)	Critical Duration (hr)
2	4.5
5	1
10	1
20	1
50	1
100	1

3.2.2 Developed Conditions

Table 5 contains the results of the developed model.

Table 5 Peak Discharges – Developed Model

Catchment ID	Peak Discharge (m^3/s)					
	2 year	5 year	10 year	20 year	50 year	100 year
A	0	0.91	1.49	2.13	2.57	2.95
B	0	0.19	0.29	0.38	0.43	0.50
C	2.77	3.20	3.60	4.19	4.66	5.26

Catchment ID	Peak Discharge (m³/s)					
	2 year	5 year	10 year	20 year	50 year	100 year
D	0	1.88	3.12	4.33	5.15	5.90
E	0	0.45	0.73	0.98	1.13	1.29
F (outlet)	2.77	4.71	7.56	9.93	11.58	13.25

The critical durations for the above events under developed conditions have remained unchanged from those in Table 4, except for the 2 year ARI design event where it has reduced to a 15 minute event.

3.2.3 Attenuation Requirements

When a comparison is made between the existing and developed peak discharges, it can be seen that the construction of the power station increases the peak discharge from the site. These increases are tabulated in Table 6.

Table 6 Change in Peak Discharge – Existing Vs Developed

Design Event ARI (years)	Change in Peak Discharge (m³/s)
2	+2.01
5	+1.51
10	+2.21
20	+2.26
50	+2.26
100	+2.52

To reduce these developed discharges to equal or less than those pre-development, a detention basin is required to attenuate the developed flows. Preliminary design of the detention basin is based on the following criteria (QUDM 2007):

- The low flow outlet should be designed so that the 5 year ARI design event can easily pass without great restriction;
- The maximum water depth for a 20 year ARI design event shall be equal or less than 1.2 m deep; and
- The spillway should have capacity to pass a 100 year ARI design event, should the low flow outlet become partially or fully blocked.

3.2.4 Developed Conditions with Detention Basin

Preliminary design of a detention basin has yielded the following parameters

- 13 ML (~1.8x85x85 m) basin consisting of:
  - 2x 750 mm diameter reinforced concrete pipe at the invert of the basin
  - A spillway 1 m above the invert, 10 m wide with 10H:1V side slopes
  - A total height of 1.8 m, including 300 mm freeboard

This is a preliminary design and has potential for further refinement in the detailed design stage.

The routing results of the above specified detention basin are given in Table 7.

Table 7 Peak Discharges – Developed Model with Detention Basin

Catchment ID	Peak Discharge (m^3/s)					
	2 year	5 year	10 year	20 year	50 year	100 year
Outlet (D/S of F)	0.23	1.5	2.9	5.3	7.5	9.0

The discharges exiting the basin are less than the existing discharges and displays that the designed basin is acceptable for reducing the developed (increased) discharges from the site.

3.3 Lawful Point of Discharge

The Queensland Urban Drainage Manual (QUDM, 2007) states that a lawful point of discharge exists if the following criteria are not met:

1. That the location of the discharge is under the lawful control of the local government or other statutory authority from whom permission to discharge has been received. This will include park, drainage or road reserve, stormwater drainage easement.
2. That in discharging in that location, the discharge will not cause an actionable nuisance (i.e. a nuisance for which the current or some future neighbouring proprietor may bring an action or claim for damages (arising out of the nuisance). In general terms this implies no worsening as a result of the discharge.

The WPP meets the above criteria and consequently does not have a lawful point of discharge. Runoff from the site drains into a road reserve and into existing stormwater

infrastructure created for that road. In addition it has been shown that using a detention basin will attenuate the flow so that it is no worse than the pre-development discharge.

4. Stormwater Quality Assessment

4.1 Overview

Industrial and urban development increases stormwater pollutant and hydraulic loads primarily due to the increase in impervious areas associated with roads, buildings, car parks and pathways. These surfaces accumulate a range of pollutants during dry periods and transport them rapidly to receiving waters during rainfall events. As a result, there is potential for stormwater pollutant loads to be significantly higher as a consequence of development, which can cause adverse impacts on downstream water bodies and ecosystems unless appropriate mitigation measures are implemented.

Studies suggest that pollutant loads delivered to receiving waters from minor rainfall events (less than the 3 month ARI) constitute in excess of 90% of the average annual volume of stormwater discharge (Wong, 1997 cited in Austroads, 2003). Urban pollutants accumulate during dry weather and are successively washed off by the initial rainfall on urban surfaces. Thus by providing water quality treatment measures for these minor events, a significant portion of the annual load can be captured and treated.

4.2 Stormwater Quality Objectives

As there were no Water Quality Objectives (WQOs) available from LVRC, the following WQOs have been adopted from the Queensland Water Quality Guidelines (QWQG, 2009). Table 8 contains the construction phase objectives and Table 9 contains the post-construction objectives.

Table 8 Construction Phase Design Objectives

Pollutant/Issue	Stormwater Design Objectives
Coarse sediment	Retain coarse sediment onsite
Fine sediment (Total Suspended Solids – TSS)	Take all reasonable and practicable measures to collect all runoff from disturbed areas and drain to a sediment basin—up to the design storm event. Site discharge during sediment basin dewatering complies with a TSS concentration less than 50 mg/L up to the design event—flocculation as required. In storms greater than the design event take all other reasonable and practicable measures to minimize erosion and sediment export.
Turbidity	Released waters from the approved discharge point(s) have turbidity (NTU) less than 10% above receiving waters turbidity - measured immediately upstream of the site.

Pollutant/Issue	Stormwater Design Objectives
Nutrients (N and P)	Manage through sediment control.
pH	Acceptable site discharge pH range 6.5 to 8.5.
Litter or other waste	Prevent litter/waste entering the site or the stormwater system or internal watercourses that discharge from the site—minimise on-site production, contain onsite and regularly clear bins.
Hydrocarbons and other contaminants	Prevent from entering the stormwater system or internal watercourses that discharge from the site - control storage, limit application and contain contaminants at source. Waste containing contaminants must be disposed of at authorised facilities. Store oil and fuel in accordance with Australian Standard AS1940—no visible oil or grease sheen on released waters.
Wash down water	Prevent from entering the stormwater system or internal watercourses that discharge from the site.
Cations and anions	As required under an approved Acid Sulfate Soil Management Plan, including aluminium, iron and sulfate.

For further information regarding construction phase water quality objectives, please refer to Section 5 of the Erosion Management Plan located on Appendix 9 of the Information Request Response Document.

Table 9 Post Construction Phase Design Objectives

Pollutant	Minimum reductions in mean annual loads from unmitigated development (%)
Suspended Solids (TSS)	80
Total Phosphorous	60
Total Nitrogen	45
Gross Pollutants >5 mm	80

4.3 Pollutant Sources

Table 10 outlines the typical pollutants and sources produced by industrial activities.

Table 10 Pollutants of Concern

Pollutant	Roof	Hardstand	Car park / Access
Litter	N	Y	Y
Sediment	N	Y	Y
BOD	N	N	N
Nutrients (N and P)	Y	N	N
Pathogens - faecal coliform	N	N	N
Hydrocarbons (incl. oil and grease)	N	Y	Y
Heavy Metals	N	Y	Y
Surfactants	N	N	N
Organochlorins / organophosphates	N	N	N
Thermal pollution	N	Y	Y
pH altering substances	N	N	N

Therefore the key indicators to be evaluated are:

- Litter;
- Sediments (Suspended Solids);
- Nutrients (Total Nitrogen and Total Phosphorus);
- Hydrocarbons (Oils and greases);
- Heavy Metals; and
- Thermal Pollution..

4.4 Stormwater Quality Treatment Options

The stormwater treatment train (hierarchy of treatment devices) has been selected based on the constraints, opportunities, likely pollutants, and pollutant sources, of the site. The QWQG (2009) state that the objectives outlined in Table 9 are expected to be exceeded by an appropriately sequenced treatment train. The following stormwater treatment devices are proposed for the site:

- Rainwater tanks (or equivalent) with treated first flush devices;
- Solid pollutant filter (in-pit);
- Sand Filters;
- Car park rain gardens/Bio-retention swales;

- Gross pollutant traps.

4.4.1 Rainwater tanks (or equivalent) with first flush treatment

To improve the effectiveness of potential Stormwater Quality Improvement Devices (SQIDs) by reducing their hydraulic load and reduce potable water consumption it is recommended that all roofs be fitted with rainwater tanks. Stormwater collected from the roofs of the buildings can be stored within underground or above ground tanks and reused for toilet flushing and vehicle wash down facilities. These tanks could be located underground to minimise the area required for installation and be designed so that potable water top up would maintain a continuous supply of water when the tank empties. The use of stormwater tanks provide an effective way of diverting “clean” stormwater away from the other SQIDs reducing their hydraulic load and potentially improving their effectiveness to treat stormwater from the more polluted areas of the development.

Rainwater tanks are an excellent first line SQID as well as allowing for water re-use in situations that use water for wash down areas, irrigation and toilet flushing. It is important to firstly treat the first flush from roofed areas to prevent pollutants from entering the tank system and comprising their operation due to clogging and blockage. Diverted first flush water should be treated (sand filter box or equivalent) and subsequently discharged to the main stormwater system.

4.4.2 Solid pollutant filter (in-pit)

The in-pit pollutant filters have the capacity to remove both coarse and fine sediment, and gross pollutants thereby reducing the pollutant loading to the downstream system and should be inserted into each stormwater pit.

4.4.3 Sand Filters

Sand filters operate in a similar manner to bio-retention system with the stormwater runoff passing through filter media.

Typically sand filters consist of three chambers; sedimentation chamber that traps gross pollutants and allows sedimentation. The second chamber is a filter chamber, which removes finer sediments by allowing the stormwater runoff to percolate through a filter media. The third is a discharge chamber, this functions as a bypass system by conveying stormwater runoff to the downstream drainage when the water levels in the sedimentation and sand filter chambers exceed the extended detention depth. The treated runoff from the filter media is collected in the underdrain and discharged to the legal point to the stormwater system. Figure 1 shows a typical cross-section of a sand filter.

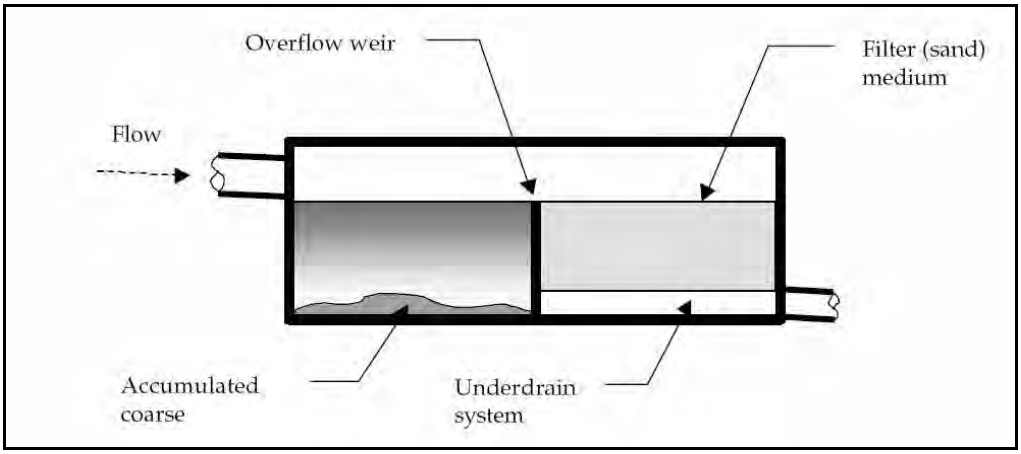


Figure 1 Typical section of a sand filter

Source: Managing Urban Stormwater: Treatment Techniques, November 1997

4.4.4 Car park rain gardens/Bio-retention swales

Bio-retention uses a soil matrix to act as a filter to remove fine and medium sediment and the attached pollutants. The soil matrix also provides a media for the attachment of micro-organisms and plants to assimilate dissolved pollutants such as metals and nutrients. The size of a bio-retention area is normally designed to contain the volume of runoff from the catchment for the 3-month critical storm, which represents over 90% of rainfall events. The volume of stormwater is contained in the soil voids as well as a temporary storage zone above the bio-retention area. Discharges from the bio-retention will be either into the underlying aquifer through the natural sandy soils or through a sub-soil pipe that collects stormwater and conveys it to the stormwater pits.

Infiltration through the bio-retention media is controlled so the residence time of stormwater within the system can be maintained. This can be controlled through either engineering the soil or utilising orifice plates and subsoil lines to collect the filtrate. The infiltration rates should be configured to drain the bio-retention over a period of 24 to 48 hours. The recommended planting within the bio-retention area is either turf or rock and the selection of planting can either delineate the bio-retention area or blend it with

the surrounding verges. The proposed development is to include car park bio-retention swales and a standard pit and pipe drainage system. With the inclusion of breakouts in the car park kerb line, low flows are directed over the surface of the bio-retention area while higher flows are directed to the piped stormwater system. Bio-retention has excellent nutrient removal treatment efficiencies Figure 2 shows a typical cross-section of a Bio-retention device.

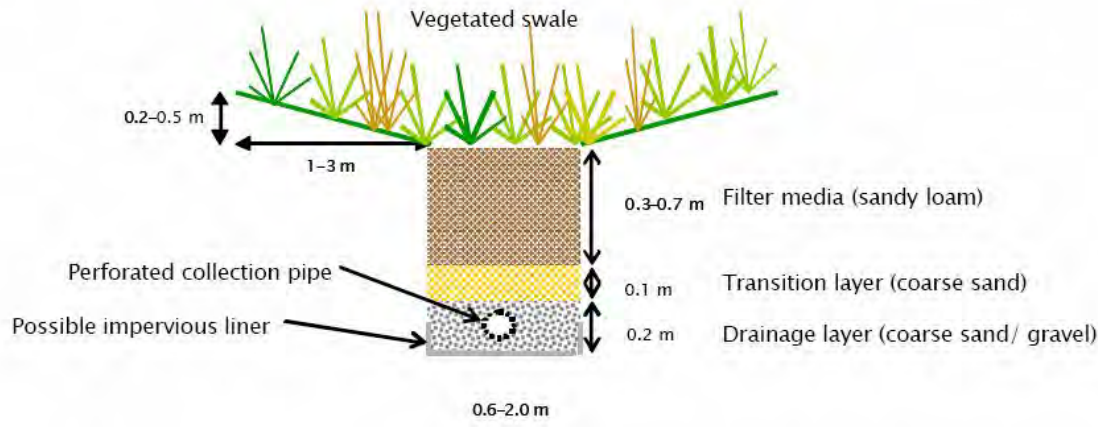


Figure 2 Typical section of a Bio-retention system

Source: Brisbane City Council: Draft Water Sensitive Urban Design Engineering Guidelines, August 2005

4.4.5 Gross pollutant traps

Gross Pollutant Traps (GPT's) remove litter and coarse to medium sediments. Some GPT's can also remove oils and greases.

4.5 Maintenance and Monitoring Requirements

The routine maintenance of the proposed infrastructure is required to minimise the potential for untreated stormwater discharging from the site. Maintenance requirements for the proposed stormwater management of the site are detailed in the following sections.

4.6 Rainwater Stormwater Treatment

Roof water from the development will be discharged into the underground tank fitted with a first flush system. The units should be maintained in accordance with the manufacturer's requirement.

4.7 Bio-retention Swales

Proper maintenance of bio-retention devices is critical in ensuring that filtering capacity of the system will not be reduced. This will be primarily achieved by maintaining complete vegetation covering of the soil throughout the length or area of the system,

and prevent conduct of activities that could compact the soil and limit the infiltration rate of water through it. Other maintenance works will include:

- Watering, replanting and weeding to maintain vegetation cover especially during establishment;
- Removal of litter and debris removal;
- Routine inspection of inlet point, surcharge pits and field inlet pits;
- Routine inspection and repairing any damage to the profile;
- Removal and management of invasive plants;
- Inspection after all storm events to verify that they are working as intended.
- Removal of dead vegetation and replaced with plants of equivalent size and species;
- Checking for channelling or erosion; and
- Monitoring of ponding areas in the filter material.

4.8 Sand Filters

Sand filters must be designed to provide adequate access for inspection and maintenance. To determine the required cleaning frequency, regular filter inspections are necessary to check for signs of blockages. The following maintenance activities might be required for sand filters:

- Routine removal of collected sediments;
- Drying of sediments may be require before disposal;
- Sand filter media may required removal of vegetation;
- The sand filters should be inspected after all storm events to verify that they are working as intended.
- The filter surface could be regularly raked to remove sediment and to break up any crusts; and
- When necessary the top layer of the filter media can be removed and replaced.

Maintenance works will be the responsibility of the property owners and will be undertaken on a regular basis. The maintenance of treatment trains will form part of the developer's maintenance program for the site.

4.9 In-Pit Pollutant Baskets

In-pit pollutant baskets should be checked regularly at initial development stage, as there are higher levels of sediment and litter loads due to significant disturbance and the nature of the site construction. The units should be checked at monthly intervals and immediately after significant rain event. Once the construction phase is completed routine maintenance should be subject to the manufacturer's guidelines. It is important that the in-pit basket unit be maintained accordingly to minimise the incidence of failure

due to debris reducing the effectiveness of the system. Utilising a maintenance log will assist in providing long term maintenance requirements.

4.10 GPTs

The GPTs should be checked regularly at initial development stage, as there are higher levels of sediment and litter loads due to significant disturbance and the nature of the site construction. The unit should be checked at monthly intervals and immediately after significant rain event. Once the construction phase is completed routine maintenance should be subject to the manufacturer's guidelines. It is important that the GPT unit be maintained accordingly to minimise the incidence of failure due to debris reducing the effectiveness of the system. Utilising a maintenance log will assist in providing long term maintenance requirements.

4.11 Maintenance Frequency

The proposed maintenance frequency for the proposed treatment devices is detailed in Table 11. This table is provided as guide and should be updated as more detailed performance information from the site is obtained through the maintenance log.

Table 11 Stormwater Maintenance Frequency

Element	Inspection Frequency	Maintenance Frequency	Maintenance Activities
GPT	Monthly After every major runoff event.	During Inspection or when litter sump is full	Remove captured pollutant and dispose in an appropriate manner.
In-pit baskets	Monthly After every major runoff event.	During Inspection or when litter sump is full	Remove captured pollutant and dispose in an appropriate manner.

Element	Inspection Frequency	Maintenance Frequency	Maintenance Activities
Sand Filters	Monthly After every major runoff event.	During Inspection or when inlet chamber is full	Routine removal of collected sediments; Drying of sediments may be require before disposal; Sand filter media may required removal of vegetation; The sand filters should be inspected after all storm events to verify that they are working as intended. The filter surface could be regularly raked to remove sediment and to break up any crusts; and When necessary the top layer of the filter media can be removed and replaced.
Bio-retention	Monthly After every major runoff event.	Water ponding for over 24 hours after a storm event.	Watering, replanting and weeding to maintain vegetation cover especially during establishment; Removal of litter and debris removal; Routine inspection of inlet point, surcharge pits and field inlet pits; Routine inspection and repairing any damage to the profile; Removal and management of invasive plants; Inspection after all storm events to verify that they are working as intended. Removal of dead vegetation and replaced with plants of equivalent size and species; Checking for channelling or erosion; and Monitoring of ponding areas in the filter material.

4.11.1 Maintenance Record

A record of all maintenance checks for all stormwater controls onsite and should be kept to evolve an appropriate maintenance routine. The maintenance record will also provide verification that maintenance procedures are being carried out and the maintenance report should include details of the following;

- The date of maintenance;
- The name of the persons performing the maintenance;

- Type of maintenance actions performed for each water quality device; and

The state of the device including an estimate of the type and weight of litter removed and the amount of sediment captured where appropriate.

5. Conclusions

5.1 Stormwater Quantity

Using RAFTS rainfall runoff routing software, it has been found that there is an increase in peak discharge from the site as a result of construction of the power station. However this increase can be rectified by using a detention basin to attenuate the flow. Preliminary design parameters of a suitable basin are given in Section 3.2.4. The resulting effect of such a detention basin has shown that the outflow will not be detrimental to downstream properties or infrastructure.

5.2 Stormwater Quality

As a result of the WPP, there will be an increase in pollutants produced at the site from various sources. It is recommended that runoff be treated using a treatment train, including the measures below:

- Rainwater tanks (or equivalent) with treated first flush devices;
- Solid pollutant filter (in-pit);
- Sand Filters;
- Car park rain gardens /Bio-retention swales;
- Gross pollutant traps.

6. References

Department of Natural Resources and Water, *Queensland Urban Drainage Manual* 2007.

Department of Environment and Resource Management, *Queensland Water Quality Guidelines*, 2009.

NSW Environmental Protection Authority, *Managing Urban Stormwater – Treatment techniques*, 1997.

Appendix A

IFD Table

GHD
Client : Westlink Pty Ltd.
Title : Westlink Power Project DA Assistance
Job No : 41-22282

www.ghd.com.au
tbamail@ghd.com
Tel. 07 4633 8000 Fax. 07 46131687

Rainfall Intensity-Frequency-Duration Calculation to AR&R

Program : **IFD.xls**
Version : **3.0**

Data

Location : **Gatton, QLD**

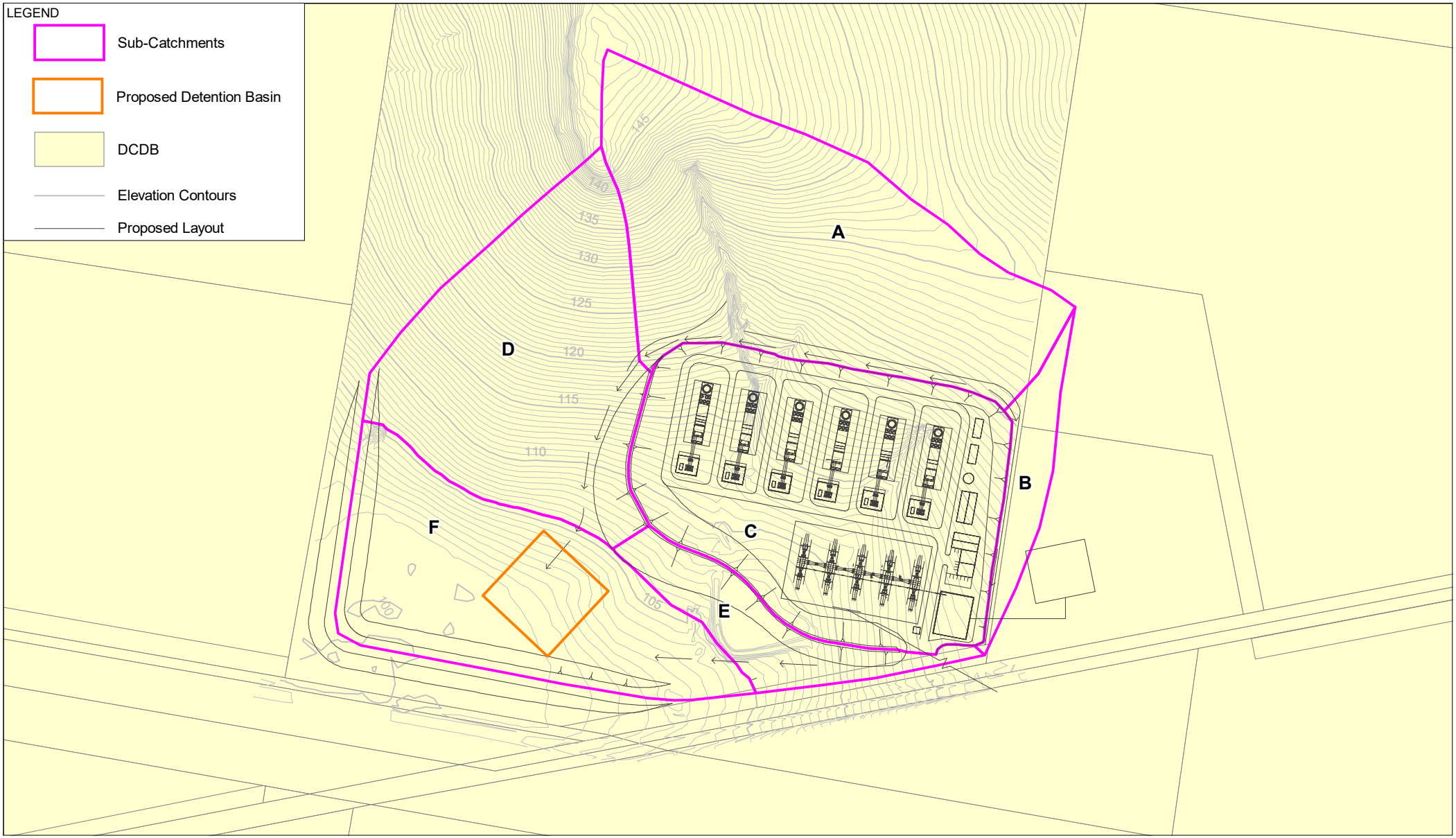
1 HR DUR 2 ARI	41.50	mm/hr
12 HR DUR 2 ARI	6.90	mm/hr
72 HR DUR 2 ARI	1.70	mm/hr
1 HR DUR 50 ARI	76.00	mm/hr
12 HR DUR 50 ARI	12.00	mm/hr
72 HR DUR 50 ARI	3.40	mm/hr
G (skewness)	0.30	mm/hr
F2 Geo factor 2 ARI	4.36	
F50 Geo factor 50 ARI	17.00	

Duration		Design Rainfalls for Average Recurrance Intervals								
(min)	(hr)	1 Year (mm/hr)	2 Years (mm/hr)	5 Years (mm/hr)	10 Years (mm/hr)	20 Years (mm/hr)	50 Years (mm/hr)	100 Years (mm/hr)	200 Years (mm/hr)	500 Years (mm/hr)
5	0.083	101.3	130.5	165.4	187.1	216.8	257.6	289.9	324.0	371.9
6	0.100	95.0	122.5	155.1	175.5	203.4	241.7	272.0	304.0	348.9
7	0.117	89.7	115.7	146.5	165.8	192.1	228.2	256.9	287.1	329.5
8	0.133	85.2	109.9	139.2	157.4	182.5	216.8	244.0	272.7	312.9
9	0.150	81.3	104.8	132.8	150.2	174.1	206.8	232.7	260.1	298.5
10	0.167	77.9	100.4	127.1	143.8	166.7	198.0	222.9	249.1	285.8
11	0.183	74.8	96.4	122.1	138.1	160.1	190.2	214.1	239.2	274.5
12	0.200	72.0	92.9	117.6	133.1	154.2	183.2	206.2	230.4	264.4
13	0.217	69.5	89.6	113.5	128.4	148.8	176.8	199.0	222.4	255.2
14	0.233	67.3	86.7	109.8	124.2	144.0	171.0	192.5	215.1	246.9
15	0.250	65.2	84.0	106.4	120.4	139.5	165.7	186.5	208.4	239.2
16	0.267	63.3	81.5	103.3	116.8	135.4	160.8	181.0	202.3	232.1
17	0.283	61.5	79.3	100.4	113.5	131.6	156.3	175.9	196.6	225.6
18	0.300	59.8	77.1	97.7	110.5	128.1	152.1	171.2	191.3	219.5
20	0.333	56.9	73.3	92.8	105.0	121.7	144.6	162.7	181.8	208.6
25	0.417	50.9	65.6	83.0	93.9	108.9	129.3	145.5	162.6	186.6
30	0.500	46.3	59.7	75.6	85.5	99.1	117.7	132.4	148.0	169.8
35	0.583	42.7	55.0	69.6	78.8	91.3	108.4	122.0	136.3	156.4
40	0.667	39.7	51.2	64.8	73.3	84.9	100.8	113.5	126.8	145.5
45	0.750	37.2	47.9	60.7	68.7	79.6	94.5	106.3	118.8	136.4
50	0.833	35.1	45.2	57.2	64.7	75.0	89.1	100.3	112.1	128.6
55	0.917	33.2	42.8	54.2	61.4	71.1	84.4	95.0	106.2	121.8
60	1.00	31.6	40.8	51.6	58.4	67.7	80.4	90.4	101.1	115.9
75	1.25	27.1	34.9	44.1	49.8	57.7	68.4	76.9	85.9	98.5
90	1.5	23.8	30.7	38.7	43.7	50.5	59.9	67.3	75.1	86.1
120	2	19.4	24.9	31.4	35.4	40.9	48.4	54.4	60.6	69.3
180	3	14.5	18.6	23.3	26.2	30.3	35.7	40.1	44.6	51.0
240	4	11.8	15.1	18.9	21.2	24.4	28.8	32.2	35.9	40.9
300	5	10.0	12.8	16.0	17.9	20.7	24.3	27.2	30.3	34.5
360	6	8.8	11.2	14.0	15.7	18.0	21.2	23.7	26.4	30.1
480	8	7.1	9.1	11.3	12.7	14.6	17.1	19.1	21.2	24.2
540	9	6.5	8.4	10.4	11.6	13.3	15.7	17.5	19.4	22.1
600	10	6.1	7.7	9.6	10.7	12.3	14.5	16.2	17.9	20.4
720	12	5.3	6.8	8.4	9.4	10.8	12.6	14.1	15.6	17.8
810	13.5	4.9	6.2	7.7	8.7	10.0	11.7	13.1	14.5	16.5
900	15	4.5	5.8	7.2	8.1	9.3	10.9	12.2	13.6	15.5
1,080	18	3.9	5.0	6.3	7.1	8.2	9.7	10.9	12.1	13.8
1,440	24	3.2	4.1	5.1	5.8	6.7	8.0	9.0	10.1	11.5
2,160	36	2.3	3.0	3.8	4.3	5.1	6.1	6.9	7.7	8.9
2,880	48	1.8	2.4	3.1	3.5	4.1	4.9	5.6	6.3	7.3
4,320	72	1.3	1.7	2.2	2.5	3.0	3.6	4.1	4.7	5.5

Note: Values for 200 and 500 yearARI are approximate only and does not conform to Book 6 of AR&R (1999)

Appendix B

Catchment Map



1:5,000

0 50 100

metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 56

O

Westlink Pty Ltd.
Westlink Power Project

Job Number 41-22282
Revision A
Date 18 Dec 2009

Catchment Delineation

Figure 1

\41\22282\GIS\Maps\Deliverables\22282-01-01.wor

Suite 4, 1-3 Annand Street Toowoomba QLD 4350 Australia T 61 7 4633 8000 F 61 7 4613 1687 E tbamail@ghd.com.au W www.ghd.com.au

GHD

1-3 Annand Street Toowoomba QLD 4350 Australia
PO Box 1642 Toowoomba Qld 4350 Australia
T: (07) 4633 8000 F: (07) 4613 1687 E: tbamail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	P. Muir	A. Hallgarth		P. Wootton		24/01/09
B	P. Muir	A. Hallgarth		P. Wootton		29/01/10

APPENDIX 16: STAGE 1 CONCEPT DESIGN, SITE GENERAL ARRANGEMENT

154-2-CI-DWG-0004

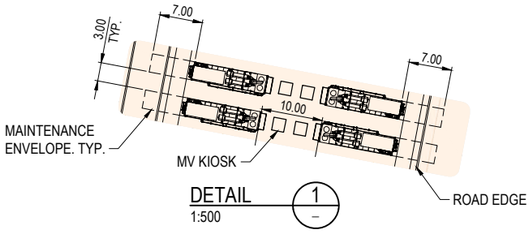
NORTH

LEGEND

- STAGE 1 EARTHWORKS
- STAGE 2 EARTHWORKS
- EXISTING ROAD EDGE
- EXISTING ELECTRICAL
- EXISTING FENCE
- CLEAN WATER
- PLANT AREA DRAINAGE
- UNDERGROUND CABLE CORRIDOR

NOTES

1. PROPOSED STABILISATION WORKS TO EXISTING GULLIES AND DAM TO BE INVESTIGATED DURING DETAILED DESIGN PHASE.
2. DRAIN EROSION PROTECTION ADJACENT TO EXISTING DWELLING, SUBJECT TO DETAILED DESIGN.
3. DETAIL OF NORTH BATTER OF PLANT AREA DRAIN SUBJECT TO DETAILED DESIGN.
4. CONSTRUCTION RAMPS AND EROSION CONTROL MEASURES FOR EARTH VISUAL SCREENING BUND TO BE CONSIDERED IN DETAILED DESIGN.
5. CUT AND EARTH BUND BATTER SLOPES SUBJECT TO GEOTECHNICAL ASSESSMENT DURING DETAILED DESIGN.
6. 2MW SIEMENS GAS ENGINES (52 OFF).
7. TESLA MEGAPACKS (44 OFF).



DETAIL 1 — 1:500

EXISTING GULLIES TO BE MAINTAINED. REFER NOTE 1.

A CI-DWG-0005

PROTECTED VEGETATION AREA. EXISTING TREES TO REMAIN

PROVIDE EROSION PROTECTION. REFER NOTE 2.

EXIST. SHED

EXIST. DWELLING/

EXIST. DAM

REFER NOTE 7

REFER NOTE 6

REFER NOTE 3

BIO-RETENTION AREA

EVAPORATION POND

SWITCHYARD AREA

CAR PARK

ROCK RETAINING WALL (SANDSTONE OR SIMILAR) WHERE BATTER IS STEEPER THAN 1 IN 2. SUBJECT TO DETAILED DESIGN

STORMWATER DETENTION BASIN

EARTH BUND REFER NOTE 4

EXISTING TREES TO REMAIN

EARTH BUND

LOCALLY STEEPEN BATTER SLOPES FROM 1 IN 3 UP TO 1 IN 2.5 TO PROVIDE CLEARANCE TO TREES. FINAL BATTER SLOPES SUBJECT TO DETAILED DESIGN

GAS EASEMENT BOUNDARY

EXIST. SWAMP

NEW PLANTING TO EARTH BUND FOR SCREENING.

C CI-DWG-0005

EXISTING TREES TO REMAIN

ROCK RETAINING WALL (SANDSTONE OR SIMILAR) OR LOCALISED BUND FINAL BATTER SLOPE SUBJECT TO DETAILED DESIGN

NEW PLANTING TO EARTH BUND FOR SCREENING.

CAR PARK AND BUND EARTHWORKS AVOID GAS EASEMENT BOUNDARY

GAS EASEMENT BOUNDARY

WARREGO HIGHWAY

FORDS ROAD

B CI-DWG-0005

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DATE	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	REFERENCE DRAWINGS
A	18.11.20	ISSUED FOR REVIEW	GS	PW	PB	
B	25.11.20	ISSUED FOR USE	GS	SS	PB	
C	22.01.21	ISSUED FOR INFORMATION	HL	PW		

SCALES

0 10 20 40 60
Full Size 1:1000 ; Half Reduction 1:2000
SCALE (m)

H DATUM	V DATUM
MGA 56	AHD

CLIENT

LOCKYER ENERGY PROJECT

PHRONIS
© Phronis Consulting Pty Ltd.
Level 5, Building 2, 50 McDougall St, Milton, Qld 4064
T. +61 7 3506 1100 | F. +61 7 3229 8177 | www.phronis.com.au

PROJECT NUMBER	PROJECT NAME
154-2	LOCKYER ENERGY PROJECT

TITLE

DESIGNED	P.WHITTLE
DRAWN	G.SMITH
CHECKED	P.WHITTLE

STAGE 1 CONCEPT DESIGN
SITE GENERAL ARRANGEMENT
52 x 2 MW GAS ENGINES AND 44 x 1.25 MW BATTERIES

APPROVED	#	DATE	SHEET SIZE	DRAWING NUMBER	REVISION
			A1	154-2-CI-DWG-0004	C

APPENDIX 17: CULTURAL HERITAGE ASSESSMENT

FORDS ROAD, GATTON QLD

DUTY OF CARE

CULTURAL HERITAGE ASSESSMENT

EVERICK HERITAGE CONSULTANTS

FEBRUARY 2018
PREPARED FOR LOCKYER ENERGY

Report Reference: Love, S., T. Robins and R. Mazlin 2017. *Lockyer Energy Gatton: Cultural Heritage Duty of Care Assessment* (February 2018). Everick Heritage Consultants Pty Ltd. Unpublished report prepared for Lockyer Energy.

EVERICK HERITAGE CONSULTANTS PTY LTD

ABN: 78 102 206 682
Level 9, 100 Mary Street
BRISBANE, QLD 4000
T: (07) 3211 4478 E: info@everick.com.au

Document Status:

Rev No.	Version	Author(s)	Amended Sections	Date	Authorised
1	Draft	S. Love and R. Mazlin	All	17.08.2017	T. Robins
2	Corrections	S. Love	Recommendations	22.08.2017	T. Robins
3	Final	S. Love	None	24.08.2017	T. Robins
4	Revision	R. Mazlin	All	02.02.2018	T. Robins
5	Final	S. Love	None	05.02.2018	T. Robins

EXECUTIVE SUMMARY

Everick Heritage Consultants (the 'Consultant') were commissioned by Lockyer Energy (the 'Proponent') to undertake a Duty of Care Assessment of lands for a proposed natural gas facility on part of Lot 191 CSH2361 in Gatton, QLD (Figure 1). This report presents the results of a desktop assessment of the Project Area conducted for the purposes of ensuring the Proponent meets their Duty of Care statutory requirements for Aboriginal cultural heritage.

The Proponent has commissioned this Duty of Care Assessment in order to assist in meeting their cultural heritage Duty of Care obligations under the *Aboriginal Cultural Heritage Act 2003* (Qld) ('ACHA') ahead of proposed development on part of the site.

As part of a desktop study, Everick undertook searches of the relevant heritage registers. A search conducted on 09 June 2017 of the DATSIP database revealed no registered Aboriginal sites within the Project Area or within a 1000 m buffer zone (Ref.22641, Appendix A). There were also no listed Designated Landscape Areas or Registered Study Cultural Heritage Areas for the Project Area.

A search conducted on 09 June 2017 of the Native Title Register found that a Native Title Claim was lodged by the Jagera People #2 (QC2003/015 PRC) over the Project Area. An updated search conducted on 02 February 2018 of the Native Title Register found that a Native Title Claim was lodged by the Yuggera Ugarapul People (QC2017/005) over the Project Area. This represents a new Native Title claimant over the region. As this is freehold land, the Native Title has been extinguished. There is no cultural heritage body for the Project Area.

Results:

The following conclusions can be made from the results of the desktop study and field inspection:

- The Project Footprint has seen significant ground disturbance within the meaning of Category 4 of the Duty of Care Guidelines. The modification of this area was through extensive clearing and construction activities. These activities have removed any reasonable potential for archaeologically significant deposits to be located within the Project Footprint. The area has low potential for buried archaeological deposits and the Project Activities will not cause further harm to Aboriginal cultural heritage. The application of the ACHA Duty of Care Guidelines, the project would fall under Category 4, meaning the works can proceed with caution.
- Three (3) Aboriginal objects were identified during the survey:
    - One (1) piece of culturally modified glass was found on the surface.

- One (1) coarse silcrete core was identified just outside the Project Footprint and will not be impacted by the Project.
- One (1) chert core was identified in association with an ephemeral waterway. These areas have reasonable potential for residual cultural values.

- Two (2) potential scar trees were identified along the western side, outside the Project Footprint.
- The elevated knoll central to the Project Area could be defined as a landscape feature consistent with paragraph 6.2 of the DoC Guidelines. However, this area is not being impacted by the Project. There are no other landscape features within the meaning of Duty of Care paragraph 6.2 within the Project Area.
- Consultation with Jagera People #2/ Yuggera Ugarapul People was outside the scope of this assessment. It is noted that there are no Significant Aboriginal Areas registered on the DATSIP database or in the ethnographic literature within the Project Area. No areas of high intangible heritage significance were identified that are likely to be impacted by the Project.

The recommendations listed below have been formulated from the results of the desktop assessment and the field inspection that relate specifically to the Project Footprint, as illustrated in Figure 1. The Consultant is of the opinion that given the significant ground disturbance recorded within the Project Footprint, the proposed works are unlikely to result in additional harm to Aboriginal heritage. The following recommendations are cautionary.

Recommendation 1: Avoidance of Recorded Sites

It is recommended that the Proponent ensures that the three (3) isolated artefacts and two (2) potential scar trees (Figure 14) are not subject to inadvertent harm during construction works. Each should be fenced or flagged as appropriate, and marked on relevant construction plans as 'no go' areas.

Recommendation 2: Aboriginal Objects Find Procedure

It is recommended that if it is suspected that Aboriginal material has been uncovered as a result of development activities within the Project Area:

a) work in the surrounding area is to stop immediately;

b) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

c) the current Aboriginal Party (presently Jagera People #2) should be engaged to identify the find, assisted by an appropriately qualified archaeological consultant if reasonably required; and

d) if the material is found to be of Aboriginal origin, the Aboriginal Party for the region, being Jagera People #2, should be consulted over the management of the find. Any management agreement should be clearly documented in writing signed by both parties.

Recommendation 3: Aboriginal Human Remains

Although it is highly unlikely that Human Remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station (Gatton) and DATSIP are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal Party for the region, being Jagera People #2, should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal People rather than scientific specimens.

DEFINITIONS

Aboriginal Cultural Heritage means the same as described in the *Aboriginal Cultural Heritage Act 2003* (ACHA). Namely, that it is a significant Aboriginal area, or a significant aboriginal object, or evidence, of archaeological or historic significance, of Aboriginal occupation of an area of Queensland.

Aboriginal Object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises Queensland, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Aboriginal Place means any place declared to be an Aboriginal Place (under the Aboriginal Cultural Heritage Act 2003) or as gazetted by The Minister or a representative of The Minister. It may or may not contain Aboriginal Objects.

ACHA means the *Aboriginal Cultural Heritage Act 2003 (Qld)*.

The Consultant means qualified archaeological staff of Everick Heritage Consultants Pty Ltd.

DATSIP means the Queensland Department of Aboriginal and Torres Strait Islander Partnerships.

Development means the proposed natural gas facility in Figure 1

Duty of Care (DoC) means the Aboriginal Cultural Heritage Duty of Care, as defined in s.23 of the ACHA.

DoC Guidelines means the guidelines established under s.1.1, 1.2 and s.28 of the ACHA.

The Project means future Proposed Works, including ground surface disturbance within the boundaries of the Project Area.

Project Area means Lot 191 CSH2361, Fords Road Gatton, QLD (Figure 1).

Significant Aboriginal Area means an area of particular significance to the Aboriginal parties as defined under the *Aboriginal Cultural Heritage Act 2003* (Qld).

CONTENTS

FIGURES

1. INTRODUCTION

1.1 Scope of this Assessment

Everick Heritage Consultants (the 'Consultant') were commissioned by Lockyer Energy (the 'Proponent') to undertake a Duty of Care Assessment of lands for a proposed natural gas facility on part of Lot 191 CHS2361 in Gatton, QLD (Figure 1). This report presents the results of a desktop assessment of the Project Area conducted for the purposes of ensuring the Proponent meets their Duty of Care statutory requirements for Aboriginal cultural heritage.

1.2 Assessment Methodology

This report is designed to provide the Proponent with the appropriate information to implement suitable management strategies and compliance regarding Aboriginal cultural heritage values during the development stages of the Project. The methods used for this assessment are in compliance with the *Aboriginal Cultural Heritage Act* 2003 (Qld) ('ACHA') and all relevant legislation as described in Section 2 of this Report.

The Duty of Care assessment includes for the purposes of this Project:

a) a background review of environmental factors (palaeoclimatic data, soils, geology and land use);

b) a preliminary assessment of the Project Area against the ACHA Duty of Care Guidelines;

c) a search of applicable registers;

d) an assessment of the potential for the Project Area to contain significant Aboriginal Cultural Heritage;

e) results of site inspection;

f) mapping of any archaeologically/culturally sensitive areas; and

g) management recommendations addressing the Proponent's statutory obligations under the ACHA.

1.3 Project Description

Lockyer Energy has proposed development of a natural gas energy production facility on part of Lot 191 CSH2361 Fords Road Gatton, QLD (Figure 1).

1.4 Report Authorship

The desktop analysis and site inspection were undertaken by Senior Archaeologist Dr Serena Love and Archaeologist Robert Mazlin. This report was prepared by Dr Serena Love and Robert Mazlin. Consultation with the client was conducted by Tim Robins.

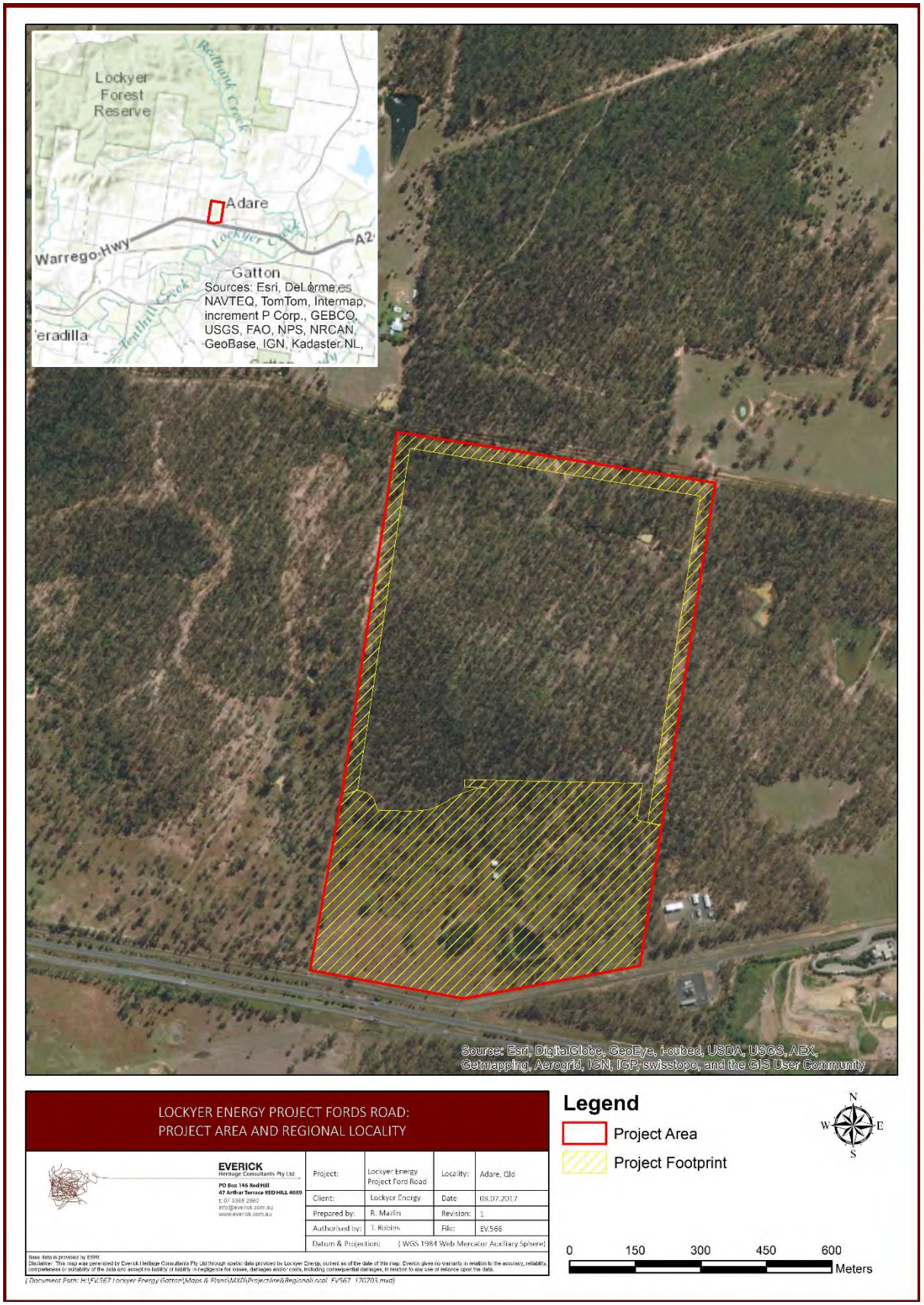


Figure 1: Project Area.

2. LEGISLATIVE AND PLANNING CONTEXT

In relation to cultural heritage, the site will be affected by one primary piece of legislation. Aboriginal heritage falls within the auspices of the *Aboriginal Cultural Heritage Act 2003* (Qld) (the ACHA). This legislation operates independently of any development application process. *The Native Title Act 1993* (Cth) intersects with the ACHA in Part 4 Section 34 which prescribes the hierarchy of identifying Native Title parties; Aboriginal Parties (Section 35) or Registered Aboriginal Bodies (Section 36) for the purposes of consultation and management of Aboriginal cultural heritage. Section 34 specifically documents the meaning of a Native Title Party as registered native title claimants and holders, either current or past.

2.1 The Aboriginal Cultural Heritage Act 2003 (Qld)

The *Aboriginal Cultural Heritage Act 2003* (Qld) (the ACHA) is the primary piece of legislation governing Aboriginal cultural heritage in Queensland. The key components of the ACHA include:

- granting a statutory right to Aboriginal Peoples to determine cultural significance, without the need for any reference to scientific values;
- providing Aboriginal Peoples with substantial control over the impact assessment process (in certain circumstances), including the discretionary right to seek independent archaeological advice;
- the protection of Aboriginal Areas holding significant intangible cultural values; and
- the establishment of a system of negotiations between land-users and Aboriginal Peoples over heritage management, with a largely hands off role for government administrators.

In giving control over heritage decisions to Aboriginal Peoples, the *stated* aims of the ACHA (Sections 4 and 5) were progressive. They were also consistent with much of the contemporary academic literature recognising that cultural heritage should be treated as a human right, not a scientific discipline (Coombe 1999; Blake 2000; Silverman and Ruggles 2007). Keeping with this progressive theme, Aboriginal heritage to be protected under the ACHA was defined as either a 'significant Aboriginal place' or a 'significant Aboriginal area' which is of particular significance due to either:

a) Aboriginal tradition; or

b) the history, including contemporary history, of any Aboriginal Party for the area

This definition is particularly broad, and clearly envisaged protection for significant Aboriginal heritage values that do not necessarily have a physical manifestation (ACHA, Section 12(2)).

The Act established a cultural heritage 'Duty of Care' for all land users, in accordance with Section 23 of the ACHA. Under the concept of Duty of Care, a person or organisation who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the Aboriginal cultural heritage Duty of Care). Aspects of the Duty of Care requirement include:

a) the nature of the activity, and the likelihood of its causing harm to Aboriginal cultural heritage;

b) the nature of any Aboriginal cultural heritage likely to be harmed by the activity;

c) whether the land user carried out a study or survey, of the area affected by the activity to find out the location and extent of Aboriginal cultural heritage, and the extent of the study or survey; and

d) the extent to which the person has complied with Aboriginal cultural heritage Duty of Care Guidelines.

2.1.1 The Duty of Care Guidelines

The Duty of Care Guidelines (The DoC Guidelines) can be followed, for certain lands and projects, as the sole method of a cultural heritage assessment and reporting. Understanding the DoC Guidelines is important for planners, as they may be of use as a negotiation tool where agreement cannot be reached with the Aboriginal Party, for discrete sections of the Project, and/ or subsequent development applications.

The DoC Guidelines are based on the concept of ground disturbance; both the previous ground disturbance to a location, and the proposed ground disturbance which will be carried out by the intended project. In summary, the type of ground disturbance is classified into five (5) categories under the DoC Guidelines which are as follows;

CATEGORY 1 – No Ground Surface Disturbance. This means there is no further ground surface disturbance, and therefore no threat to physical Aboriginal Heritage. Proposed works that are assessed as falling into this category may proceed without further investigation.

CATEGORY 2 – No Additional Surface Disturbance. This means ground surface disturbance has occurred in the past, and the proposed activities is the same or similar to what has occurred previously. Examples given of a Category 2 disturbance are grazing cattle on paddocks already used for grazing cattle, and maintaining and using pre-existing roads and vehicle tracks.

CATEGORY 3 - Developed Area. Similar to Category 2, disturbance of the proposed works will be impacting an area already disturbed. Category 3 specifically applies to works of infrastructure in areas of infrastructure, e.g. sewer maintenance, road upgrades, electrical infrastructure etc.

CATEGORY 4 – Areas previously subject to Significant Ground Disturbance. This category particularly applies to landscapes that initially may not fall into the proceeding categories but in which Aboriginal Cultural Heritage is unlikely to be harmed. An example of a Category 4 landscape would be regenerated forest after extensive timber logging had occurred. Care must be taken, however, with this category as residual Aboriginal Cultural Heritage value may remain, particularly ceremonial or mythological value which may not have been impacted by the "Significant Ground Disturbance".

CATEGORY 5 – Any activity or area that does not fall into the preceding categories.

"Significant Ground Disturbance" as mentioned in Category 4 means:

a) disturbance by machinery of the topsoil or surface rock layer of the ground such as by ploughing, drilling, creating bore holes, or dredging; and

b) the removal of native vegetation by disturbing root systems and exposing underlying soil.

Where a development will result in no additional ground disturbance, or will be limited to areas that have seen Significant Ground Disturbance, the Duty of Care Guidelines state that a development is unlikely to harm Aboriginal heritage. In practice, application of the DoC Guidelines can have little relevance to whether a project is likely to impact on Aboriginal cultural heritage. The legislators have, in essence, adopted a pseudo-archaeological principle in determining potential risk to Aboriginal cultural heritage. The inherent reasoning is that if an area of cultural significance has been previously disturbed - and therefore of assumed low scientific value - it must also be of low cultural value.

There is a gap in logic between this approach and the stated aims of the legislation in two ways. Firstly, this reasoning applies a two dimensional approach to managing three dimensional archaeological problems (see Category 4 of the DoC Guidelines); it is assumed that if the ground surface is disturbed, so too are any sub-surface deposits. Fortunately this issue is not critical to the current assessment, as the Development Footprint soils are so shallow.

Just as importantly, it is a widely recognised principle that cultural significance may have little or no relationship to the archaeological significance, and can even survive physical impacts. For this reason, the DoC Guidelines should be applied with caution, whilst best practice will generally encompass archaeological and cultural knowledge applied in tandem with disturbance analysis. Equally, any community consultation, investigation and impact mitigation practises should be proportional to the risks to heritage. Ultimately proponents must pay for such investigations, and an ethical approach to heritage management should ensure that such expenses are limited to what is reasonable in the circumstances, consistent with the requirements of the ACHA.

2.2 The Native Title Act 1993 (Cth)

Under Section 3 of the *Native Title Act 1993* (Cth), the main objectives of the legislation are to:

a) provide for the recognition and protection of Native Title;

b) establish ways in which future dealings affecting Native Title may proceed and to set standards for those dealings;

c) establish a mechanism for determining claims to Native Title; and

d) provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of Native Title.

Native Title is the recognition by Australian law that some Aboriginal People have rights and interests in their land that come from their traditional laws and customs. Native title rights may include the right of Aboriginal People to:

a) live on the area;

b) access the area for traditional purposes including camping or ceremonial activities;

c) visit and protect important places and sites;

d) hunt, fish and gather food or traditional resources including water, wood and ochre; and

e) teach law and custom on country.

(National Native Title Tribunal, 2011).

2.3 Codes of Practice

2.3.1 The Burra Charter

The Australia ICOMOS (International Council on Monuments and Sites) -the peak body of professionals working in heritage conservation - has adopted the Burra Charter 2013 as a guide to standard of practice for a range of parties; including heritage consultants who provide advice, make decisions about or undertake works to places of cultural significance. The Burra Charter has no effect on Queensland or Commonwealth Law and as such, has been followed in this assessment.

Cultural significance as defined by the Burra Charter (2013) means all types of places of cultural significance, including natural, Aboriginal and historic places. The Burra Charter states that places of cultural significance must

be conserved for present and future generations in accordance with the principles of inter-generational equity (Australia ICOMOS Burra Charter 2013: 1).

The Burra Charter (2013) advises that the process for undertaking works in an area identified as culturally significant should:

- Understand the significance;
- assess the cultural significance;
- develop a statement of cultural significance;
- identify all factors and issues relating to the significance;
- develop a policy managing cultural significance;
- prepare a management plan;
- implement the management plan; and
- periodically review the management plan.

The Burra Charter (2013) uses five terms to identify different aspects of cultural significance; they are (in alphabetical order) aesthetic, historic, scientific, social and spiritual values. Each of these terms may have tangible or intangible aspects, and the Burra Charter views both aspects as equally important.

Aesthetic Values are the sensory and perceptual experience of a place which can include concepts of beauty and formal aesthetic ideals.

Historic Values relate to all aspects of history which means this value can underlie other values. A place may have historic value through its involvement in historic events, phases, movement or activity and can be linked to art, architecture, science, spirituality and society.

Scientific Value relates to the ability of the place to reveal more about an aspect of the past through examination or investigation of the place. This includes archaeological techniques. The scientific value usually depends on the importance of the information or data generated by further research and its rarity, quality or representativeness.

Social Value is the intangible values and meanings embodied in or evoked by a place. This can include spiritual identity, traditional knowledge, art and practices of a cultural group. Spiritual values may be interdependent on the social values and physical properties of a place.

A common theme of all the principle tenets of the Burra Charter (2013) involve engaging in open minded dialogue with those parties that hold knowledge of any of the values described above.

2.3.2 Ask First

The *Australian Heritage Commission 2002 Ask First* document is recommended as outlining best practice for the preparation of an EIS or PER when Aboriginal consultation is required. Consultation with Aboriginal People involves:

- Identifying traditional owners and other Aboriginal People with rights and interests in the area;
- identifying non Aboriginal people with rights and interests in the area;
- meeting with relevant Aboriginal People to describe the project or activity;
- agree on a process for addressing Aboriginal heritage matters;
- arranging a meeting of all stakeholders to discuss the project or activity and agree who will undertake work;
- undertaking background research;
- ensuring the relevant Aboriginal People are actively involved and identifying their heritage places or values;
- identifying any special management requirements with relevant Aboriginal People;
- meeting with stakeholders to identify constraints of managing identified heritage places and values; and
- implementing and reviewing the outcomes with relevant Aboriginal People and other stakeholders.

The document, *Ask First*, recommends that consultation processes consider the different degrees of knowledge that may exist in Aboriginal communities, including restricted information based on gender and age. It also recommends that consultation be undertaken for each new project unless advised by Traditional Owners not to do so.

3. ENVIRONMENTAL CONTEXT

The Project Area is bordered by Fords Road to the south, Ranger Road to the north and freehold land to the east and west. A number of dams exist within the lot. A raised knoll in the centre of the Project Area with an elevation of 150 m asl slopes toward an elevation of 110 m asl in the north and 100 m asl in the south. It is approximately

2.5 km north of Gatton and is located within the Lockyer Valley Regional Local Government Area. The Project Area is situated within a landscape of river and creek flats, surrounded by sandstone hills.

3.1 Vegetation and Geology

The surrounding hills and valleys with low escarpments and cliffs are sandstone, belonging to either Gatton Sandstone or Ma Ma Creek or Heifer Creek Sandstone. The Project Area includes two distinct geological categories (Figure 2). The Woogaroo Subgroup accounts for the majority of the lot while the south west corner is typical of Qr-9543. Both are a stratified volcanic and metamorphic geological unit, Woogaroo Subgroup being of Triassic/Jurassic age and while the lower lying area of Qr-9543 is of Quaternary age. The dominant rock type in Qr-9542 is colluvium, with a lithothology of residual soil, colluvium; sand, soil, clay, rock debris.

Immediately to the south of the Qr-9543 geological unit sits Qa-QLD which is associated with the floodplains of Lockyer Creek and its tributaries. It is likely that the south west of the Project Area formed part of the Lockyer Creek drainage network prior to the construction of the Warrego Highway.

The geological categories relevant to the Project Area are mirrored in a similar vegetative mosaic. Broadly speaking, the lands classed as Wooogaroo Subgroup are associated with Eucalypt woodlands to open forests while the colluvial soils of Qr-9543 support eucalypt open forests to woodlands on floodplains. In terms of vegetation, no differentiation is made between the Qa-QLD and Qr-9543 geologies which suggests that resource exploitation within the south west of the Project Area would have been comparable to that documented in closer proximity to waterways. Possible clearing to accommodate pastoral activities make it difficult to accurately ascertain to what degree the vegetation coverage of the lower flats reflects original conditions.

3.2 Water Sources

Lockyer Creek is the nearest major watercourse, approximately 1 km south east of the Project Area, and would have played an important role in the occupation and subsistence of the regions original inhabitants. It is clear that the tributaries of Lockyer Creek which surround the Project have been significantly modified through post-contact activities. Numerous ephemeral creeks and drainage lines have been dammed to provide reliable agricultural water, making reconstructions of previous standing water bodies difficult. Aerial imagery suggests that prior to these dams and the construction of the Warrego Highway, a number of creeks would have originated within the Project Area and terminated in Lockyer Creek.

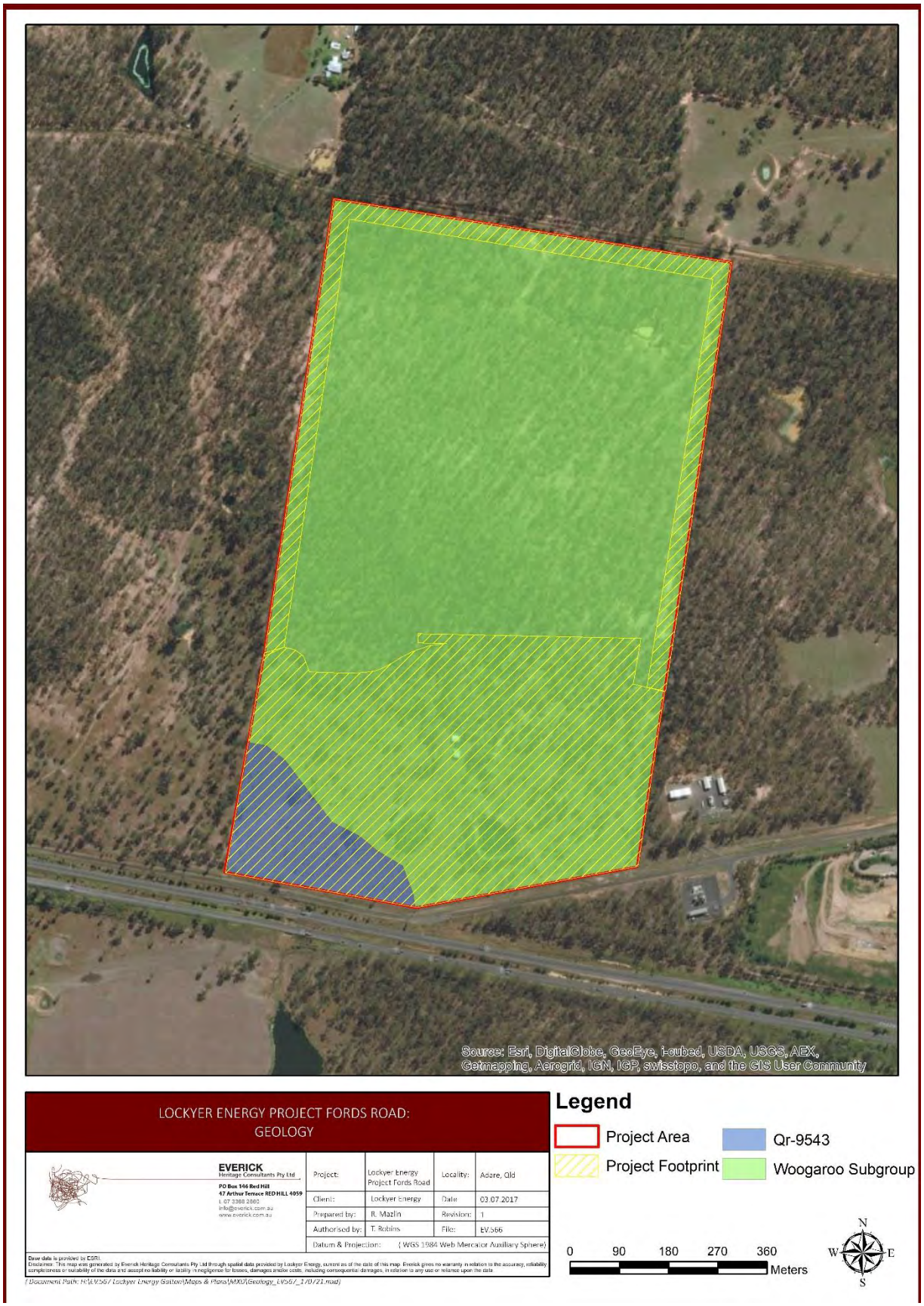


Figure 2: Geology of the Project Area.

4. DESKTOP REVIEW

4.1 Aboriginal Settlement and People

It is now accepted Aboriginal occupation of Australia dates back to at least 40,000 years (Hiscock 2008), with current research attempting to push these dates back further. Relevant to the region of the Darling Downs, carbon dating of charcoal from cultural contexts recovered in King's Creek and Clifton also suggest an occupation date of 40,000 years (Copland *et al.* 2006: 2; French 1989: 6). The oldest human remains in the region is a fossilised human skull found at Talgai Station in 1886 (Gill 1978). Radiocarbon dating suggests the Talgai skull is of the Pleistocene era, between 9,000 and 11,000 years old (Gill 1978; Hiscock 2008).

Limited research has been published about the prehistory of Aboriginal People in and around the Darling Downs area before the arrival of Europeans. When the first Europeans arrived in 1840's, it is estimated that 300,000 Aboriginals were living in Australia, with about a third of those living in Queensland (French 1989: 8) but these figures are difficult to determine due to the high level of violent conflicts between Aborigines and European settlers (Copland *et al* 2006). Colonial Secretary Christopher Rolleston kept an annual record of Aboriginal populations and claims only 120 people were living in the Darling Downs West in 1886 (Copland *et al* 2006: 31).

4.2 Aboriginal Economy and Movements

Following the formation of Moreton Bay by 6,000 BP there occurred a great economic, technological and demographic change in South-East Queensland Aboriginal culture (Morwood 1986). According to Meston (cited in Steele 1984: 148), the Yuggera (or Cateebil) territory extended as far as the Dividing Range near Toowoomba (). Aboriginal People were known to hunt in this area using a technique that burned the grasslands to encourage new growth that would in turn attract animals. This technique earned these Aboriginals the name "Gooneburra", or "the ones who hunt with fire".

The population numbers are largely unknown but are reconstructed based on the numbers of 'humpies', permanent shelters made from the inner bark of ironbark trees (Steele 1984: 148). Over 400 sheets of bark were collected when the humpies were destroyed in 1841 by order of the Superintendent of Flocks at Grantham. By this estimate, there were 100 Aboriginals living in the areas. However, these population estimates would drastically peak to approximately 20,000 during the tribal gatherings for the harvesting of the Bunya nuts. This triennial event saw tribes travel from great distances to the Bunya Mountains and is mentioned in various historical texts. The event not only gave tribes the opportunity to harvest the protein rich nuts but also engage in cultural exchange, which included forging trade agreements, fighting tournaments and marriage arrangements.

Associated with this event was ritual visits to the Gummingurru stone arrangement, located on one of the main routes between South-East Queensland and the Bunya Mountains, north of Toowoomba (Ross 2008). Clans from across South-East Queensland would come to Gummingurru for initiation or 'man-making' ceremonies so that the men could be allowed to participate in social activities at the Bunya Feasts (Ross 2008: 93). The Darling Downs tribes were also known for their seasonal movements to the Moreton Bay region to exploit the abundant marine resources, which supplemented their diet when bunya trees were not fruiting (Morwood 1987). The economic exploitation of south-east Queensland resources intensified in the Mid-Holocene era due to population growth and advancements in technology through cross-cultural contact at events such as the bunya feasts (Morwood 1987).

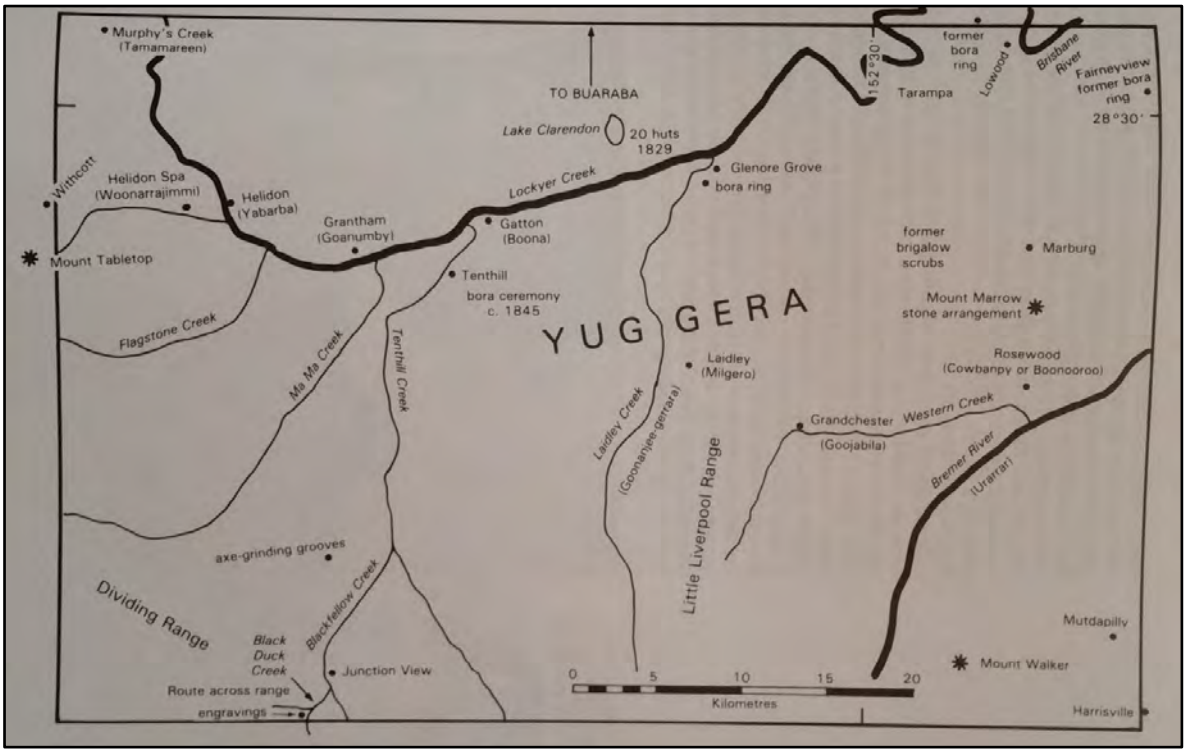


Figure 3: Map of Yuggera territory in Lockyer Valley, from Steele 1984: 149, fig. 68.

4.2.1 Aboriginal and European Conflict

In the early stages of European settlement of the Darling Downs region there was extensive conflict between the Aboriginal groups and European settlers. From 1841-1843 the Darling Downs Aboriginal population was decimated through warfare and massacres, with a reported 60-80% of tribes destructed by the violence. French (1982: 17) reports that although some Aboriginals were shy and stayed away from the European settlers, others "put up a short, sharp resistance" by stealing sheep and cattle. In "1861 Captain John Coley, in his evidence to the Select Committee on the Native Police Force, claimed that over 250 whitemen had been killed in the Downs-Brisbane area" (French 1982: 17). Steele (1984) describes an Aboriginal group called "Moppy's Tribe", who retaliated to the invasion by killing shepherds, stealing sheep and plundering drays in the Helidon/Drayton region.

The most serious resistance to the European settlers was a conflict known as the "Battle of One Tree Hill" at Tabletop Mountain, near Toowoomba (Strong *et al.* 2015; French 1993, Uhr 2003). The battle took place on September 12, 1843, when the Aborigines ambushed the squatters by felling trees across the road who were ferrying Forbes Brothers supplies from Moreton Bay on the main road between Helidon head Station and the base of the main range (Uhr 2001: 559). The resistance was led by Multuggerah, of the Jagera People (French 1993), who was also known as 'King Moppy'. James Bonner, one of Multuggerah's descendants, who claims that Multuggerah sent word to John Campbell of Westbrook Station to warn the Europeans about an imminent attack but his advice was ignored (Backhouse 2016). Within 2 hours of the attack, Stephen Simpson, his police and about 20 Europeans pursued the attackers up Mount Davidson (Uhr 2001: 559). Multuggerah and his warriors were waiting in ambush and rained bounders on pursuant squatters. These actions escalated to a violent confrontation between squatters and Aborigines when a military unit tacked down and killed the Aboriginals in the Lockyer Valley. William Charles Wilkes was a shepherd on Helidon Station and claims to be an eye-witness to the events. Much of the details about the massacre are detailed in his mock-heroic poem *The Raid of the Aborigines* written by Wilkes in 1844 (Uhr 2001, 2003). Following these events, Aboriginal society broke down (the last Bora ceremony in the Downs was held in 1858) and the remaining population either assimilated into the European way of life or became fringe dwellers.

4.3 European Settlement

The Darling Downs was first explored by Europeans on June 5th 1827 by Allan Cunningham as he walked the Sandy and Thane's Creeks (Hall 1988). Cunningham ventured north from the Hunter Valley in search of good land and was very taken with the Darling Downs, nick-naming it the 'Garden of Australia' (Hall 1988; Parsons 2003). It was the policy of European explorers to watch for smoke as an indicator of Aboriginal occupation of an area. Cunningham originally thought the area was largely unoccupied, and therefore free to claim, but later discovered Aboriginal camps to the west of Warwick along the Condamine River (Parsons 2003).

Cunningham explored the Lockyer Valley in 1892 (Steele 1972). Sheep and cattle were introduced after 1840s and were allowed to graze in unfenced areas, such as Helidon Run. European homesteads were built but had minimal impact on the environment. However, European grazing animals had a damaging effect on the local hydrology, as many watercourses began to dry up (Beal 1993).

The three Leslie Brothers came from a wealthy Scottish family and travelled the Condamine to explore Canning Downs (to the east of Warwick) and over the ridge of Glengallan Creek (Parsons 2003). This trio of brothers declared themselves the primary pioneers of the region surrounding Warwick. The Leslie Brothers were soon followed by others, most notably Dalrymple and Gammie, who built sheep and cattle stations (Hall 1988). The literature often refers to this inundation as 'The Invasion' as the settlers swamped into the area with no regard for

Aboriginal culture or life. Some Aboriginal groups tried to retaliate, but could not stand up against the aggressive nature and abundant ammunition that the settlers' possessed. By 1848 the Aboriginal resistance died down, leaving both parties in a vulnerable state resulting from widespread massacres. Europeans continued to build the local economy through agricultural means and the area was well established by the 1900s, following a large building boom.

4.4 Previous Cultural Heritage Assessments

A review of previous archaeological assessments form part of the basis for making predictive statements as to the type and densities of sites and the environmental contexts in which they might be found.

In 2015, the Department of Transport and Main Roads engaged Turnstone Archaeology to provide an Aboriginal Cultural Heritage Assessment for the Toowoomba Second Range Crossing. The route was 41 km long, extending from the Warrego Highway west of Helidon, along the Toowoomba Escarpment to the crest of the Toowoomba Range, 17 km to the Gore Highway. 133 new cultural heritage sites were identified from the survey from the Gore Highway to Postmans Ridge Road (Strong *et al*. 2015). These are predominantly concentrations of stone artefacts, isolated finds, and scarred trees. A possible ceremonial complex was identified near Gowrie Junction. A series of 54 test pits were excavated; 39 between the Gore Highway and the Toowoomba escarpment and a further 15 between Postmans Ridge Road and Gittens Road (approximately 16-20 km northwest of the Project Area) (Strong *et al*. 2015). 1270 artefacts were recovered (532 Aboriginal and 738 historical) from these test excavations. Some of the historical glass artefacts has evidence of secondary use by Aboriginal People (Strong *et al*. 2015). The excavations also identified Aboriginal fireplaces with burnt animal remains of edible species, four ochre pieces used for decoration and a possible ceremonial complex at Holmes Road.

4.4.1 Summary of Other Studies Relevant to the Region

In 2009, Southeast Queensland Catchments commissioned Turnstone Archaeology to undertake an assessment on the Blackfellow Creek Catchment Area as a part of their Healthy Country Initiative (Strong 2009). This program aimed to engage Traditional Owners in natural resource management and the production of preliminary predictive models for Aboriginal cultural heritage. The study focussed on an area immediately south of Mount Sylvia, approximately 22 km south of the Project Area, at its closest point. By using cultural landscape and environmental approaches, the study produced potential areas of cultural significance and potential site types which could occur within the focus area.

The report concluded that artefact scatters and isolated artefacts are likely to be found on stream terraces, within 100 m of the creek bed. Upper sandstone terraces were also identified as areas for the potential to retain artefacts,

along with rock shelters and caves. Areas including cliffs/escarpments; flood plains; creek banks and hillslopes were recognised as features containing a low potential for Aboriginal settlement.

4.5 DATSIP Cultural Heritage Database Search Results

A search conducted on 09 June 2017 of the DATSIP database revealed no registered Aboriginal sites within the Project Area or within a 1000 m buffer zone (Ref.22641, Appendix A). There were also no listed Designated Landscape Areas or Registered Study Cultural Heritage Areas for the Project Area.

Mandatory site registration ceased in 2003, and as such, the DATSIP database may not represent the extent of known Aboriginal cultural heritage sites in the region.

A search conducted on 09 June 2017 of the Native Title Register found that a Native Title Claim was lodged by the Jagera People #2 (QC2003/015 PRC) over the Project Area. An updated search conducted on 02 February 2018 of the Native Title Register found that a Native Title Claim was lodged by the Yuggera Ugarapul People (QC2017/005) over the Project Area. This represents a new Native Title claimant over the region. As this is freehold land, the Native Title has been extinguished. There is no cultural heritage body for the Project Area.

Local, State and National Heritage Registers: The following heritage registers were accessed on 07 July 2017 for Indigenous and historic places within the Gatton area:

- **The World Heritage List:** contains no places within close proximity to the Project Area.
- **Commonwealth Heritage List:** contains no places within close proximity to the Project Area.
- **The National Heritage List:** contains no places within close proximity to the Project Area.
- **Register of the National Estate:** contains five (5) places within the Gatton area. None are in close proximity to the Project Area.
- **The State Heritage Register (QLD Heritage Office):** contains no places within close proximity to the Project Area.
- **Lockyer Valley Local Heritage Register:** contains no places within close proximity to the Project Area.

4.6 Disturbance Analysis

4.6.1 Historic Aerial Photography

Historic aerial photographs of the Project Area were reviewed to assist in ascertaining the level of past ground disturbance. This information is also used in developing a predictive model for potential cultural heritage site locations. Aerial photographs from 1933, 1951, 1969, 1974, 1982, and 1997 were examined. The earliest available

photograph indicates that much of the Project Area was heavily vegetated (Figure 4). It cannot be conclusively determined if this vegetation is remnant or regrowth from a clearing episode prior to 1933, however the topography of the property suggests that it is likely original. When compared to vegetation in a neighbouring lot to the north, notably the vegetation within the Project Area appears less dense which may indicate selective thinning. An area of cleared land existed in the south toward what is now Fords Road which may have accommodated pastoral activities (Figure 5). Lands utilized for pastoral grazing are acknowledged to have undergone ground disturbance which will have reduced the likelihood of encountering in situ archaeological material. Imagery from 1951 and 1969 (Figure 6) show very little change in vegetation coverage and disturbance history, aside from the introduction of a number of tracks in the north eastern corner of the Project Area and a dam in the south east. By 1974 an additional two dams had been constructed in the portion of the Project Area bordering Ranger Road (Figure 7). Vegetation appears to have been thinned slightly in the 1982 imagery (Figure 8), however regrowth has occurred by 1997 (Figure 9).

Examination of historic aerial photography suggest that the majority of the Project Area has not been subject to significant ground disturbing activities. It is clear that thinning of vegetation has occurred, however current vegetation patterns may retain remnant individuals. The absence of evidence indicating extensive clearing, or activities such as cropping or pastoral grazing which often follow, also increase the potential for Aboriginal Objects to be encountered within the Project Area. This assessment indicates minimal ground disturbance across much of the property which would have potentially had a low impact on archaeological potential. A portion in the south western corner, as well as the lands surrounding currents dams, are assessed to have experienced reasonable ground disturbance and the impact from this activity would have a high impact upon potential Aboriginal cultural heritage.

Figure 4: Historic aerial from 1933.

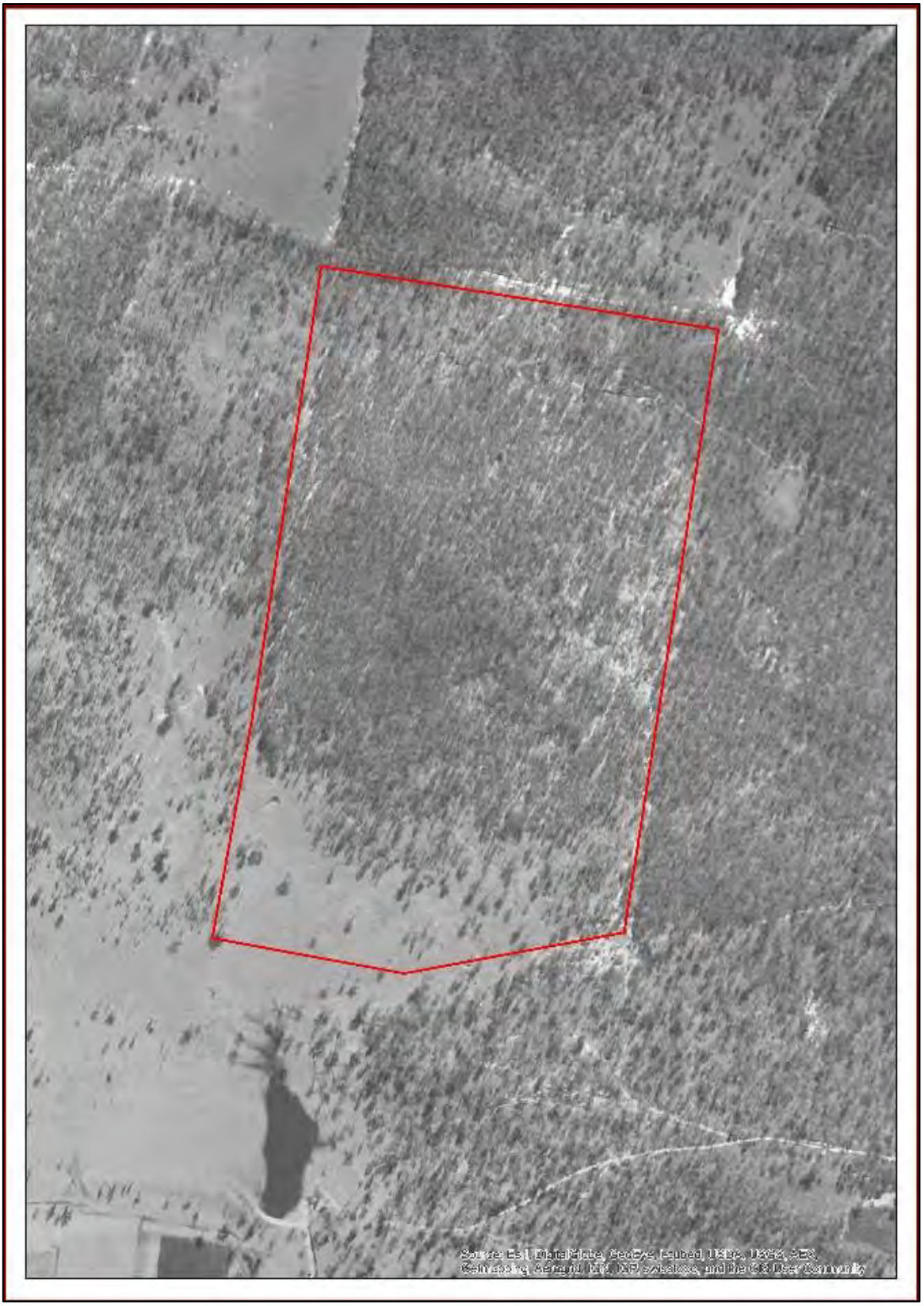


Figure 5: Historic areial from 1951.

Figure 6: Historic aerial from 1969.

Figure 7: Historic aerial from 1974.

Figure 8: Historic aerial from 1982.

Figure 9: Historic aerial from 1997.

4.7 Predictive Cultural Heritage Model

The nature of Aboriginal occupation in the region, being relatively intense and over a long time scale, makes it almost certain that the Project Area has potential to contain Aboriginal Objects. Given the location of the proposed development and the extent of ground disturbance, the types of Aboriginal cultural heritage that may remain within parts of the Project Area include, but are not limited to:

Single artefacts – usually made from stone, which may / may not have been used as tools. Can be found throughout any landscape at any point. May have been left where they were discarded by Aboriginal People as they moved through the landscape, rather than having arrived at a particular location due to a particular event or premeditated action. There was considered a high potential for isolated stone artefacts to exist within the Project Area.

Artefacts scatters (denser concentration of artefacts) – occur when the density of artefacts reaches a threshold of size or density or both. These types of sites usually have a variety of artefact types and sizes made often from different raw materials. They also often are interpreted as indicative of a purposeful action of Aboriginal People within the landscape, or representing a specific action event. There is a moderate to high potential for stone artefact scatters to exist within Project Footprint.

Scarred Trees or Resource Areas – Scarred trees are less likely to be encountered due to the European land use practises carried out in the region. However, given the parts of the Project Footprint appear to have not been subject to extensive clearing, there is the potential for mature trees to retain evidence of cultural scarring.

Regarding intangible heritage values for the Project Area, the Consultant cannot provide an assessment or interpretation of any non-physical cultural values the Aboriginal People of the region may maintain for the Project Area. Having conducted a review of previous archaeological assessments across the region, the consultant can confirm that no intangible heritage values have been recorded on the public record in association with the area.

5. FIELD SURVEY

5.1 Survey Team

A field survey for Aboriginal cultural heritage of the Project Area was undertaken on 12 July 2017 by Everick Senior Archaeologist Dr Serena Love and Archaeologist Robert Mazlin with Andrew Murdoch of Arche Energy.

5.2 Survey Methods

The field methods aim to inspect exposed ground surfaces within the Project Area as conditions would allow; to record any archaeological material found and assess its significance; and assess the potential for concealed Aboriginal archaeological sites. The assessment also aims to establish if there are sites or areas of a non-archaeological nature significant to the Aboriginal community.

Archaeological features may typically include evidence of stone artefacts scatters or individual artefacts, traces of bone (human and animal), shell deposits, scarred trees and ash-stained earth that might represent fireplaces. When artefacts are found their locations are recorded with a GPS (using WSG84 datum) using a Samsung tablet, photographed and generally described. A note is made of artefact types and their numbers. General characteristics of the artefacts are noted including raw material type and condition including the degree of weathering and heat cracking. The length, width and thickness of a number of artefacts are recorded.

Photographs are taken as a record of general features and conditions and to document the degree of surface visibility. Notes are made of the degree of surface visibility, the area of visibility, ground cover, vegetation, land uses and any other relevant features. The extent of survey coverage and particular archaeological features were recorded using GPS. In addition to assessing the cultural heritage potential of the Project Area, the survey aims to confirm the interpretation of the nature and degree of ground disturbance.

5.3 Survey Coverage

The Project Footprint was targeted during survey. The density of ground cover and vegetation in some parts of the Project Area made the detection of Aboriginal archaeological sites limited. To achieve as thorough an archaeological assessment as possible a systematic ground survey of all surfaces is the best method for effective coverage, however due to the limited ground surface visibility (GSV), the inspection was conducted in an opportunistic manner concentrating on exposed surfaces. Tracks and exposures adjacent to waterways were targeted by the survey, although other cleared areas within the Project Footprint were also examined. Systematic

spot checks were conducted where areas of higher GSV and/or mature growth trees, with the potential to contain cultural scars, were identified. Areas where Aboriginal material is predicted, such as near ephemeral waterways and the areas with possible remanent vegetation, were inspected but these areas had less than 20% GSV (Figure 10-Figure 11).

An assessment of the constraints to site detection is made to assist in formulating a view as to the effectiveness of the field inspection to find Aboriginal sites and cultural materials. It also assists in the forming of a view of the likelihood of concealed sites, keeping in mind a site-specific knowledge of the impacts that European land uses and natural processes may have had on the 'survivability' of Aboriginal sites in the Survey Area.

The constraints to site detection are almost always most influenced by post European settlement land uses and seldom by natural erosion processes. The area of surface exposure and the degree of surface visibility within exposed surfaces are usually the product of 'recent' land uses e.g. land clearing, ploughing, road construction, natural erosion and accelerated (man-made) erosion. In this case the major 'man made' constraints to Aboriginal site survivability and detection would be due to the vegetation thinning/clearing (Figure 12) and earth works associated with the construction of dams (Figure 13) and dwellings.

Figure 10: Example of survey conditions on knoll slopes.

Figure 11: Example of survey conditions within southern flats.

Figure 12: Evidence of vegetation thinning.

Figure 13: Example of introduced dam

5.4 Survey Results

Survey of the Project Footprint identified two (2) isolated stone artefacts, one (1) piece of culturally modified glass and two (2) potential scar trees (Figure 14). GSV varied greatly dependent upon the vegetation. Due to the heavy grass cover of the southern flats ground surface visibility was extremely low, while the eucalypt-dominated slopes of the central knoll afforded greater surface exposure. The two isolated artefacts recorded were identified in areas of good ground surface visibility. A number of areas, such as water erosions and tree falls, had exposures of subsurface deposits but no artefacts were identified in these sediments. Multiple tree stumps are evidence for selective logging, as opposed to drag chaining for tree removal (see Figure 12). Only one site, being a potential scar tree, was found in an area where objects were predicted, such as near waterways.

Figure 14: Project Area with survey results.

5.4.1 Silcrete Core

One coarse grained silcrete core was identified (UTM –E: 428587.05, N: 6954369.40) approximately 50 m north of the Project Footprint (Figure 15). The isolated artefact measured 60 mm x 60 mm x 50 mm and was located in area of disturbed exposed ground surface.

Figure 15: Coarse grain silcrete core

5.4.2 Chert Core

One isolated find was found on the rim of a dry depression (UTM E: 428011.00, N: 6954182.00). It was a worked stone core with negative flake scars on both the dorsal and ventral surfaces (Figure 16). The material is a uniform brown chert and the object measured 38 mm x 20 mm x 4 mm.

Figure 16: Isolated artefact, chert core.

5.4.3 Worked Glass Piece

One piece of culturally modified glass was identified in the far south eastern corner of the Project Area (UTM E: 428596.18, N: 6953971.21), near the entrance gate. Originally the base of a brown glass beer bottle, the artefact has been a number of negative flake scars as a result of knapping activities (Figure 17). Given the item was recorded in a mowed area it is unlikely that was found in its original context. Measurements for the worked glass are approximately 45 mm x 80 mm x 7 mm.

Culturally modified glass objects are known to have been made and used by Aboriginal Peoples as well as early European settlers. The object was not found with any other associated objects or features.

Figure 17: Glass artefact.

5.4.4 Potential Scar Tree 01

Location	**-27.528993 152.272041**
Species	Ironbark
Living Status	Dead
Tree Status	Standing
Regrowth?	No
Scar One Dimensions	300 x 1910 x 25
Height Above Ground Scar One	0
Circumference of Tree at 1500mm	1620
Height of Tree	10
Number of Scars	1
Shape of Scars	Oval
Orientation Scar One	North
Axe Marks	no

Figure 18: Potential Scar Tree 01

5.4.5 Potential Scar Tree 02

Location	-27.527766 152.272338
Species	Eucalypt
Living Status	Living
Tree Status	Standing
Regrowth?	No
Scar One Dimensions	400 x 1470 x 90
Height Above Ground Scar One	1230
Circumference of Tree at 1500mm	1710
Height of Tree	15
Number of Scars	1
Shape of Scars	Oval
Orientation Scar One	North
Axe Marks	no

Figure 19: Potential Scar Tree 02

5.4.6 Survey Conclusion

The following conclusions can be made from the results of the desktop study and field inspection:

- The Project Footprint has seen significant ground disturbance within the meaning of Category 4 of the Duty of Care Guidelines. The modification of this area was through extensive clearing and construction activities. These activities have removed any reasonable potential for archaeologically significant deposits to be located within the Project Footprint. The area has low potential for buried archaeological deposits and the Project Activities will not cause further harm to Aboriginal cultural heritage. The application of the ACHA Duty of Care Guidelines, the project would fall under Category 4, meaning the works can proceed with caution.
- Three (3) Aboriginal objects were identified during the survey:
    - One (1) piece of culturally modified glass was found on the surface.
    - One (1) coarse silcrete core was identified just outside the Project Footprint and will not be impacted by the Project.
    - One (1) chert core was identified in association with an ephemeral waterway. These areas have reasonable potential for residual cultural values.
- Two (2) potential scar trees were identified along the western side, outside the Project Footprint.
- The elevated knoll central to the Project Area could be defined as a landscape feature consistent with paragraph 6.2 of the DoC Guidelines. However, this area is not being impacted by the Project. There are no other landscape features within the meaning of Duty of Care paragraph 6.2 within the Project Area.
- Consultation with Jagera People #2/ Yuggera Ugarapul People was outside the scope of this assessment. It is noted that there are no Significant Aboriginal Areas registered on the DATSIP database or in the ethnographic literature within the Project Area. No areas of high intangible heritage significance were identified that are likely to be impacted by the Project.

6. RECOMMENDATIONS

The recommendations listed below have been formulated from the results of the desktop assessment and the field inspection that relate specifically to the Project Footprint, as illustrated in Figure 1. The Consultant is of the opinion that given the significant ground disturbance recorded within the Project Footprint, the proposed works are unlikely to result in additional harm to Aboriginal heritage. The following recommendations are cautionary.

Recommendation 1: Avoidance of Recorded Sites

It is recommended that the Proponent ensures that the three (3) isolated artefacts and two (2) potential scar trees (Figure 14) are not subject to inadvertent harm during construction works. Each should be fenced or flagged as appropriate, and marked on relevant construction plans as 'no go' areas.

Recommendation 2: Aboriginal Objects Find Procedure

It is recommended that if it is suspected that Aboriginal material has been uncovered as a result of development activities within the Project Area:

e) work in the surrounding area is to stop immediately;

f) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

g) the current Aboriginal Party (presently Jagera People #2) should be engaged to identify the find, assisted by an appropriately qualified archaeological consultant if reasonably required; and

h) if the material is found to be of Aboriginal origin, the Aboriginal Party for the region, being Jagera People #2, should be consulted over the management of the find. Any management agreement should be clearly documented in writing signed by both parties.

Recommendation 3: Aboriginal Human Remains

Although it is highly unlikely that Human Remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station (Gatton) and DATSIP are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal Party for the region, being Jagera People #2, should be consulted as to how the remains should be dealt

with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal People rather than scientific specimens.

REFERENCES

Backhouse, A. 2016. "Revealded: Who is Aboriginal warrior Multuggera", *The Chronicle*, May 9.

Beal, D.J. 1993. *The Making of Rosalie. A History of the development of the Modern Landscape of the Darling Downs Portion of the Rosalie Shire from the 1840s*. Toowoomba: University of Southern Queensland.

Blake, J. 2000. On Defining the Cultural Heritage. *International and Comparative Law Quarterly* 49:61-85.

The Burra Charter, 2013. The Australia ICOMOS Charter for Places of Cultural Significance. International Council on Monuments and Sites.

Coombe, R. 1999. Intellectual Property, Human Rights & (and) Sovereignty: New Dilemmas in International Law Posed by Recognition of Indigenous Knowledge and the Conservation of Biodiversity. *Indiana Journal of Global Legal Studies* 6: 59-78.

Copland, M., J. Richards and A. Walker 2006. *One Hour More Daylight: A historical overview of Aboriginal dispossession in southern and southwest Queensland*. Toowoomba: The Social Justice Commission.

French, M. 1989. *Conflict on the Condamine. Aborigines and the European Invation.* Darling Downs Institute Press: Toowoomba.

French, M. 1993. The Great 'Darkey Flat Massacre' Mystery. *Journal of Australian Studies* 17(38): 12-24.

Gill, E. D. 1978. Geology of the Late Pleistocene Talgai Cranium from S. E. Queensland, Australia. *Archaeology and Physical Anthropology in Oceania* 13 (2/3): 177–197.

Hiscock, P. 2008. *Archaeology of Ancient Australia*. Routledge: London.

Hall, T. 1988. *The Early History of Warwick District and Pioneers of the Darling Downs.*

Morwood, M.J. 1986. The archaeology of art: Excavations at Maidenwell and Gatton Shelters, Southeast Queensland. *Queensland Archaeological Research* 3: 88-132.

Morwood, M.J. 1987. The archaeology of social complexity in south-east Queensland. *Proceedings of the Prehistoric Society (London)* 53: 337-350.

National Native Title Tribunal, 2011

Parsons, D. 2003 *Wadingh Wadingh: A History of Aboriginal People in the Warwick Area and Their Land.* Maryvale: David Parsons.

Ross, A. 2008. Managing Meaning at an Ancient Site in the 21st Century: The Gummingurru Aboriginal Stone Arrangement on the Darling Downs, Southern Queensland. *Oceania* 78(1): 91-108.

Silverman, H. and Ruggles, D. 2007. *Cultural Heritage and Human Rights.* New York: Springer.

Steele, J.G. 1972. *The Explorers of the Moreton Bay District 1770-1830*. St Lucia: University of Queensland Press.

Steele, J.G. 1984. *Aboriginal Pathways in Southeast Queensland and the Richmond River*. St Lucia: University of Queensland Press.

Strong, M. 2009. *Predictive Landscape and Cultural Environmental Modelling of the Blackfellow Creek Focal Area, Lockyer Valley, for SEQ Catchments Healthy Waterways Project*. Prepared for South East Queensland Traditional Owners Alliance Limited. South East Queensland Healthy Waterways Partnership, Brisbane.

Strong, M., A. Tucci and J. Foley 2015. *Aboriginal Cultural Heritage Survey, Assessment and Mitigation for the Toowoomba Second Range Crossing: Gore Highway, Westbrook, to Postmans Ridge Road, Helidon, South East Queensland*. Turnstone Archaeology for Western Wakka Wakka (Beattie), on behalf of Department of Transport and Main Roads. Sandstone Point, Turnstone Archaeology

Uhr, F. 2001. The Raid of the Aborigines: A brief overview and background to the poem. *Journal of the Royal Historical Society of Queensland* 17/12: 559-561.

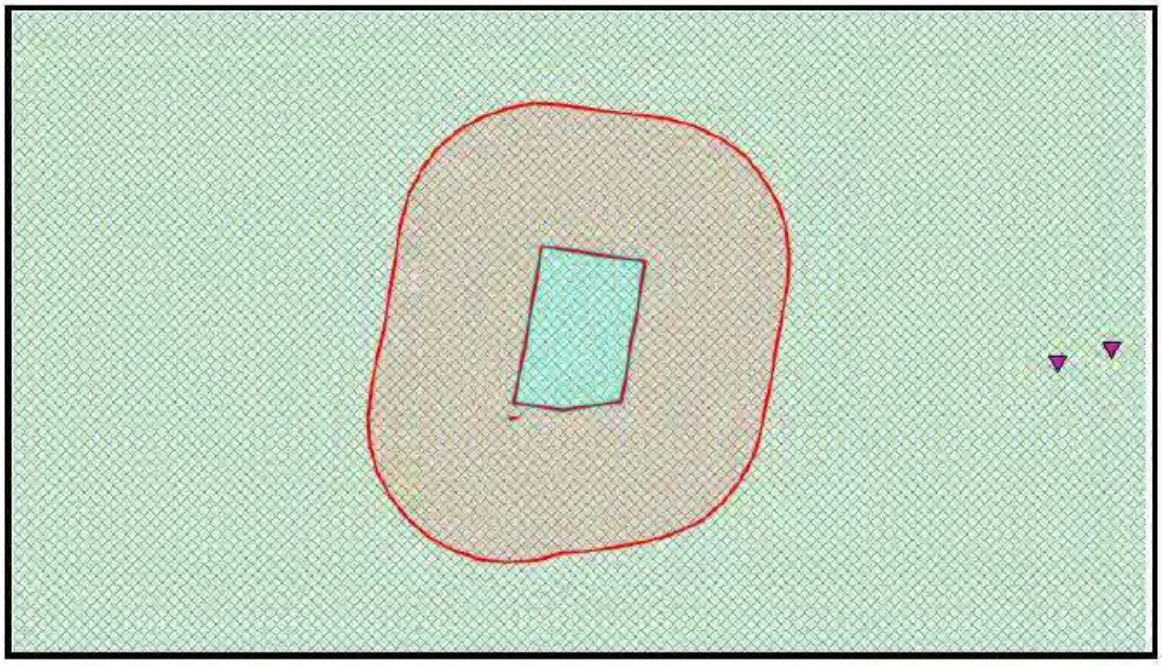
Uhr, F. 2003. September 12, 1843; The Battle of One Tree Hill- a turning point in the conquest of Moreton Bay. *Journal of the Royal Historical Society of Queensland* 18/6: 241-254.

APPENDIX A: DATSIP SEARCH RESULTS

Queensland Government
Department of Aboriginal and Torres Strait Islander Partnerships

Lot on Plan Search

Reference Number:	22641
Lot:	191
Plan:	CSH2361
LGA:	Lockyer Valley Regional
Buffer Distance:	1000 metres



There are no Aboriginal cultural heritage site points recorded in your specific search area.

There are no Aboriginal cultural heritage site polygons recorded in your specific search area.

09/06/2017 9:06 am

Lot on Plan Search

Cultural heritage party for the area is:

QC Ref Number	QUD Ref Number	Party Name	Contact Details
QC2003/015 PRC	QUD6014/03	Jagera People #2	Jagera Daran Pty Ltd c/- Ms Madonna Thomson Managing Director 124 Racecourse Rd Ascot QLD 4007 Phone: (07) 3868 1244 Fax: (07) 3868 3206 Mobile: 0435 795 337 Email: madonna.thomson@jageradaran.com

Cultural heritage body for the area is:

Body Name	Contact Details
Jagera Daran Pty Ltd	Ms Madonna Thomson Managing Director 124 Racecourse Rd Ascot QLD 4007 Phone: (07) 3868 1244 Fax: (07) 3868 3206 Mobile: 0435 795 337 Email: madonna.thomson@jageradaran.com

There are no cultural heritage management plans recorded in your specific search area.

There are no Designated Landscape Areas (DLA) recorded in your specific search area.

There are no Registered Study Cultural Heritage Areas recorded in your specific search area.

Regional Coordinator:

Name	Position	Phone	Mobile	Email
Andrew Rutch	Cultural Heritage Coordinator Southern Region	1300 378 401	0459 840 294	Andrew.Rutch@datsip.qld.gov.au

09/06/2017 9:06 am

Lot on Plan Search

I refer to your application in which you requested advice on Aboriginal cultural heritage places recorded on the above location.

I wish to advise that no Aboriginal cultural heritage is recorded on the Cultural Heritage Database and Register in your specific search area, from the data provided by you. However, it is probable that the absence of recorded Aboriginal cultural heritage places reflects a lack of previous cultural heritage surveys of the area. Therefore, our records are not likely to reflect a true picture of the Aboriginal cultural heritage values of the area.

All significant Aboriginal cultural heritage in Queensland is protected under the Aboriginal Cultural Heritage Act 2003, and penalty provisions apply for any unauthorized harm. Under the legislation a person carrying out an activity must take all reasonable and practical measures to ensure the activity does not harm Aboriginal Cultural Heritage. This applies whether or not such places are recorded in an official register and whether or not they are located in, on or under private land.

Aboriginal cultural heritage, which may occur on the subject property, is protected under the terms of the Aboriginal Cultural Heritage Act 2003 even if the Department of Aboriginal and Torres Strait Islander Partnerships has no records relating to it.

Please refer to our website www.datsip.qld.gov.au/people-communities/aboriginal-and-torres-strait-islander-cultural-heritage for a copy of the gazetted Cultural Heritage duty of care guidelines, which set out reasonable and practical measures for meeting the duty of care.

Should you have any further queries, please do not hesitate to contact the approval officer on 1300 378 401.

Kind regards

The Director
Cultural Heritage | Community Participation | Department of Aboriginal and Torres Strait Islander Partnerships

09/06/2017 9:06 am

APPENDIX 18: NOISE MEASUREMENT MANUAL

Noise Measurement Manual

Queensland Government

Prepared by: Department of Environment and Science

Version	Date	Description of changes
2	1 March 1995	Major revision
3	1 March 2000	Major revision
4	22 August 2013	Major revision
4.01	10 March 2020	Minor revision

March 2020

Contents

Purpose

This document prescribes the processes required to measure noise in accordance with the Environmental Protection Regulation 2019 (EP Reg) under section 59 and 60.

Noise measurements taken using these procedures can be used by Authorised Persons to make assessments under the *Environmental Protection Act 1994* (EP Act) and subordinate polices and guidelines. These laws are enforced by the Queensland Government, local governments and other administering authorities.

Information included in this document is applied by administering authorities to assist in the decision making process for applying enforcement provisions under the EP Act.

Guidance material in the appendices should be used in conjunction with other relevant legislation and standards referenced within this document.

Scope

This manual explains how to:

- Plan a noise measurement
- Take on-site source and background noise measurements.
- Determine component levels by removing ambient noise
- Make adjustments to account for tonal and impulsive characteristics
- Report noise measurements.

Activities listed in schedule 1 of the EP Act (and as cross-referenced in Section 7, subsection (6)(a) and (b) of the Environmental Protection Policy, EPP (Noise)) are not within the scope of this manual. Exclusions in the scope also cover any licensed or unlicensed activities and operations of facilities considered to be ancillary to those listed in Schedule 1 of the EP Act (e.g. maintenance depots that support transport infrastructure).

Limitations

This document does not include guidance for all situations. Noise measurement methodologies outside the scope of this manual may be required. In those circumstances, detailed assessment notes should be taken which specify why the measurements were taken in a different manner. This manual is intended for use by Authorised Persons and those with a basic understanding of acoustics.

Legislation

Relevant legislation and subordinate policies include, but are not limited to, the following:

- *Environmental Protection Act 1994*
- Environmental Protection Regulation 2019
- Environmental Protection (Noise) Policy 2019 (EPP Noise)

Responsibilities of “Authorised Persons”

All ‘authorised persons’ as defined under the EP Act who conduct noise measurements are responsible for performing their work in accordance with the procedures described in this manual. Authorised persons must prove that no deviation from the procedures has occurred during noise measurement, except in special circumstances. Where deviation has occurred, the authorised person must provide details including a statement of reasons.

Acronyms and terms

Some frequently used acronyms and terms are detailed in Table 1.

Table 1. Acronyms and Terms

Acronym/term	Meaning
AS	Australian Standard
CASA	Civil Aviation Safety Authority
DA	Development Approval
dB	Decibel
DES	Department of Environment and Science
DTMR	Department of Transport and Main Roads
EA	Environmental Authority
EP Act	*Environmental Protection Act 1994*
EP Reg	Environmental Protection Regulation 2019
EPP Noise	Environmental Protection (Noise) Policy 2019
EPO	Environmental Protection Order
ERA	Environmentally Relevant Activity
Hz	Hertz
L_p	Sound pressure level
NATA	National Australian Testing Authority
OLGR	Office of Liquor and Gaming Regulation
Pa	Pascal
Registered Operator	A person or company who is currently on the Register to operate an ERA under an Authority
SLM	Sound level meter
TEP	Transitional Environmental Program

Purpose of measurement

Authorised Persons assess noise levels to establish a level of compliance with the EP Act. The noise measurements collected during site inspections may be used as evidence for enforcement.

Confirm jurisdiction

The officer investigating the noise nuisance must confirm what jurisdiction the complaint falls within. Table 2 indicates the distribution of responsibility between government bodies for controlling common noisy activities at the time of publishing this document.

Table 2. Responsible authorities

Activity	Local Government	OLGR	DES	DTMR	Police	Water Police	Airservices Australia	Commonwealth
Residential noise, ie air-conditioning units, pool pumps, animals.	■							
Devolved activities as listed in section 133 of the EP Reg 2019 *1	■							
Premises with liquor licence		■						
Activities described in Schedule 2 and not devolved to Local Government as listed in section 133 of the EP Reg 2019			■					
State owned or operated activities			■					
On road noisy vehicles and trail bikes				■				
Off road noisy vehicles and trail bikes					■			
Music, loud stereos, parties and rowdy behaviour and burglar alarms					■			
Boat noise, canals, rivers and creeks	■					■		
Aircraft in flight							■	
Helicopters							■	
Noise from Defence Force								■

Exceptions to devolution

An activity is not devolved to the relevant local government if:

a) the activity includes an environmentally relevant activity administered by the State at the same place (see r. 142 of the EP Reg)

b) the activity is carried out by a local government or the State (see r. 140 of the EP Reg)

c) the activity is carried out as a mobile and temporary activity in more than one local government area (see r. 141 of the EP Reg).

Complaint details and noise emission diary sheets

Prior to commencing a noise investigation it is suggested that the investigating officer request the complainant to complete noise emission diary sheets.

Refer Example Template **–** Noise Emission Diary Sheet (Appendix 1).

Investigation details and emission criteria

A noise assessment involves the examination of the nature and characteristic of a noise. The investigating officer must gather basic information relating to the complaint and noise source including, but not limited to:

- the type of noise
- the time the noise happens (noise may be a nuisance at any time of day or night)
- a subjective assessment of the source noise i.e. is the noise audibl**e within the complainant's backyard** and/or house; is the noise at a level that would preclude sleep or prevent the complainant from enjoying the confines of their own home; **or impact upon the complainant's ability to watch television etc.**
- the duration of the noise
- the frequency of the noise (both the tone/pitch and how often it occurs)
- notes of any other noise that can be heard, i.e. extraneous noises and any observation as to their relations in sound level (e.g. traffic noise is much louder than the noise under investigation, or the noise under investigation can be heard clearly over other noises etc.)

Before an Authorised Person can decide to issue a direction notice in relation to a contravention of section 440 of the EP Act involving an emission of noise, the Authorised Person must consider the general emission criteria as stated within section 363 of the EP Act.

Refer Appendix 5**—**Officer Checklist 1**—**Investigation Details/Emission Criteria.

Weather

A noise measurement should be taken on a day with a calm to gentle breeze and without rain. Some conditions to avoid are high wind (generally, do not conduct the assessment if the wind is higher than 5 meters/second (m/s)), or rain.

If it is necessary to measure in a wind-affected position, check the manufacturer's specification for the microphone and confirm that the windshield can be used in these conditions.

It may assist to check the Bureau of Meteorology website: http://www.bom.gov.au/ prior to conducting a site visit for the local weather forecast and wind conditions for the area.

The investigating officer must note the approximate wind speed using the Beaufort Scale as shown in Table 3.

Table 3. Beaufort Scale (Source AS 2221.1)

Wind force number	Explanatory notes	Specification of Beaufort scale for use on land	Mean wind speed m/s
0	Calm	Calm, smoke rises vertically	Less than 0.5
1	Light Air	Direction of wind indicated by smoke drift, but not by wind vanes	0.5-1.5
2	Slight Breeze	Wind felt on face, leaves rustle, ordinary vane moved by wind	1.5 - 3
3	Gentle Breeze	Leaves and small twigs in constant motion; wind extends light flag	3 to 5
4	Moderate Breeze	Raises dust and loose paper; small branches moved	5 to 8
5	Fresh Breeze	Small trees in leaf begin to sway; wavelets from the inland waters	8 to 11
6	Strong Breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty	11 to 14

Safety

If there are hazards in the general location of where the ideal measurement position is, find an alternative location or time with similar conditions, but without the hazard.

Refer Appendix 2—Personal Safety / Risk Reduction Measures.

Noise descriptors

A noise assessment may be completed for the following reasons:

- to determine if an environmental nuisance has been caused
- to verify if a noise standard has been contravened by emission of noise.

It is important to ensure the correct noise descriptor is assessed:

Time varying noise: $L_{Aeq,T}$ is used to quantify the noise where the L_p varies over time. In most situations, the $L_{Aeq,T}$ is the most appropriate descriptor used to investigate environmental noise complaints.

Steady noise: In cases where constant noise is present e.g. constant machine noise, the $L_{A90,T}$ can be used as an equivalent to $L_{Aeq,T}$. This generally has the advantage of removing extraneous ambient effects from the measurement. For example, noise from occasional traffic and birds won't be captured by the $L_{A90,T}$. The $L_{A90,T}$ descriptor is commonly used to assess noise emissions from sources including fan noise, domestic air-conditioners and pool pumps.

Short duration/non-steady noise: Impact, impulse and transient noise is measured with L_{Amax}. This noise descriptor is also used to assess sleep disturbance and awakening criteria as per WHO, 1999 and 2009

Frequency weighting

The frequency weighting, A, C and Z will be specified by the noise standard, guideline or licence condition. A-weighting is most common and should be used unless specified otherwise.

Time weighting

The Time Weighting (Fast, Slow or Impulse) will be specified by the noise standard, guideline or licence condition. Fast is the default unless otherwise specified.

Measurement time

The noise under investigation should be measured for sufficient time to establish that the measured value adequately represents the subject source noise. The source noise is measured over a time interval of at least 15 minutes or, if the noise continues for less than 15 minutes, the duration of the source noise.

Refer Appendix 3—Basic Acoustic Principles.

Measurement location

When an investigating officer is undertaking a noise assessment it is essential to make note of the following on a site map:

- location of noise source
- background noise measurement location
- source noise measurement location
- topography between noise source and sensitive receivers.

When assessing environmental nuisance or noise standards under the EP Act:

When assessing under the EP Act, select the location that is considered to best represent the most affected location. These measurements are typically conducted in or near buildings and are not required to be in a free field.

When assessing a licence condition under the EP Act:

The appropriate measurement location and descriptor should be referenced in the DA, licence conditions or notice/order i.e. at the nearest sensitive receiver, nearest commercial premises, nearest nuisance sensitive premises or boundary. These measurements are not required to be in a free field unless specified.

Measurement method

Handheld Quick Assessment

The handheld assessment method is useful to get an idea of noise levels, however a tripod should be used for a compliance inspection or to take enforcement action.

To obtain the most accurate data using this method, hold out the SLM at arm's length and hold it out to your side with the microphone pointed towards the source of the noise, to minimise sound reflecting off your body.

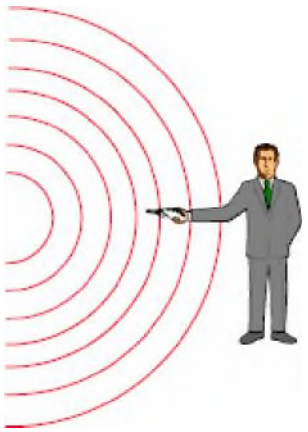


Figure 1. SLM handheld assessment method

Source Bruel & Kjaer

SLM (including microphone) mounted on tripod

SLM mounted on a tripod is the method used most commonly and is the standard methodology for most noise measurements where compliance/enforcement action may be taken as a result of the investigation.

Care should be taken not to make noises whilst observing the meter in this method and ensuring the least amount of reflective surface from your body is exposed to the meter.

Figure 2. SLM mounted on tripod *Source Bruel & Kjaer*

Affected height of the receptor

A noise reading should always be taken at the height of the receptor. If the receptor is at the ground level, take a measurement at the ground level (1.2–1.5m off the ground).

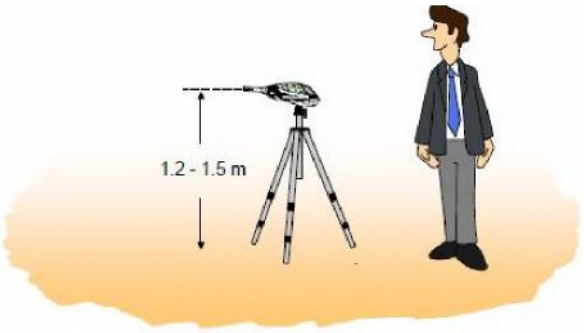


Figure 3. SLM measurement

Source Bruel & Kjaer

Microphone mounted on a tripod remotely from SLM

Sometimes situations and locations require setting up a microphone away from the location of the SLM mounted separately on a tripod. If the receptor is higher off the ground, raise the microphone to the level that is approximately at the middle of the window (or other opening to the dwelling) using an extendable tripod or position the meter in the plane of the window using an extension pole. The distance of the microphone from the façade of the building should be 3.5m.

Outside premises – free field measurements

Free field measurements are generally used to assess noise conditions set at property boundary or to assess a noise model calibration/validation point. Free field measurements are not required for measurements under the EP Act unless specified on the licence or approval conditions.

Any hard surface will reflect sound. If the microphone/SLM is placed too close to a reflective surface, the noise level will show up higher than the actual noise level. To avoid the reflection, take a reading more than 3.5m away from a reflective surface.

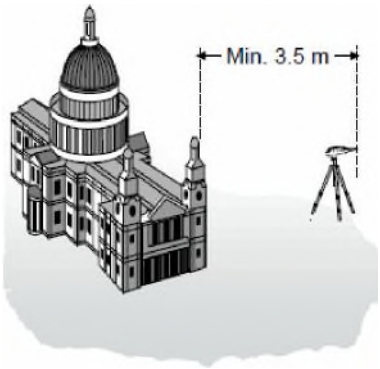


Figure 4. Minimum distance to nearest reflective surface outside premises

Source Bruel & Kjaer

Inside a room

Measurements inside buildings shall be carried out in those locations at which the noise of interest dominates. When investigating a sleep disturbance issue a noise assessment will be necessary in a bedroom, reference WHO 1999 & 2009. The preferred positions are at least 1m from walls or other major reflecting surfaces, 1.2m to 1.5m above the floor, and 1.5m from windows. The presence of furnishings or other reflective surfaces, which may result in shielding or scattering of the noise, should also be considered.

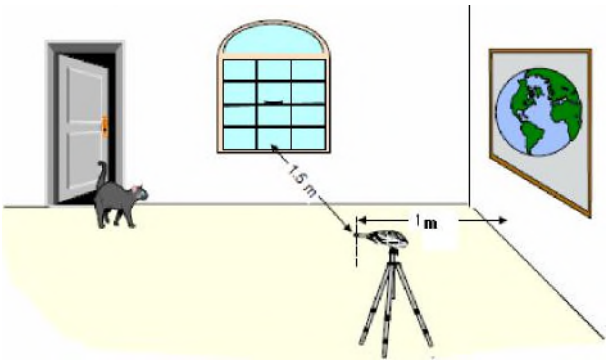


Figure 5. Minimum distance from nearest reflective surface inside room
Source Bruel & Kjaer

An outdoor location that is part of a building

(For example: under a veranda, porch, on a deck, balcony)

As per **Inside a room**. The same distances and considerations should be applied

Inside, at the façade of the building, in the plane or open window or open doorway

In many cases the intrusive noise will be most noticeable at the building opening most exposed to the source noise. In these cases, the part of the building of interest will be the open window or doorway.

The window or door should be open as wide as possible, with the microphone being located in the middle of that opening. For example see Figure 6 below:

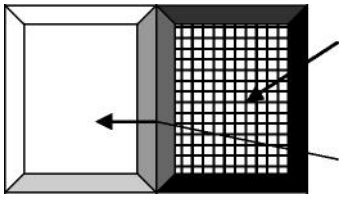


Figure 6. Measurement location with an open window

Where it is not possible to sufficiently open the window (e.g. awning window with limited opening as shown in Figure 7 below) then the measurement may be taken inside the room as discussed above.

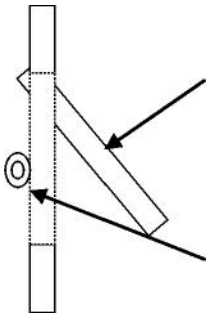


Figure 7. Measurement location with a window - limited opening

Measuring source noise and extrapolating back to the complainant's property.

An alternative method for measuring the noise under investigation is to move the sound level meter closer to the noise source to a point where the source clearly dominates, note this new position, and take a new reading. Measured levels may then need to be extrapolated back to the position of the affected resident.

Refer Appendix 4—Distance Attenuation.

Multiple noise sources

Many noise measurement situations require calculating the combined sound pressure level of multiple noise sources.

Refer Appendix 4—Multiple noise sources.

Long-term logging (unattended)

Noise logging can be useful in the following situations:

- When measuring irregular and infrequent noises, it is not always practical to measure the noise with an attended measurement.
- When it is difficult to determine the background noise during the attended period (e.g. the source doesn't stop during the attended period, or the background is known to be variable), noise logging can determine the background noise over a longer period of unattended measurement.

In these cases, the investigating officer may be able to conduct a 'logging', which allows monitoring of the noise for a longer period of time. In order to conduct outdoor logging of various durations, the SLM should be housed in an all-weather case and an outdoor all-weather microphone kit used to ensure damage to the meter/microphone does not occur. It is also important to ensure the security of the SLM, as the equipment is often very sensitive and expensive. The logger should be located using the same instructions indicated in the Measurement method section. Where an officer does perform unattended logging, it is suggested that attended measurements are also completed to calibrate the results of the unattended logging.

Calibration

There are two types of calibration necessary for noise monitoring equipment–laboratory calibration and field calibration.

Laboratory calibration

It is essential to ensure that the SLM and calibrator have been calibrated in a National Australian Testing Authority (NATA) certified calibration laboratory. The calibrators are required to be calibrated every year and the SLM must be calibrated as per the manufacturer's specifications. A sticker on the SLM and calibrator indicates the last recorded date of laboratory calibration

Field calibration

Calibration of the SLM is to be carried out before and after each set of noise measurements in accordance with AS IEC 61672.1-2004 (Standards Australia 2004a). The investigator should also recalibrate each time the SLM is moved to different locations.

The L_p shown on the meter should match the stated L_p for the calibrator being used. Standard calibration is generally 94 dB(A) but can vary slightly due to the microphone sensitivity e.g. 93.8 dB(A). The calibration level should be confirmed with the SLM manufacturer's specifications. The variation before and after the calibrations should be no more or less than 1 dB(A). If the deviation of the calibration is greater than 1 dB(A) then the results obtained during the assessment are invalid.

The background noise assessment

The background Lp is commonly referred to as the background noise level or LA90 in the absence of the source noise. Accurate measurement of the background level is important, as it is often one of the criteria used when assessing the impact or potential impact of intrusive noise.

Short term background measurements

For noise assessment purposes the short-term background noise level is generally taken as the L_{A90} level measured by the SLM, excluding all distinct extraneous noises. A minimum measurement time of 10 minutes is required to determine the background noise level under AS 1055.1. One of the most common extraneous noises encountered in Queensland whilst conducting a noise assessment is constant cicada noise. Cicadas only occur during certain periods of the day and it is advisable to postpone measurements until the insect noise stops, or return at another time. Extraneous noises which may contaminate a background noise measurement include insects, machinery and other long-duration noise sources that are not typical of the area and which can be easily distinguished and clearly identified during the measurement period. Most short-term extraneous noises will not be captured by the L_{A90}, however where this cannot be circumvented these must be reported. Ensure the background is representative of the worst-case scenario and the background noise level should be ideally measured immediately before or after the assessment of the source noise at the same location. If more than one background noise assessment is completed it is advisable to use the lowest result.

Long term background measurements

For more complex situations it may be necessary to complete long-term background monitoring. This involves measuring the L_{A90} for 8 hours or more using a SLM and is generally used for complex noise investigations.

The following time periods are generally used for background noise measurements:

- Day: 7am to 6 pm
- Evening: 6pm to 10pm
- Night: 10pm to 7am.

Comprehensive long term background noise methodology is described in the DES Planning for Noise Control Guideline.

Remote background assessment

When the noise source cannot reasonably be turned off, a background noise level can be measured at a location which has the same background noise characteristics, but away from the impact of the source noise (i.e. in a remote location).

When selecting a site to conduct remote background noise measurement, care should be taken to note the noise characteristics of the affected premises, then ensure similar distances are maintained from the major sound sources such as main roads, railway lines, forest and industrial zones (other than the one under investigation), to ensure the site has the same background noise characteristics as the affected premises.

Taking a remote background noise assessment is a less preferred method, however, in the event that this method is the only option, Record detailed notes and complete a site sketch showing the location of assessment in relation to the sensitive receiver and location of source noise.

Calculation of component noise levels

The influence of ambient noise must always be removed from the source noise level measurements for the purposes of comparison with noise limits. The source noise level with ambient noise removed is referred to as the component level. The simplest method to ensure the ambient noise is removed from the source noise is to measure at a time when the ambient noise is sufficiently low [more than 10dB(A) below the source noise level] The noise assessment

may require a measurement during periods of low ambient noise, even if that does not correspond to the time of complaint, to get a definitive result. In this case the measured noise level and component level are effectively equal.

It is also possible to mathematically remove the influence of the ambient noise from the source noise by logarithmic subtraction. Care should be exercised using mathematical adjustment, which is generally only applicable where the ambient noise environment is reasonably steady.

Table 4 provides a method for mathematical subtraction, where:

A = the measured result on site of the noise source plus ambient noise (continuous)

B = the result of the ambient noise level (continuous) only measurement

C = the noise source component level (continuous) only with the influence of the ambient noise level (continuous) removed

Table 4. Calculation of component noise levels

NOTES: * Such a result indicates that it is unlikely that noise from the noise source is an issue due to the masking effect of the ambient noise.

*,† Care should be exercised with such results as it indicates a difficult measurement. The measurement should be repeated over a number of periods to give confidence in the result. It may require measurement during periods of low ambient, even if that does not correspond to the time of complaint, to get a definitive result.

A minus B	**C**
0	At least A minus 10*
1	At least A minus 5*
2	A minus 4†
3	A minus 3†
4	A minus 2
5	A minus 2
6	A minus 1
7	A minus 1
8	A minus 1
9	A minus 1
10 or more	A

Where both the ambient noise and the source noise are reasonably steady, the L_{A90} descriptor can be used for the A minus B calculation above. This will often be the case for mechanical plant noise, such as air conditioning, refrigeration equipment and pump noise. In situations where the source noise varies with time, the L_{eq} descriptor should be used for the A minus B calculation.

Alternatively, the A-B calculation can be performed directly with the following formula:

Component Level $= 10 \times \log(10^{A/10} - 10^{B/10})$

This can be done in a spreadsheet, e.g. In MS Excel ®: (to subtract cell A1-B1)

=10*LOG(10^(A1/10)-10^(B1/10))

Corrections are then applied to the ***component level*** in recognition of the annoyance generally associated with a noise which is dominated by tonal or impulsive characteristics. This is discussed in later sections.

Adjustments made to noise levels with annoying characteristics

If a noise has tonal characteristics (especially at high frequencies) or impulsive characteristics, it is generally perceived more annoying than a noise heard without these characteristics. Examples of tonal noise include, reversing beepers, alarms, bells, buzzers, the screeching of mechanical plant, grinding metal. Examples of impulse noises include, a metal press and hammering.

Tonality adjustments

Tonal noise can be defined as having a prominent frequency and characterised by a defined pitch. A tonal characteristic can be identified objectively in accordance with the method in Australian Standard AS1055.2018

Acoustics - Description and measurement of environmental noise. The method involves comparing noise levels in adjacent one-third octave bands.

The standard states:

> *If tonal components are clearly audible and they can be detected by a one third octave analysis the adjustment may be 5dB. If the components are only just detectable by the observer and demonstrated by narrow band analysis, an adjustment of 2-3dB may be appropriate.*

If the A-weighted 1/3rd octave analysis confirms that the tonal band exceeds both neighbouring bands by 5dB the user is permitted to subjectively adjust the level. The adjustment can be 0 to 5dB to the ***component level*** depending on the audibility of the tone.

Alternatively, this analysis and correction can be performed quantitatively by performing the following check.

- Confirm the A-weighted 1/3rd octave band exceeds the neighbouring bands by 5dB
- Add 5dB to the tonal 1/3rd octave band
- Logarithmically sum all A-weighted 1/3rd octave bands, including the adjusted band
- The arithmetic difference between the log sum determined in (3) and the original overall A-weighted level becomes the tonal correction

Example: An officer measures noise from a machine and notices an audible low frequency tone at 50Hz. The total level of the measurement was 58dB(A). In this case the ambient level was more than 10dB below the measured level, so the component level is 58dB(A). Subjectively the tone was just audible as it was masked somewhat by the overall machine noise. The 1/3rd octave band component level data was entered into a spreadsheet as shown below. A 5dB correction was added to the 50 Hz 1/3rd octave band level.

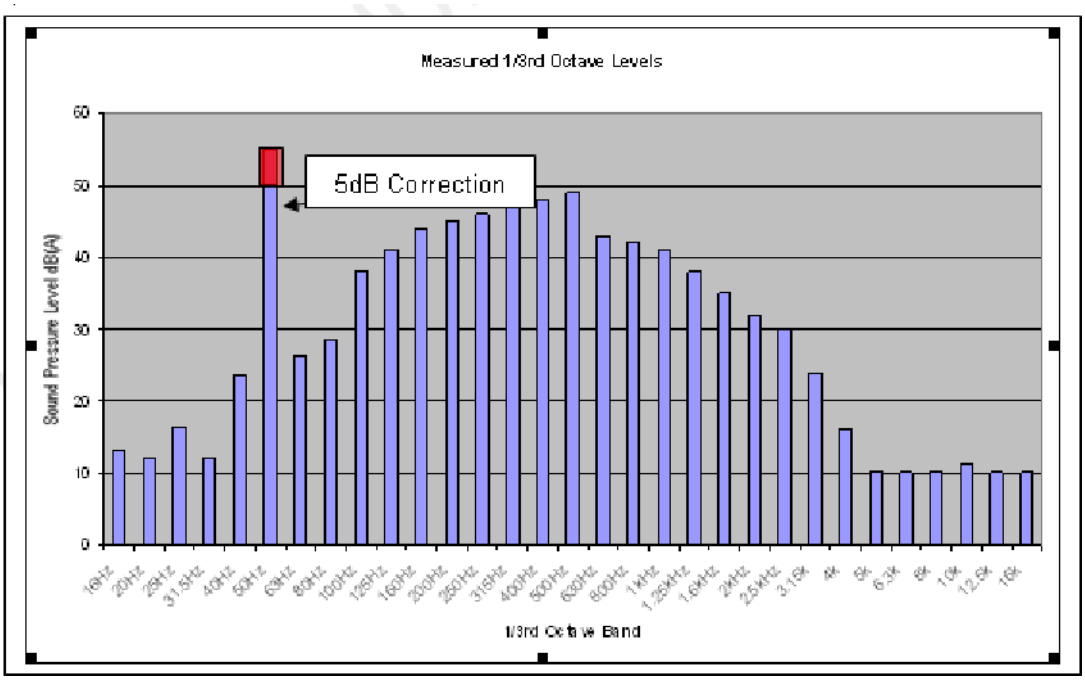


Figure 8. one-third octave band analysis

Logarithmically summing the one-third octave bands, including the corrected band gives a new total of 61dB(A). This is 3dB higher than the component level. The new corrected component level becomes 61dB(A), (i.e. a 3dB tonal correction).

Impulsive adjustments

Impulse noise can be defined as having a high peak of short duration or a sequence of such peaks (bangs, clicks, clatters, or thumps). To determine if an adjustment is necessary the investigating officer must measure the source noise using both A-weighted Fast response and Impulse response. If the difference in A-weighted maximum noise levels between Fast response and Impulse response is greater than 2dB then apply difference in measured levels as the correction up to a maximum of 5dB. The impulse adjustment should then be added to the component level (L_{Aeq} or $L_{Amax)}$ and should not exceed 5dB. Combined adjustments for tonality and impulsive noise in total should not exceed 10dB.

Low frequency noise

Low frequency noise can be defined as noise that has a dominant content less than 200Hz. Noises below 20Hz are known as infrasound and are usually not audible but rather felt as a vibration, pulsating sensation or pressure on the ears or chest. Types or activities that may produce low frequency noise include pumps, fans, boilers, ventilation plant, electrical installations and wind turbines.

Refer Appendix 3—Basic Acoustic Principles.

Saving information and record keeping

To ensure data collected conforms to rules of evidence, detailed records of the investigation and methodology must be kept. The noise assessment must be completed in accordance with this manual however where special circumstances have lead to deviations, detailed notes and records must be provided explaining the reasons for deviation.

- Refer Appendix 5—Officer Checklists:
- Investigation Details / Emission Criteria
- Noise Assessment Equipment Checklist
- Noise Assessment Procedure
- Noise Assessment Field Notes.

Controls

First review to be made in 12 months and then every 3 years thereafter by Operational Support Branch.

References

AS IEC 61260.1:2019 Acoustics – Octave-band and fractional-octave-band-filters.

British Standard 4142:1997, Rating *industrial noise affecting mixed residential and industrial areas*, London, UK.

Bruel and Kjaer (2000), *Environmental Noise*, Bruel & Kjaer Sound and Vibration Measurement A/S.

DECC 2009, *Interim Construction Noise Guideline*, Department of Environment and Climate Change NSW, Sydney, Australia.

Department of Environment and Resource Management (2000) "*Noise Measurement Manual*", 3rd Edition, Queensland, Australia.

EHA, Environmental Noise Course Notes, prepared by Frank Henry, 2010, for Department of Environment and Resource Management.

Environmental Protection Act 1994, Queensland Government, Reprinted 3rd February 2012, Reprint No. 10E

EPA 2000 "*NSW Industrial Noise Policy*", Environment Protection Authority, Sydney, Australia.

EPA 2004 *Ecoaccess Guideline for the assessment of low frequency noise*, Roberts. C, Brisbane, Australia.

Frankel LLP & Kramer Levin Naftalis, 2006, West 61st Street Rezoning Project EIS, http://www.nyc.gov/html/dcp/html/env_review/west_61st.shtml

Hassall, JR & Zaveri, K 1988, *Acoustic Noise Measurements, Bruel and Kjaer*, 5th Edition, K. Larsen & Son, Denmark.

NSW 2010 *Noise Guide for Local Government*, Department of Environment, Climate Change and Water NSW, Sydney.

Rumble, R., (2011) "*Coal seam gas industry procedural guide control of noise from gasfield activities*", prepared for the Department of Resource and Environmental Management, Queensland.

South Australian EPA (2009), *Guidelines use of the Environment Protection (Noise) Policy 2007*, Adelaide.

Standards Australia AS 1055:2018 Acoustics – Description and measurement of environmental noise.

Part 1: General procedures

Part 2: Application to specific situation

Part 3: Acquisition of data pertinent to land use

Standards Australia AS/NZS IEC61672.1:2019 Electroacoustics – Sound Level Meters – Specifications.

Standards Australia AS IEC 61672.2:2019 Electroacoustics - Sound level meters - Pattern evaluation tests.

Standards Australia AS 1633-1985 Acoustics – Glossary of terms and related symbols.

Standards Australia AS 2659 – Guide to the use of sound measuring equipment.

Part 1: Portable sound level meters

Tasmanian Department of Environment, Parks, Heritage and Arts 2008, Noise Measurement Procedures Manual, 2nd Edition.

WHO 1999 - Guidelines for community noise, World Health Organisation 1999

WHO 2009 - Night noise guidelines for Europe. World Health Organisation 2009

Appendix 1

Noise emission diary sheets template

Day and time	Time started	Time finished	Description of noise	How did the noise affect you?

Appendix 2

Personal safety

Before embarking on any site inspection it is essential that officers are aware of their legislative responsibilities for *WorkPlace Health and Safety Act 2011*.

Some of the common risks encountered whilst conducting a noise assessment include

- vehicles on the road
- machinery on site
- people (especially when conducting noise assessment at night)
- overhead wires (especially if you are raising a microphone using an extendable tripod)
- animals (dogs, stinging insects and snakes are common in some places); and
- weather including cold, heat, humidity and the sun.

Officers should be aware of their surroundings and assess any potential dangers associated with conducting a site visit and noise assessment. Hearing protection may be required when conducting environmental noise assessments.

The primary criterion for selecting a hearing protector is that the level of noise entering ears must be reduced to below the legal limits of the Workplace Health and Safety Regulation 2008, which are:

a) an 8-hour equivalent continuous A-weighted sound pressure level of 85 dB(A), referenced to 20 µPa; or

b) a C-weighted peak sound pressure level of 140 dB(C), referenced to 20 µPa.

Risk reduction measures

Once the risks are identified, the officer should consider how to reduce the risks. In most cases, the risks to personal safety while conducting noise assessment can be eliminated altogether or reduced significantly by moving to an alternative location or wearing personal protective equipment (PPE).

Personal safety comes first. No task is so important that safety can be compromised.

Appendix 3

Basis acoustic principles

Sound and noise

Sound is the mechanical vibration of a gaseous, liquid or elastic medium through which energy is transferred away from the source by progressive sound waves. Hearing is simply fluctuations in air pressure detected by the ear. ***Noise*** has a subjective quality and is often defined as unwanted sound.

Measuring sound

Air or sound pressure is measured in Pascals (Pa) but is expressed as a sound pressure level (L_p) in decibels (dB), which is a logarithmic scale used to compress the range of audible sound pressure. The relationship between sound pressure and L_p is as follows:

$$L_p\ (dB) = 10 \log(p^2 / p_{ref}^2) = 10 \log(p / p_{ref})_2 = 20 \log (p / p_{ref})$$

Where ***Lp = sound pressure level (dB)***

p = sound pressure (Pa)

$p_{ref} = 2 \times 10^{-5}$ ***- reference sound pressure (Pa)***

Some useful rules of thumb:

- Some typical sound pressure levels of common noise sources are detailed in Figure 8.
- Table 5 shows the subjective effect of changes in noise levels.

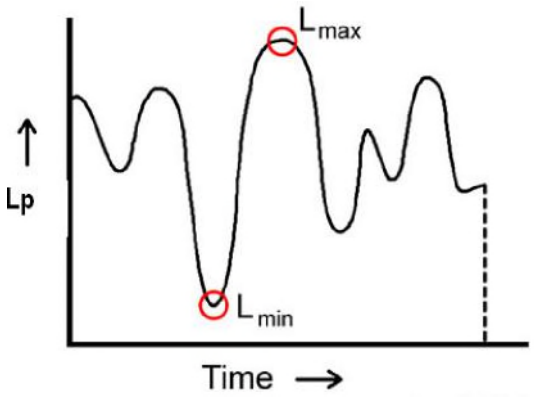
Noise descriptors used in impact assessment

The parameters frequently used for measuring noise include L_{Amin}, L_{Amax}, ^{and} L_{Aeq} ^{and} L_{A90}. Most contemporary SLMs record multiple noise parameters at the same time.

L_{Amin} ^{and} **$_{LAmax}$** refer to the equivalent minimum and maximum values recorded by the SLM during an assessment, see Graph 2. L_{max} is often compared to the L_{A90} (background) to describe the likely impact of non–steady noise such as fluctuating or impulsive noise.

L_{AmaxT} is the A-weighted L_p **obtained by using 'fast' time response and arithmetically averaging the visual maximum** levels of the noise under investigation, unaffected by extraneous noise, during the measurement period. This parameter is usually used for impact and/or intermittent noises, as this parameter does not account for a more constant noise.

L_{AmaxT} is generally only used where noise assessment is carried out using a non-integrating (analogue or digital) SLM and where the SLM does not have the capacity to calculate the statistical (i.e. **L%** sound pressure levels).

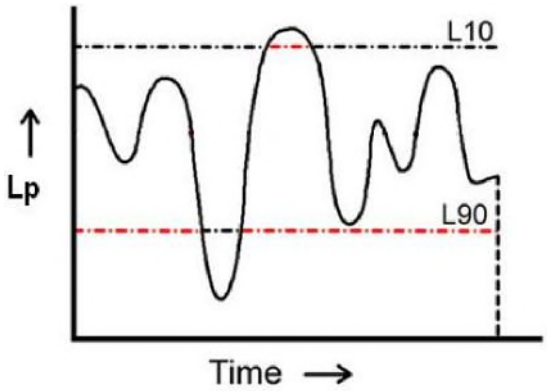


Graph 1. L_{Amin} and L_{Amax}

L_{AeqT} is the A-weighted equivalent continuous L_p of the sample time T. The $L_{Aeq,T}$ is also known as the 'time average sound pressure level' or the 'level of noise equivalent to the energy average of noise levels occurring over a measurement period'. This is the current default descriptor for environmental noise measurement. It is used widely throughout the world for measuring noise sources and it is an extremely versatile parameter.

L_{peak} is not the same as the Maximum Sound Level. The Peak, referred to as the L_{peak} or sometimes L_{pk}, is the maximum value reached by the sound pressure. There is no time-constant applied. This is the true peak of the sound pressure wave. This parameter is commonly seen within the development conditions of mines and used to regulate blasting operations.

Percentile levels are commonly used when measuring environmental noise. This is represented by L_n, where n may be a value from 1 to 99. L_n represents that noise level exceeded for n% of the measurement time. Common percentiles used are shown in Graph 2.



Graph 2. Common percentiles

L_{A90} is the sound pressure level that has been exceeded for 90% of the time. This level is taken to be the background sound pressure level.

$L_{Abg,T}$ is also known as the 'background sound pressure level', (also known as the average minimum sound pressure level) and is the A-weighted L_p obtained using 'fast' time response and arithmetically averaging the visual minimum levels of the noise under investigation, unaffected by extraneous noise, during the measurement period.

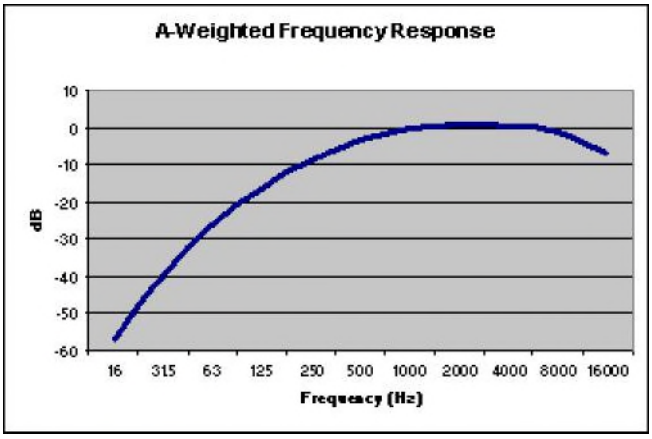
In cases where $L_{Abg,T}$ has been referenced in development approvals or legislation, it is to be taken as $L_{A90,T}$. ($L_{Abg,T}$ = $L_{A90,T}$ (unaffected by extraneous noise)).

L_{A10} is the sound pressure level exceeded for 10 % of the time of the measurement duration.

Setting up of SLM and frequency weightings

A- weighting

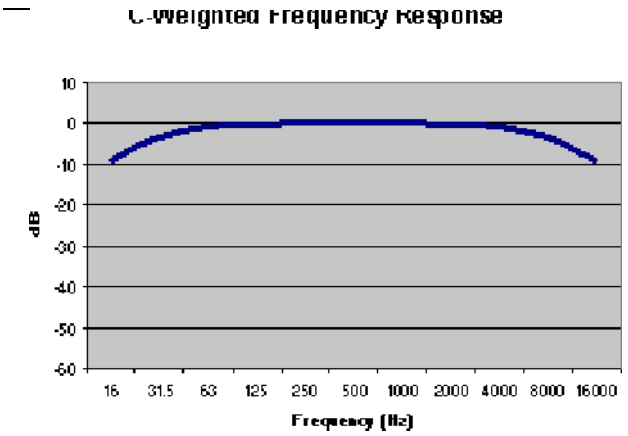
The most common weighting used in environmental noise measurement is A-weighting. The A-weighting represents the way the human ear is more sensitive to mid-range frequencies and less sensitive to high and low frequencies. Defined in the sound level meter standards (IEC 60651, IEC 60804, IEC 61672, ANSI S1.4), a graph of the frequency response can be seen to the right. A-weighted measurements are expressed as **dB(A)**, see Graph 3.



Graph 3. A-weighted Frequency Response

C-Weighting

The response of the human ear varies with the sound level. At higher sound pressure levels, the ear's response is flatter, as shown in the C-Weighted Response to the right. Although the A-Weighted response is used for most applications, C-weighting is also available on many SLMs. C-weighting can be used for Peak measurements and low frequency noise. It is often used in entertainment noise measurement, where high pressure low frequency noise is common. The C-weighting is also commonly used for sounds with impulsive characteristics such as fire-arms; shooting ranges; pile driving. C-weighted measurements are expressed as dB(C), see Graph 4.



Graph 4. C-weighted Frequency Response

Z-Weighting

Z-weighting is a flat frequency response of 0.5Hz to 20kHz ±1.5dB. This response replaces the older "Linear" or "Unweighted" responses. Z-weighted measurements are expressed as **dB(Z)**. Z-weighting has recently been used to measure explosive sounds and in the assessment of low frequency noise.

For most environmental assessments A-weighting will be used.

Time weighting

Sound level measurements using any grade of SLM can be **Fast**, **Slow**, or **Impulse** time weighted. The **Impulse** time weighting is about four times faster than **Fast**, with a short rising time constant but a slow falling one. **Fast** corresponds to a 125 ms time constant. **Slow** corresponds to a 1 second time constant. **Impulse** has a time constant of 35ms.

Ambient noise level

The ambient noise level is defined as the totally encompassing sound in a given situation at a given time, composed of sound from all sources near and far, measured using the equivalent continuous sound pressure level $_{(LAeq)}$ noise descriptor.

Rating level

The rating level can be defined as a specific noise level plus any adjustment for the character of the noise (tonal and/or impulsive) determined over the reference time interval.

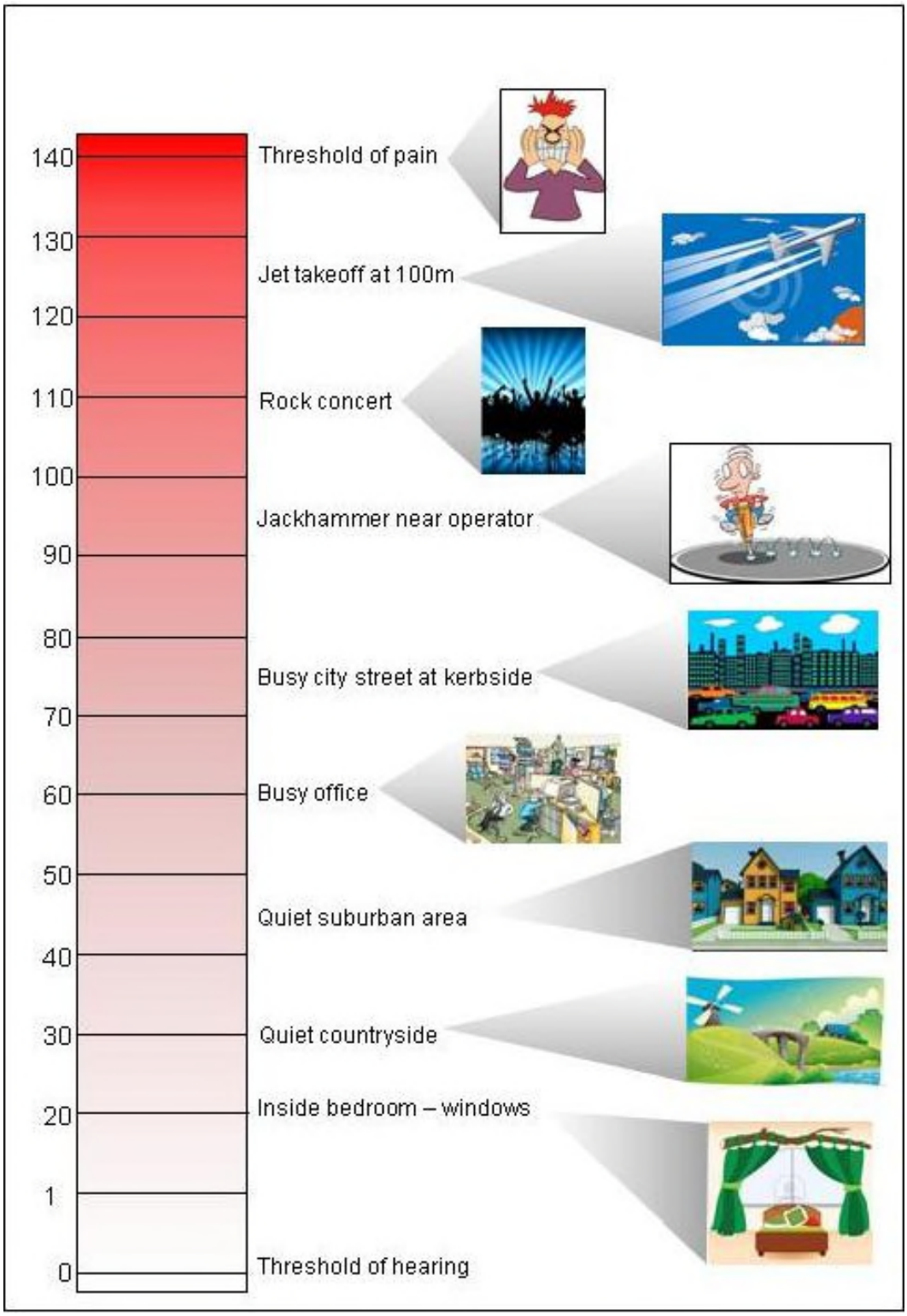


Figure 9. Common sound pressure levels dB(A)

The following tables are useful references when providing a qualitative description to related changes in sound pressure levels dB (A).

Table 5. Subjective effect of changes in noise levels

Change in level of dB	Subjective effect
3	just perceptible
5	clearly perceptible
10	twice as loud

Source Bruel & Kjaer

Table 6. Estimated community response

Amount in dB(A) by which the rating level exceeds the noise criterion	Estimated community response	
	Category	**Description**
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very strong	Vigorous community action

Source Bruel & Kjaer

Appendix 4

Distance attenuation

If the source noise is affected by extraneous noises another method to address this is to conduct a measurement where the SLM is moved closer to the source and measured levels need to be extrapolated back to the sensitive receiver/boundary. The new location must be selected where the source noise clearly dominates the area and clear notes must be taken regarding the new monitoring location. Once noise levels have been determined at this location it is possible to predict the noise level at the affected premises by extrapolating to the desired measuring location using the formulas relevant to distance attenuation.

Do not to measure too close to the source in the 'near field'. As a general rule, being at least one-third the length of the longest dimension of the source away will be outside the near field.

This method is only appropriate when terrain between source and receiver is flat and unobstructed, because effects of topography on attenuation are much reduced.

Distance attenuation is the reduction of L_p as a function of distance. As a general rule the L_p will decrease by 6 dB with a doubling of distance from a point source in the free field.

The following relationships can be used to quantify distance attenuation, reference Figure 9:

- **SPLx = SPLy – 20log(Dx/Dy) for a point source (e.g mechanical fan)**
- **SPLx = SPLy – 10log(Dx/Dy) for a line source (e.g heavy traffic along a road)**

  Where

  > SPLx = L_p at distance x from the source in metres (predicted)

  > SPLy = L_p at distance y from the source in metres (measured)

  > Dx = distance in metres to location x from the source

  > Dy = distance in metres to location y from the source

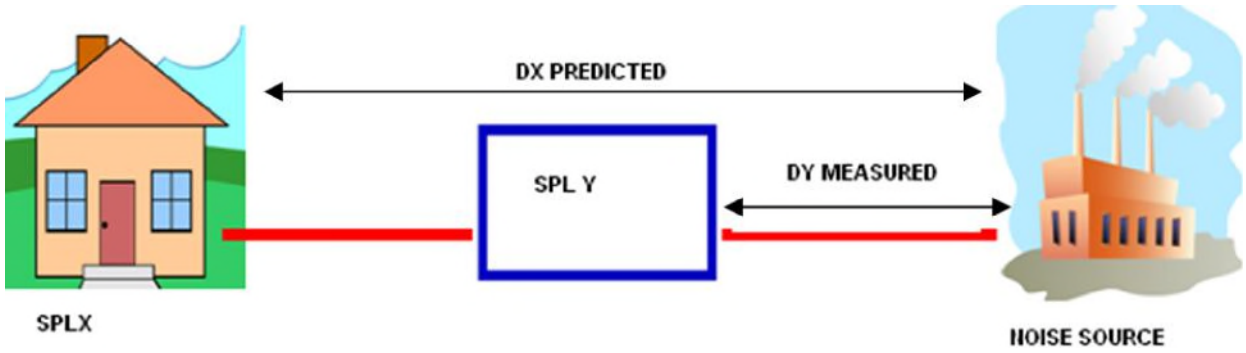


Figure 10. Pictorial representation of equation used for calculating distance attenuation

Note that the geometric distance attenuation method described above does not include several factors. Noise attenuation can often be affected by barriers, buildings, ground absorption, reflection from hard surfaces, air absorption and other atmospheric effects. These are beyond the scope of this document.

Further information is available in:

- ISO 9613:1996 Acoustics -- Attenuation of sound during propagation outdoors
- Engineering noise control : theory and practice / David A. Bies and Colin H. Hansen

Multiple noise sources

Many noise measurement situations require calculating the combined sound pressure level of multiple noise sources. As previously discussed sound pressure levels are expressed in a logarithmic scale and can therefore not be arithmetically added. For example, 40dB plus 40dB does not equal 80dB,

To add two or more noise levels reference Table 7.

Hence, 40 dB + 40 dB = 43 dB.

Sound power level difference between two Sound Sources (dB)	**Added decibel to the highest sound power level (dB)**
0	3
1	3
2	2
3	2
4	1
5	1
6	1
7	1
8	1
9	1
10 or more	0

Table 7. Multiple noise sources - addition of dB

Alternatively, an A+B calculation can be performed directly with the following formula:

Total Level $=10 \times LOG(10^{A/10} + 10^{B/10})$

This can be done is a spread sheet, e.g. In MS Excel ®: (to add cell A1+B1)

=10*LOG(10^(A1/10)+10^(B1/10))

Appendix 5

Officer Checklist 1 – Investigation details / Emission criteria

Before conducting a noise assessment, contact the complainant to gather basic information required to start an investigation.

The information should include:

a) the emission**'s characteristics or qualities**

b) **the emission's amount or rate**

c) the duration and time of the emission

d) whether the emission is continuous or fluctuating

e) the characteristics and qualities of the receiving environment, including the types of emissions that could reasonably be expected in the receiving environment

f) **the emission's impa**ct on the receiving environment

g) in relation to each affected person for the emission:

(i) any views of the affected person about the emission of which the authorised person is aware, including views about the degree of interference caused, or likely to be caused, by the emission to lawful activities at the place occupied by the affected person

(ii) the order of occupancy between the person causing the emission and the affected person

(iii) for the period during which the person causing the emission has occupied the place from which the emission is generated and the affected person has occupied the place affected by the emission**—**

- any structural or other changes to either of those places
- any change to the activities conducted at either of those places by the person causing the emission or affected person

h) any mitigating measures that have been taken or could reasonably have been taken by the person causing the emission.

The noise emission criteria are as follows**—**

a. if the authorised person has measured a sound pressure level for the noise**—**that level

b. the audibility of the noise

c. whether the noise is continuous at a steady level or whether it has a fluctuating, intermittent, tonal or impulsive nature

d. whether the noise has vibration components.

Officer Checklist 2–Noise assessment equipment checklist

Table 1 Equipment checklist

Equipment	Checked
SLM and Calibrator - Calibrated	
Protective case for SLM	
SLM Battery Life / Charged	
Wind Shield	
Tripod	
Outdoor Weather Equipment	
Outdoor battery pack charged	
Memory Cards for SLM	
Camera	
Paper / Record Sheet / Pen	
Personal Protective Equipment	

Officer Checklist 3–Noise assessment procedure

1. Select time when source noise is representative of the maximum level of noise from the activity.
2. Check settings of SLM:
    i. 'Fast' time weighting
    ii. 'A' frequency weighting
    iii. Audio recording on SLM – this can provide additional evidence.
    iv. Frontal incidence for microphone
3. Note the approximate wind speed using the Beaufort scale as shown in Table 3 of the NMM. Do not take measurements if raining or wind speed greater than 5 meters/second – (Leaves and small twigs in constant motion; wind extends light flag)
4. Calibrate the noise monitoring equipment before and after each set of noise measurements.
5. Set up the SLM up on the tripod.
6. Complete a background noise assessment-
    i. This is the $L_{A90, T}$
    ii. Ensure measurement taken in the absence of source noise
    iii. Measure continuously for a minimum time of 10 minutes
    iv. Ensure all extraneous noises are excluded – investigating officer to make detailed notes during the assessment.
7. Complete an assessment of the source noise –
    i. For time varying noise use the descriptor $L_{Aeq,T}$
    ii. The $L_{A90,T}$ descriptor is commonly used to assess noise emissions from sources including fan noise, domestic air-conditioners and pool pumps
    iii. Where source noise is affected by extraneous noises, move SLM closer to the source where it clearly dominates the area, note the new monitoring position and then these readings can be extrapolated back to the position of the complainant – see Appendix 3 'Distance Attenuation' for further information.
8. Make notes of any audible tonal and impulsive characteristics of the noise and ensure use of appropriate correction factors.
9. Take photos of both background and source noise measurement locations.
10. Save data.
11. Re-calibrate the SLM. In the event that the deviation from the first calibration is greater than 1 dB(A) then the results obtained will not be valid and the assessment will have to be repeated.

Officer Checklist 4–Noise assessment field notes

Investigating officer: _____ Address:

Noise source: _____ Date: _

Site Sketch:

- Location of nearest sensitive receiver
- Location of noise source
- Background noise measurement location
- Source noise measurement location
- Note of topography between source and sensitive receivers.

Notes

Weather, wind speed, audibility of noise, characteristic of noise, continuous or fluctuating, tonal, impulsive, extraneous noises in area, detail methodology of noise assessment and state where any deviations from procedures have occurred and why:

I _____ (print name) certify that the noise assessment has been completed in accordance with the Noise Measurement Manual. Signature _____

Investigating officer: _____ Address:

Noise source: Date:

Measurement: background / source	Calibration start	Calibration end	Time started	Time finished	Notes: subjective assessment, extraneous noises, noise characteristics i.e high pitched / droning, impulsive, tonal.

APPENDIX 19: WASTE MANAGEMENT PLAN

CLIENTS | PEOPLE | PERFORMANCE

Westlink Pty Ltd

Report for Westlink Power Project

Waste Management Plan

February 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

1. Introduction

1.1 The Project

In response to the rapidly growing demand for electricity, Westlink Pty Ltd (Westlink) is proposing a staged development of a natural gas-fired power station at a site north of Gatton in South-East Queensland, referred to as the Westlink Power Project (WPP).

The proposed WPP is to be located on a parcel of land near the township of Gatton; approximately 90 km west of Brisbane and approximately two kilometres north of Gatton, immediately north of the Warrego Highway on Fords Rd, Adare.

On the 4th of September 2009, Westlink lodged with the Lockyer Valley Regional Council (LVRC) a Development Application (DA) complete with a detailed Review of Environmental Factors (REF) for the WPP. Specifically, the DA is over Lot 191 on Crown Plan CSH2361 situated in the County of Cavendish, Parish of Lockyer contained in Certificate of Title, Title Reference 17000028 and is seeking a:

- Development Permit for a Material Change of Use (MCU) for the Electricity Generation Infrastructure;
- Development Permit for Environmentally Relevant Activity (ERA) No.14; and
- Development Permit for Operational Work (OW) for Vegetation Clearing.

The proposed use is more specifically defined as a natural gas-fired power station, consisting of the following elements:

- Staged installation of six open-cycle gas turbines;
- An electrical switchyard;
- A gas receiving unit;
- An operations building, workshop, administration building and car park; and
- Associated safety and monitoring equipment.

The proposed WPP is to be built in stages, in line with growing demand for electricity. Subject to development approval, the first stage of the project is expected to consist of 200 to 300 MW of generating capacity, with future expansion leading to a total project comprising up to 1,000 MW of open cycle gas turbines.

1.2 Purpose

The purpose of this Waste Management Plan is to provide a response to Lockyer Valley Regional Council (LVRC) and/or the Department of Environment and Resource Management (DERM) with information requested as part of this application process. This Waste Management Plan specifically address request item no. 8 of the LVRC information request outlined in correspondence dated 5th October 2009 and the DERM information request generally.

1.3 Information Requested

The requests for information addressed in this report are as follows:

DERM Information Request - EPA Item 1(d)

Provide a Waste Management Plan prepared in accordance Ecoaccess Information Sheet - "Information to be provided with an application for an environmentally relevant activity (ERA)".

Response:

As requested this Waste Management Plan has been prepared in accordance with the aforementioned information sheet.

LVRC Information Request - Waste Item 8

Identify a management regime which reduces reliance on Council Landfill.

Response:

This Waste Management Plan provides an appropriate management regime to handle wastes generated from the WPP that also addresses the limited waste disposal options at the Gatton Landfill site. Furthermore, Section 3.2 of this Waste Management Plan includes a list of alternative potential waste recycling and/or waste disposal facilities which may be utilised.

1.4 Limitations

It is important to note that this Waste Management Plan is a working document and currently contains estimates of the proposed quantities of wastes that will be generated by the WPP. Therefore this document should be updated as the design phase progresses and in response to the proposed staged construction.

2. Relevant Legislation

2.1.1 Waste Definition

The definition of waste as outlined in the *Environmental Protection Act (1994)* is adopted by Westlink for this project. This definition states:

Waste includes any thing, other than a resource approved under subsection (4) that is

a) Left over, or an unwanted by-product from an industrial, commercial, domestic or other activity; or

b) Surplus to the industrial, commercial, domestic or other activity generating waste.

This covers non-hazardous, prescribed, regulated and trackable wastes.

Waste management practices are based on the principles and requirements outlined in the following Queensland legislation:

- *Environmental Protection Act 1994 (Qld);*
- *Environmental Protection Regulation 2008 (Qld);*
- *Environmental Protection (Water) Policy 2009 (Qld);*
- *Environmental Protection (Waste Management) Policy 2000 (Qld);*
- *Environmental Protection (Waste Management) Regulation 2000 (Qld);*
- *Workplace Health and Safety Act 1995 (Qld);* and
- *Workplace Health and Safety Regulation 2008 (Qld).*

2.1.2 Environmental Protection Act 1994

The activities associated with the operation of the WPP will be conducted in accordance with the objectives of the *Environmental Protection Act 1994* in particular the following sections:

- Section 319 General Environmental Duty
  - (1*) "A person must not carry out an activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm"*
- Section 320 (1) Duty to notify environmental harm
  - (1) "*A person who, while carrying out activity, becomes aware that serious or material environmental harm is caused or threatened by the person or someone else's act or omission has a duty to notify the relevant person/authority.*

2.1.3 Environmental Protection Regulation 2008

Under the *Environmental Protection Regulation 2008*, the proposed power plant is characterised as an environmentally relevant activity ERA 14 "*Electricity generation by using fuel at a rated capacity of 10 MW electrical or more, (1) generating electricity by using gas at a rated capacity of 10MW electrical or more".* An activity that is defined as an ERA under this regulation is required to show that the activity will attain acceptable environmental performance to avoid causing serious environmental harm.

2.1.4 Environmental Protection (Water) Policy 2009

Lockyer Creek is located approximately 1 km south of the proposed WPP site and the site is located on the left bank floodplain of Lockyer Creek as outlined in Section 8.3 of the REF. Lockyer Creek also forms a large part of the Brisbane River Catchment. Therefore appropriate waste management strategies will need to be implemented to ensure that the WPP does not negatively impact on environmental values of these waterways. As a result Westlink will conduct the proposed activities associated with the construction, operation and maintenance of the WPP in accordance with the objectives of the *Environmental Protection (Water) Policy 2009.* This policy aims to protect the environmental values of waters in Queensland by the provision of water quality guidelines and objectives.

2.1.5 Environmental Protection (Waste Management) Policy 2000

Westlink accepts the principles outlined in the *Environmental Protection (Waste Management) Policy 2000*, specifically the "polluter-pays principle" which illustrates that the company will take responsibility for the management of wastes generated from the facility. To manage wastes Westlink will, where practical, adopt the waste management hierarchy as outlined in the Environmental Protection (Waste Management) Policy (2000). The hierarchy encourages wastes to be managed in the following order of preference:

- Waste avoidance;
- Waste re-use;
- Waste recycling;
- Energy recovery from waste; and
- Waste disposal.

Westlink will comply with all regulatory requirements and adopt best practice waste management initiatives during all phases of the proposed WPP.

2.1.6 Environmental Protection (Waste Management) Regulation 2000

Westlink will comply with the *Environmental Protection (Waste Management) Regulation (2000*), and adopt the objectives of the legislation into the power station's waste management practices, specifically "minimising the impact of waste on the environment" and "managing waste under the principles of ecologically sustainable development".

2.1.7 Workplace Health and Safety Act 1995

The demolition, transport and disposal of the materials associated with the existing structures on the WPP site, will be conducted in accordance with the objectives of the *Workplace Health and Safety Act 1995* if the presence of asbestos containing materials (ACM) is confirmed. In particular Section 30, "Obligations of persons in control of workplaces" shall apply to these activities:

- (1)(a) "*Places obligations on persons in control of workplaces to ensure that the risk of injury or illness from a workplace is minimised for persons coming onto the workplace to work*".

2.1.8 Workplace Health and Safety Regulation 2008

If the presence of ACM is confirmed in the existing structures on site then the demolition, transport and disposal of the materials will be conducted in accordance with the requirements outlined in the *Workplace Health and Safety Regulation 2008*. In particular Section 146, “Removing ACM” applies:

- A relevant person must not remove ACM other than in accordance with the Code of Practice for the Safe Removal of Asbestos [NOHSC, 2002 (2005)].

3. Waste Management

3.1 Waste Characterisation

3.1.1 Overview

A waste stream analysis was undertaken as part of the original REF, to assess the sources and types of waste materials likely to be generated during the construction, operation and maintenance phases, so that opportunities for waste minimisation and avoidance may be identified early on in the development. This has been summarised in this section along with potential opportunities for waste avoidance, minimisation and recovery or recycling measures have been provided and were developed with consideration of the principles of the waste hierarchy.

3.1.2 Construction Phase

There are currently no waste generating activities occurring on-site. Two structures exist – a residential house and a shed that are currently unoccupied and will be demolished at the start of the construction phase.

Fully developed proposed WPP will consist of up to six gas turbines with a total capacity of up to 1000 MW. The proposed works will involve clearing of an area of seven hectares for the access road, offices, workshop buildings, turbines and switch yard.

The construction phase will involve the demolition of the two existing structures on the site, a residential house and a shed. Due to the age of these structures they have the potential to contain ACMs that will require further assessment prior to demolition. In the event that these structures are found to contain asbestos, the demolition shall be conducted in accordance with the relevant legislative requirements by an appropriately licensed contractor and disposed of at an appropriately licensed facility.

A review of the potential waste streams from construction of Stage 1 (including earthworks) was undertaken to develop the following waste stream analysis. indicates potential waste quantities for Stage 1 construction (clearing, construction of access road, support buildings/infrastructure and the first two or three gas turbines).

Note that anticipated waste quantities are indicative only and will be revisited when the design process has further progressed. As staging progresses (it is anticipated that development will be completed in three stages), construction waste materials from each subsequent stage will be generated in similar quantities to Stage 1.

Table 1 Estimated Construction Waste Types (over 12 month period for stage 1)

Waste Type	Anticipated Quantities	Proposed Management Method
Asbestos	To be determined	Removed by an appropriately licensed contactor and disposed of at an appropriately licensed facility.
Cleared vegetation	< 200m^3	Mulched and reused onsite for landscaping purposes. Any

Waste Type	Anticipated Quantities	Proposed Management Method
		excess will be removed offsite by a licensed contractor.
Excess soil/fill	Negligible (to be disposed of on site).	Minimised by optimisation of any cut and fill requirements and landscaping. Excess soil/fill will be stockpiled onsite for reuse either in construction of bunds and landscaping.
Metal – ferrous and non ferrous (eg reinforcing used within concrete foundations, off cuts of building materials)	< $50m^3$	Where practicable will be segregated for recycling by licensed contractor.
Concrete	< $50m^3$	Segregated for collection by licensed contractor. Either disposal at appropriate hardfill facility or reuse/recycling after crushing.
Excess packaging – including timber, plastics, cardboard	Variable	Where practicable and sufficient quantities, segregate materials for recycling or reuse (particularly timber). Other packaging will be disposed of to general waste skip bins to be removed from site by a licensed contractor.
Excess paints and paint containers	<200 litres	To be handled by painting contractor, either reused on other sites or disposed of via licensed contractor. Paint containers to be disposed of by licensed contractor. Paint residues and containers are regulated wastes.
Spent oils from construction plant	n/a	n/a - construction plant maintenance to occur offsite
General Waste –including general construction waste, waste packaging, office and food waste.	1 x $10m^3$ skip bin per week	Waste will be segregated and separated where possible for recycling and/or offsite disposal by a licensed contractor.
Waste Generated during Commissioning and Testing		
- General waste including gaskets, other metallic waste,	Up to 10x240 litre of wheelie bins	

Waste Type	Anticipated Quantities	Proposed Management Method
cable off-cuts, and other components - Waste oil from flushing of turbine oil system	Approximately 10,000 litres	
Waste oil from flushing of transformers	Approximately 10,000 litres	

The waste volumes likely to be generated during the construction phase will be collected by an appropriately licensed contractor and disposed of at an appropriately licensed facility. All feasible attempts will be made to reuse or recycle materials where services are available.

3.1.3 Operational Phase

The operational phase of the WPP will generate several waste items including waste oils from the cooling and lubrication oil systems, oily waste materials from cleaning activities, chemicals and associated containers used in the turbine wash and other treatment processes and general wastes and recyclables.

A review of the potential waste streams for the normal operation of Stage 1 was undertaken to develop the following waste stream analysis.

A summary of the estimated waste quantities for normal operations of Stage 1 is outlined in Table 2. Note that anticipated waste quantities are indicative only and will be revisited when the design process has further progressed. As staging progresses, it is anticipated that further development will see an increase in operational wastes (approximately doubling after stage 2 is completed and further similar increases after stage 3 is completed).

Table 2 Operational Waste Estimates (Stage 1)

Waste Type	Estimated Quantity per annum	Proposed Management Method
Waste Oils	To be determined during the detailed design stage.	Stored onsite in waste oil storage shed for collection and recycling by licensed contractor.
Oily rags, booms, pads and adsorbents	Up to 10 x 240 litre wheelie bins or 200 litre drums	Stored onsite in waste oil storage shed for collection and recycling or disposal by licensed contractor.
Chemical containers	To be determined during the detailed design stage.	Triple rinsed prior to offsite disposal by licensed contractor.
Gas condensate	< 100 litres	Stored with waste oil, for recycling by licensed contractor.
Silica gel	<1 kg/year	Stored onsite in waste oil storage shed for collection and disposal by licensed contractor.
General waste	Negligible	Not anticipated to generate a significant amount of general waste.

Waste Type	Estimated Quantity per annum	Proposed Management Method
		Likely waste streams would include food waste and packaging in which case the operator would ensure waste is collected by a licensed contractor.
Recyclables – paper, cardboard, plastic containers, aluminium cans	Negligible	Not anticipated to generate a significant amount of general waste. Likely waste streams would include food waste and packaging in which case the operator would ensure waste is collected by a licensed contractor

3.1.4 Maintenance and Overhauls

The maintenance and overhaul phase of the WPP will generate waste items including waste oils from the cooling and lubrication oil systems, waste water from the turbine wash down process and general wastes/recyclables.

A review of the potential waste streams for the normal maintenance and overhaul of Stage 1 was undertaken to develop the following waste stream analysis. A summary of the estimated waste quantities for normal maintenance and overhaul of Stage 1 is outlined in Table 3.

Note that anticipated waste quantities are indicative only and will be revisited when the design process has further progressed. As staging progresses, it is anticipated that further development of future stages will see a pro-rata increase in maintenance and overhaul wastes.

Table 3 Estimated Waste for Maintenance and Overhauls (Stage 1)

Waste Type	Estimated Quantity per annum	Proposed Management Method
Waste oils	Approximately 3500 litres (15,000 litres once every 4-5 years)	Stored onsite in waste oil storage shed for collection and recycling by licensed contractor.
Waste water from blade washing and the turbine compressor washing system	144 m^3	Collected in a tank/drum and trucked away for disposal by a licensed contractor
General waste	Negligible	Likely waste streams would include packaging in which case the operator would ensure waste is collected by a licensed contractor.
Recyclables – paper, cardboard, plastic containers, aluminium cans	Negligible	Not anticipated to generate a significant amount of general waste. Likely waste streams would include packaging in which case the operator would ensure waste is collected by a

Waste Type	Estimated Quantity per annum	Proposed Management Method
		licensed contractor.

3.2 Identification and Assessment of Waste Handling Facilities

This section provides a list of potential waste recycling and/or waste disposal facilities aimed at addressing the limited waste disposal options at the Gatton Landfill site. The potential waste disposal facilities (located in Toowoomba and Ipswich) and the waste accepted by each facility are outlined in Table 4. It is important to note that these are only potential options as all waste will be collected by an appropriate licensed contractor and disposed of at an appropriately licensed facility. The waste management contractors and the location of the waste recycling and/or waste disposal facilities that will handle the waste generated by the WPP will be identified in the appropriate commercial waste management contracts.

The licensed waste management contractors will remove and dispose of, hazardous and regulated waste generated during the construction, operation and maintenance phases of the proposed WPP. Once the waste is collected, the waste management contractors are responsible for ensuring that the waste is disposed of in accordance with the appropriate legislation at an appropriately licensed recycling and/or landfill facility as detailed under the *Environmental Protection (Waste Management) Regulation 2000.*

The tracking of all trackable waste generated by the WPP will be managed in accordance with the *ecoaccess, Waste Management, Generators – Waste Tracking, Information Sheet (EPA, 2002).* An anticipated inventory of regulated wastes that may be generated during the demolition, construction, operation and the maintenance phases and the waste tracking requirements are addressed in Section 4 of this report.

Table 4 Potential Waste Handling Facilities

Potential Facility	Location	Asbestos (yes/no)	Metal (yes/no)	Concrete (yes/no)	Timber (yes/no)	Recyclables including, paper, cardboard, glass, plastic and metal containers (yes/no)	General Waste (Putrescent) (yes/no)	Excess Paints and Paint Containers (yes/no)	Chemical Containers (yes/no)	Waste oil including booms, pads and absorbents (yes/no)
Transpacific Industries	1 Wilkinson Str Toowoomba 4350	no	no	no	no	no	no	yes	yes	yes
Transpacific Industries	100 Chum Rd, New Chum 4303	yes	yes	yes	yes	no	no	no	no	no
Transpacific Industries	343 Bowhill Rd Willawong 4110	no	yes	yes	yes	yes	no	no	no	no
Thiess Services	Swanbank Rd Swanbank 4306	yes	yes	yes	yes	yes	yes	no	no	no
J.J. Richards / Veolia Environmental Services	Champions Way, Willowbank, 4306	yes	no	no	no	yes	yes	yes	yes	yes

4. Waste Minimisation Strategy

In order to manage the impacts of the construction, operation and maintenance of the WPP and to minimise the amount of waste generated, a waste minimisation strategy will be developed for the project. A number of key items are required to be addressed in order to achieve waste minimisation and capitalise on recycling opportunities. These are as follows;

- Coordinate and communicate the strategy to site project managers, supervisors, workers and contractors;
- Appoint a responsible person (site manager) to oversee the implementation of the waste minimisation plan, promote the plan and reward best performances where possible;
- Develop reporting arrangements to monitor waste minimisation; or alternatively, ensure disposal and recycling contractors separate monitor and recycle all site waste as far as practicable so that the objectives of the plan are met;
- Involve any waste contractors before construction commences to ensure waste management strategies are compatible with collection systems; and
- Provide relevant training and ongoing education to ensure the strategy is effectively implemented.

In addition to the overall objectives of the waste minimisation strategy, specific options that can be utilised to address the principles of the waste management hierarchy in order of preference are provided below.

Waste Avoidance

- Use designs that minimise the generation of waste during construction, operation and maintenance phases of the project;
- When selecting a product or material consider the durability of materials and future cost savings of buying an item once and reusing it in a number of ways over the life of the development;
- Include clauses in contracts that discourage over supply of materials and the generation of waste;
- As far a possible accurately estimate the quantities of materials required for the job to avoid over supply;
- Minimise the handling and transport of materials on and off-site;
- Implement erosion and sediment control procedures to ensure that sediment content in stormwater is appropriately managed to minimise erosion on site; and
- Investigate reducing oil waste by recycling and reusing waste oil, by passing through an on-site oil cleaning system.

Waste Reuse

- Ensure waste is separated into recoverable and non-recoverable streams. Also ensure new and undamaged recovered waste materials are kept separated;
- Establish a specific area within the site for the storage and removal of different streams of recovered waste materials. It should be secure and access restricted to authorised personnel;
- Mulch or chip and reuse vegetation wastes in landscaping;

- Crush large quantities of concrete, brick and other suitable materials and use as roadbase footings (where specifications can be met) retaining walls, drainage etc;
- Organise pallet returns with follow on deliveries with suppliers where possible;
- Plan to use excess or waste materials effectively, for example:
  - identify which waste materials will be generated (eg concrete, timber, plasterboard, fill etc) and determine how they could be reused;
  - coordinate use of material between jobs, excess materials can be used on other sites if required;
  - consider how excess or waste material could be used if they become available (e.g. fill, drainage material, soil conditioners, framing etc);
  - advertise the availability of free recovered waste materials locally;
  - maximise the separation of wastes and minimise the contamination of recoverable materials;
- Stockpile unused waste material for future use, ensure stockpiles are well managed;
- Reuse off-cuts where possible and store appropriately in the interim; and
- Engage a recovery contractor to remove recoverable materials from site.

Waste Recycling

- Consider using products and materials with recycled content where possible. Check the performance of recycled content products to ensure they meet engineering specification;
- Notify suppliers that recycled content products are preferred where other technical specifications are also met; and
- Use fixtures / materials in fit-outs that can be reused in later refurbishments.

Waste Disposal

- Collect data and record the movement of waste and recovered materials on and off site. Require contractors to supply this information as part of the contract;
- Identify the specific locations of potential sources of waste material (e.g. site sheds and offices, particular trades, particular work activities or areas);
- Develop disposal procedures such as the types of containers to be employed, clear and appropriate signage, suitable location for bins and stockpiles;
- Provide relevant training and ongoing education to ensure efficient disposal (e.g. minimal contamination, maximum resource recovery);
- Utilise chemical toilet and ablutions facilities for construction workers or drain waste water to holding tanks that can be emptied by a contractor;
- Early installation of stormwater control devices and cut off drains to manage runoff from construction areas to ensure appropriate disposal and handling of stormwater sources. This will be addressed in the Stormwater Management Plan located in Appendix 10 of this Information Request Response; and
- Installation of oil water separator to separate oil from the water collected in the turbine region and other bunded areas like transformers, during operation and maintenance periods.

5. Waste Tracking

The construction, operation and maintenance phases of the WPP will result in the generation of regulated wastes as defined under Schedule 2 of the *Environmental Protection (Waste Management) Regulation 2000*. This regulation outlines the waste tracking legislative requirements that apply to waste generators and handlers when moving regulated wastes within Queensland (including importing or exporting regulated wastes into or out of QLD).

The potential trackable wastes generated during each phase of the proposed WPP are outlined in Table 5

Table 5 Potential Trackable Wastes

Phase	Trackable Wastes
Demolition	Asbestos
Operational Phase	Waste Oil
	Oily Rags, Booms, Pads and Adsorbents
	Used Chemical Containers
Maintenance Phase	Waste Oil
	Waste Water Containing Oil/Hydrocarbons

A waste tracking system will be developed and approved by the Department of Environment and Resource Management (DERM) prior to moving trackable wastes from WPP site. The waste tracking system will facilitate the tracking of all regulated wastes generated at the WPP (waste generator), handled by the appointed waste management contractor (waste handler) and finally recycled or disposed of by the licensed facility (waste receiver).

The waste tracking system will include the recording of the following information as outlined in the *ecoaccess, Waste Management, Approval of a Waste Tracking System, Information Sheet (EPA, 2002):*

- The quantity and type of waste produced by the waste generator;
- The date and time when the waste was transported by the waste handler;
- The type and quantity of waste received by the waste receiver.

The information recorded in the waste tracking system will be kept by Westlink for a period of five years in accordance with the requirements of Schedule 2 of the *Environmental Protection (Waste Management) Regulation 2000*.

6. Conclusion

It is important to note that this Waste Management Plan is a working document and currently contains estimates of the proposed quantities of wastes that will be generated by the WPP. Therefore this document should be updated as the design phase progresses and in response to the proposed staged construction.

A range of solid and liquid wastes will be generated during the construction, operation and maintenance phases of the WPP. In order to manage the impacts and to minimise the amount of waste generated, it is recommended that a waste minimisation strategy be developed for the project that includes the principles of the waste hierarchy namely avoidance, reuse, recycling and disposal as the least preferred option.

The proposed waste management methods will allow for appropriate temporary segregation/separation of nonhazardous and recyclable materials and corresponding storage prior to collection. All waste generated by the WPP will be collected, transported by an appropriately licensed contractor and will be disposed of at an appropriately licensed recycling or landfill facility.

A range of trackable wastes will be generated during the construction, operation and maintenance of the WPP. All trackable wastes will be managed in accordance with the relevant legislative requirements and will be appropriately segregated and temporarily stored prior to removal and disposal from site by an appropriately licensed contractor and disposed of at an appropriately licensed facility. The trackable wastes will be tracked by means of a Waste Tracking System approved by DERM.

7. References

State of Queensland (1994) *Environmental Protection Act;*

State of Queensland (2008) *Environmental Protection (Water) Policy*;

State of Queensland (2008) *Environmental Protection Regulation*

State of Queensland (2000) *Environmental Protection (Waste Management) Policy*;

State of Queensland (2000) *Environmental Protection (Waste Management) Regulation*;

State of Queensland (1995) Workplace Health and Safety Act

State of Queensland (2008) Workplace Health and Safety Regulation 2008

Environmental Protection Agency, (2002) *ecoaccess, Waste Management, Generators – Waste Tracking, Information Sheet*

Environmental Protection Agency, (2002) *ecoaccess, Waste Management, Approval of a Waste Tracking System, Information Sheet*

GHD

201 Charlotte Street Brisbane QLD 4000
GPO Box 668 Brisbane QLD 4001
T: (07) 3316 3000 F: (07) 3316 3333 E: bnemail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	W Button	A Marszalek		P. Wootton		24/12/10
1	W. Button	A Marszalek		P Wootton		02/02/10