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Murrumbidgee to Googong Water Transfer - Landscape Rehabilitation Management Plan

BWA-M2G-EN-ECP-008-3

January 2012

Delivered by the Bulk Water Alliance

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Abbreviations

Abbreviation	
ACTEW	ACTEW Corporation Limited
ACTPLA	ACT Planning and Land Authority
AEMP	Aquatic Ecology Management Plan
AQMP	Air Quality Management Plan
BWA	Bulk Water Alliance
CEMP	Construction Environment Management Plan
CESM	Community Engagement and Stakeholder Management
EWMS	Environmental Work Method Statement

Abbreviation	
DECCW	NSW Department of Environment, Climate Change and Water
DECCEW	ACT Department of Environment, Climate Change, Energy and Water
ECP	Environmental Control Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC ACT 1999	*Environmental Protection and Biodiversity Conservation ACT 1999*
ESCP	Erosion and Sediment Control Plan
HLPS	High Lift Pump Station
IRMP	Incident Response Management Plan
LALC	Local Aboriginal Land Council
LLPS	Low Lift Pump Station
M2G	Murrumbidgee to Googong
NVMP	Noise and Vibration Management Plan
PCL	Parks, Conservation and Lands
PER	Public Environment Report
POEO	NSW *Protection of the Environment Operations ACT 1997*
RAO's	Representative Aboriginal Organisations
ROW	Right of Way
SAD	Sensitive Area Diagram
SEP	Site Environmental Plan
SWMP	Soil and Water Management Plan
TEMP	Terrestrial Ecology Management Plan
WMP	Waste Management Plan

Environmental Commitments and Conditions of Approval / Licences

Table 1.1 M2G EIS Commitments

Commitment No.	Commitment / Condition	Reference within LRMP
17	Detailed design of the pipeline will ensure the pipeline is constructed in the identified construction impact zone in order to minimise direct impact on moderate to good quality Box Gum Grassy Woodland, grasslands and hollow-bearing trees and rock outcrops, and any other higher quality vegetation, as far as practicable.	Appendix B of CEMP
18	The construction and scour widths will be reduced in areas that contain EEC's and/or threatened species habitat. The exact location and extent of reduced construction corridor widths will be determined in the CEMP.	Appendix B of CEMP
19	Where the removal of hollow-bearing trees and/or hollow limbs is unavoidable, an appropriately qualified arborist will be employed. Tree hollows will be inspected for resident fauna by a qualified ecologist/zoologist prior to felling or trimming. Any trees or limbs that are removed will be retained on site for ground based habitat.	Relocation of timber - Appendix D of LRMP Terrestrial Ecology MP (TEMP)
40	The pipeline route will be periodically inspected to ensure rehabilitation and stabilisation works have been effective in the longer term.	Section 5.4.5 of LRMP
42	Reinstatement of disturbed areas during construction of the project will be undertaken progressively during the construction period. A Rehabilitation Plan will be developed to describe the rehabilitation management, objectives and activities necessary to assess and rehabilitate areas impacted by construction works.	LRMP
44	Landscaping, vegetation rehabilitation, replacement planting and encouragement of natural regeneration will be undertaken in accordance with the rehabilitation plan.	LRMP

Table 1.2 M2G DA Conditions of Approval (ACT)

Condition No.	Commitment / Condition	Reference within LRMP
2	A Rehabilitation and Landscape Management Plan that details the rehabilitation management and activities necessary to assess and rehabilitate areas impacted by the construction of the M2G pipeline be endorsed by the Senior Manager, Asset Acceptance (AA), PCL, TAMS and	LRMP

Condition No.	Commitment / Condition	Reference within LRMP
	the EPA and evidence of this endorsement be submitted to ACTPLA. During construction, all existing vegetation (trees, shrubs and grass) located on the verge and unleased Territory land immediately adjacent to the development will be managed, protected and maintained in accordance with the Rehabilitation and Landscape Management Plan. The plan will include as a minimum, the following sub-plans and mitigation measures:	
2 (a)	• *Aquatic Ecology Management sub-plan* An Aquatic ecology management sub-plan that details the procedures to manage and minimise the potential impact on aquatic environments be endorsed by PCL, TAMS and the EPA	Aquatic Ecology Management Plan (AEMP) – sub-plan to Construction EMP (CEMP)
2 (b)	• *Flora and Fauna Management sub-plan* A Flora and Fauna management sub-plan that details the mitigation and management of impacts on flora and fauna including weed control during construction and operation phase be endorsed by PCL, TAMS	Terrestrial Ecology MP (TEMP) – sub-plan to CEMP
2 (c)	• *Monitoring and Research Program* A Monitoring and Research Program for the aquatic ecosystem including fish, in both the Murrumbidgee and Burra/Googong be developed in consultation with and approved by the Research and Planning Unit, PCL, TAMS prior to the commencement of works.	Ecological Monitoring Program (Appendix A of AEMP) (And part of the Operation Environment Management Plan, OEMP)

Table 1.3 M2G DoP Conditions of Approval

Condition No.	Commitment / Condition	Reference within LRMP
6.3 b)	Rehabilitation details and a program for reporting on the effectiveness of flora and fauna management measures, including a schedule for planting and seeding within areas supporting endangered ecological communities. Management methods shall be reviewed where found to be ineffective	LRMP
2.10	After construction is complete and for a period of two years after that time (or as otherwise required by the Director General) the proponent shall monitor areas along the project alignment for weed infestation. Any infestations shall be managed to remove or minimise their spread.	Weed Management Procedure, Appendix D of LRMP

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1 Introduction

1.1 Background

The Murrumbidgee to Googong (M2G) Water Transfer is one of the recommended options for delivering improved security to the water supply for the ACT and region. It involves pumping water from the Murrumbidgee River (within the ACT) and transferring it via a 12km pipeline to Burra Creek (in NSW), from where it would flow for approximately 13km to the Googong Reservoir.

This plan has been designed to address client expectations and requirements, and adequately address risks and stakeholder concerns. The BWA is committed to providing the services it offers in a manner that conforms to the contractual requirements and to all relevant regulatory and legislative requirements.

The BWA will ensure that the controls are properly implemented and are regularly monitored and audited to assess their effectiveness. Changes to the stipulated controls will be instigated if they are not achieving their objectives.

The project comprises the following key features:

Infrastructure	Description
Intake/low lift pump station	The intake/low lift pump station will comprise a concrete box structure built into the riverbank. The low lift pump station will include a screen, grit collection and removal, pumps and valves and filtration to prevent fish transfer.
High lift pump station	The pump station will pump water to a high point at Gibraltar Range, from where it will run under gravity to the discharge point. The high lift pump station will consist of a building enclosing a pump hall and electrical services and an amenities area.
Pipeline	The pipeline will transfer the water from the low lift pump station to the high lift pump station, then onto the outlet structure. It will be constructed of 1016 mm diameter steel pipe. The pipeline will be approximately 12 km long, with the pipe located approximately 1.8 m to 4 m below ground level. Air valves and scour valves will be located at regular intervals along the pipeline to provide pressure relief and to allow cleaning.
Outlet structure	The outlet structure will take the form of a weir box arrangement located on the bank of Burra Creek. It will comprise a rectangular concrete box approximately 12 m along the creek bank with a 250 mm grated opening along the west bank of Burra Creek. Water will flow into the weir box from the pipeline and will discharge over the weir and run down the creek bank to the creek, which flows to Googong Reservoir. This method of discharge is designed to minimise scouring of the creek bed near the outlet.
Electric power supply	The electrical infrastructure will comprise a 132 kV/11 kV substation in Williamsdale and a single 11 kV cable to the high lift pump station.
Mini-hydro power generator	Electricity provided by the grid will be supplemented by electricity generated by a mini-hydro electric power facility which will be constructed as part of the project.

Table 1.1 Key features of the M2G pipeline project

1.2 Purpose of the LRMP

The purpose of this Landscape Rehabilitation Management Plan (LRMP) is to describe the rehabilitation management, objectives and activities necessary to successfully rehabilitate areas impacted by construction activities. This LRMP has been prepared to address the likely general requirements of the regulatory agencies and to meet the requirements of the Bulk Water Alliance's environmental policy and overarching Environmental Management System (EMS), which commits the BWA to adopt best practice management techniques in restoring the M2G pipeline corridor to a condition equal to or better than the Bulk Water Alliance (BWA) inherited.

This LRMP specifically addresses the methods, techniques and timing for rehabilitating after the construction activities. It incorporates the recommendations contained within the EIS (refer to Section 5.1) for landscape rehabilitation activities within the construction boundary. This LRMP also addresses how the site will be decommissioned and rehabilitated upon completion of construction activities. A further purpose of the LRMP is to meet the reasonable expectations of directly affected landholders, the community and special interest groups e.g. Friends of Grassland.

This LRMP does not address the EIS recommendations to create biodiversity offsets as a result of the proposed clearing. ACTEW Corporation will be responsible for delivering any offsets package required for loss of native vegetation or through commitments the ACT Government has made in relation to carbon sequestration as a result of the construction activities.

1.3 Objectives of the LRMP

The objectives of the Landscape Rehabilitation Management Plan (LRMP) are to:

- document landscape rehabilitation methods and techniques to be adopted in rehabilitating the M2G pipeline corridor and associated construction areas;
- document commitments raised in the Murrumbidgee to Googong Water Transfer Environmental Impact Statement (EIS) relating to landscape rehabilitation;
- go beyond a culture of business as usual (compliance) by demonstrating excellence in landscape rehabilitation;
- minimise the potential and actual impacts on water quality within the Murrumbidgee and Burra Creek catchments through the effective stabilisation of the reshaped landscape following construction works;
- comply with ACT, NSW and Commonwealth legislative requirements for conservation and reinstatement of native vegetation communities;
- ensure existing landscape and ecological assets are protected wherever possible and the impact of construction activities on areas of native vegetation, particularly endangered ecological communities and threatened species are minimised;
- prevent the spread of noxious weeds and the dispersal of alien plant and animal species;
- successfully rehabilitate public landscape assets and any native vegetation disturbed by construction activities;
- ensure vegetative cover is re-established and all land and waterways disturbed by construction activities are returned to a stable condition as soon as possible;
- reinstate natural drainage patterns to pre-existing landforms,
- ensure erosion control measures are installed in erosion prone areas, and
- consult with individual landowners and relevant stakeholders to incorporate their feedback during development and implementation of the LRMP.

1.4 Performance Goals

- Successful rehabilitation of affected areas in accordance with the specifications and requirements of this management plan;
- compliance with all ACT, NSW and Commonwealth legislative requirements relating to landscape rehabilitation;
- no complaints from individual landowners / leaseholders as well as relevant stakeholders relating to landscape rehabilitation activities;
- deliver on commitments stated in the EIS and provided to individual landowners and relevant stakeholders.

2 Legislative & Regulatory Compliance

2.1 Relevant Legislation

Key legislation relating to landscape rehabilitation management onsite is detailed below. Other legislation associated with the M2G project is outlined in the CEMP.

Table 2.1 Key Legislation

Legislative Jurisdiction	Relevant Act
Commonwealth	*Environmental Protection and Biodiversity Conservation Act 1999*
	Water Act 2007
Territory (ACT)	*Environmental Protection Act 1997*
	Water Resources Act 2007
	Nature Conservation Act 1980
	Fisheries Act 2000
	Pest Plant and Animals Act 2005
New South Wales (NSW)	*Protection of the Environment Operations Act 1997*
	Threatened Species Conservation Act 1995
	National Parks and Wildlife Act 1974
	Water Management Act 2000
	Noxious Weeds Act 1993
	Native Vegetation Act 2003

2.2 Guidelines and Standards

Key reference materials relevant to management of soil and water during design and construction components of the M2G project include:

- Soils and Construction: Managing Urban Stormwater – Volume 1, 4th Edition (Landcom) March 2004;
- *Environment Protection Guidelines for Construction and Land Development in the ACT*, Environment Protection Authority, ACT, August, 2007;
- ACT Government, *Clean Water, Healthy Landscapes, Lower Cotter Catchment Strategic Management Plan (Final*), January 2007;
- ACT Code of Forest Practice, Version 1, August, 2005.
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000);
- Florabank Guidelines, *Model Code of Practice for Community Based Collectors and Suppliers of Native Seed*, 1998
- NPWS, *Rehabilitation Guidelines for the Resort Areas of Kosciuszko National Park*, August 2007
- Sharp, Dorrough, Rehwinkel, Eddy and Breckwoldt, 2005, *Grassy Ecosystems Management Kit: A Guide to Developing Conservation Management Plans*. Environment ACT, Canberra

- Langford, Simpson, Garden, Eddy, Keys, Rehwinkel and Johnston, 2004, *Managing Native Pastures for Agriculture and Conservation*, NSW Department of Primary Industries
- Eddy, D., 2002, *Managing Native Grassland: a guide to management for conservation, production and landscape protection*, WWF Australia, Sydney
- Greening Australia, *Revegetation Techniques, A guide for Establishing Native Vegetation in Victoria*, Greening Australia Victoria, 2003;
- Bennett E 2005 *Management of native grasses in the urban landscape*, Native Grass Resource Group Inc., Adelaide.
- Chivers IH & Raulings KA 2009 *Australian native grasses: a manual for sowing, growing and using them*, 3rd edition, Native Seeds Pty Ltd, Melbourne.
- Cole I, Dawson I, Mortlock W & Winder S 2000 *Guideline: Using native grass seed in revegetation*, Florabank, Canberra.
- Waters C, Whalley W & Huxtable C 2000 Grassed up: guidelines for revegetating with Australian native grasses, NSW Agriculture, Dubbo.
- AS 4970 – 2009 Protection of Trees on Development Sites

2.3 Conditions of Approval

The conditions of approval relevant to landscape rehabilitation have been addressed at the front of this document (Tables 1.1 – 1.5). Where a specific condition of approval or commitment has been documented, this has been listed with a reference to where this document or other Construction or Operational EMP documents addresses this specific condition.

2.4 Licences and Permits

A licence to collect native seed may be required by the appointed revegetation contractor should collection of native seed occur on State or Territory land. This licence will be sought prior to undertaking any seed collection activities.

Other licences and permits relating to management of native vegetation are covered in the Aquatic and Terrestrial Ecology Management Plans.

3 Structure and Responsibilities

Roles and responsibilities of BWA personnel are covered in detail in Section 3 of the CEMP. They are, in part, repeated in this section of the LRMP with particular relevance to landscape restoration and management.

3.1 Site Structure

The general project structure for the management of landscape rehabilitation issues is shown in Figure 3.1 below.

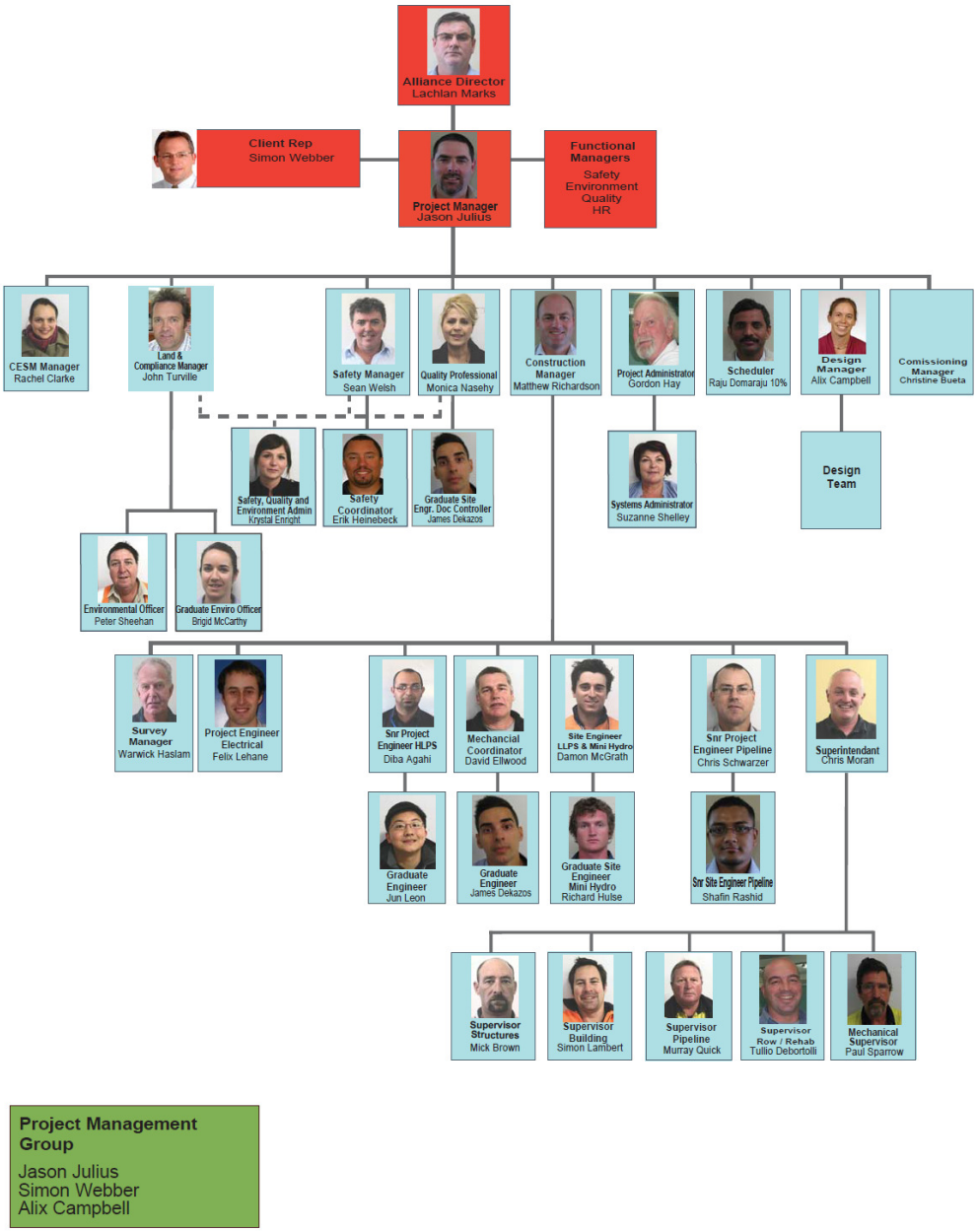


Figure 3.1 Murrumbidgee to Googong Project Management Hierarchy

3.2 M2G Project Manager

The M2G Project Manager has the role of ensuring that the project is delivered on time, within budget and is consistent with the aims and objectives of the Bulk Water Alliance. This role is accountable for all aspects of the project including safety, environment and heritage, quality, budget and deliverables.

3.3 M2G Construction Manager

The M2G Construction Manager is responsible for delivery of the construction phase of the Project to ensure that impacts are minimised and obligations are met. The M2G Construction Manager will be working with the M2G Environmental team to ensure that the Bulk Water Alliance's prescribed environmental and landscape rehabilitation outcomes are achieved.

3.4 M2G Land and Compliance Manager

The M2G Land and Compliance Manager, and his/her delegate, has primary on-site responsibility for managing all aspects of environmental management and compliance for the construction and rehabilitation phase of the project.

The key responsibilities of the M2G Land and Compliance Manager and the M2G Environmental Officer will be to:

- liaise with government agencies and relevant stakeholders regarding the implementation of this LRMP;
- provide a regular construction program identifying critical construction activities;
- monitor the revegetation activities within the project site in consultation with the M2G Landscape Design Manager.
- implementation of weed management activities outlined in the Weed Management Procedure (Appendix D of this LRMP);
- relocation/translocation of threatened species/significant species after seeking advice from DECCW;
- coordinate seed collection activities in consultation with Parks Conservation Service (PCS);
- organise nursery contractors to germinate and grow native plants for planting within the M2G project;
- coordinate direct seeding and planting contractors to implement the Landscape Rehabilitation Management Plan; and
- coordinate contracts for the maintenance of Landscape initiatives.

3.5 M2G Landscape Design Manager

The M2G Landscape Design Manager provides specialist landscape architectural input and advice to the Project and provides detailed design drawings for implementation. Specific responsibilities are to:

- prepare landscape architectural design drawings, that fit with the objectives, methodologies and treatments adopted in this LRMP;
- provide specialist input into the development and implementation of this LRMP; and
- provide specialist landscape architectural advice in relation to a design construction interface.

3.6 M2G Community Engagement & Stakeholder Manager

The M2G Community Engagement & Stakeholder Team Leader has primary on-site responsibility for managing all aspects of community and stakeholder communication. Such activities include:

- consulting with landholders, the community and other stakeholders and provide them with feedback;
- reporting on community and stakeholder feedback to M2G managers;
- managing community complaints and coordinate a response;
- documenting community and stakeholder consultation and feedback; and
- developing and implementing the Construction Community and Engagement Stakeholder Management Plan (CESM Plan) and its procedures.

3.7 Subcontractors

Specialist subcontractors will be engaged to assist with the implementation of this LRMP. These will be managed by the M2G Land and Compliance Manager, or their delegate, and will include (but not be limited) to the following:

- seed collection contractors;
- consulting Ecologist;
- weed management contractors;
- landscape (revegetation) contractors;
- nursery (Plant Supply) contractors;
- direct seeding contractors; and
- specialist Landscape Rehabilitation consultants.

4 Environmental Aspects and Impacts

4.1 Environmental Aspect, Impact and Risk Identification

Environmental aspects as referred to in this document are those activities associated with the project that have the potential to cause, or result in, adverse environmental impacts. Due to the complexity of the project, it is conceivable that various aspects of the project would carry a varying degree of environmental risk which needs to be managed accordingly.

Effective environmental management should be proactive rather than reactive. In order to facilitate a proactive style of environmental management, a risk management style of assessment has been utilised to identify and assess environmental aspects associated with the project, and to implement appropriate mitigation strategies to minimise the likelihood of environmental risks associated with each aspect. This process involves:

1. Identifying the risk/aspect
2. Analysing the risk/aspect (determining likelihood and consequence)
3. Evaluating the risk/aspect
4. Treating the risk

All identified aspects are assessed based on the risk assessment matrix (Table 4.1). Risk assessment is based on (1) the likelihood of an impact occurring as a result of the aspect; and (2) the consequences of the impact if the event occurred. Following this assessment, each impact is assigned a risk category which ranges from “low” (low likelihood and consequence) to “extreme” (high likelihood and consequence). Table 4.2 describes each level of risk.

A risk category identified as having an extreme or high risk (a significant impact) may be downgraded if appropriate environmental controls and measures are implemented and maintained. Proactive planning, installation and maintenance of appropriate environmental controls and ongoing monitoring will reduce the risks associated with each environmental impact identified for the project. Table 4.3 details the environmental aspects identified for the project, the initial risk category prior to appropriate management strategies, the proposed management strategy and a revised risk category.

Table 4.1 Risk Scoring Matrix

		Consequences				
	Likelihood	1	2	3	4	5
		Negligible discharge	Uncontrolled Discharges in minor quantities	Moderate breach of environmental Statutes	Major breach of environmental statutes	Shutdown of project due to Environmental breach
A	Almost Certain	H	H	E	E	E
B	Likely	M	H	H	E	E
C	Moderate	L	M	H	E	E
D	Unlikely	L	L	M	H	E
E	Rare	L	L	M	H	H

Table 4.2 Risk Definition and Classification – Qualitative Measures and Likelihood Scale

Level	Categorisation Of likelihood	Description
A	**Almost certain**	Is expected to occur during the project, 90% or > probability
B	**Likely**	Will probably occur during the project, ~50% probability
C	**Moderate**	Might occur at sometime during the project, ~10% probability
D	**Unlikely**	Could occur at some time during the project, ~1% probability
E	**Rare**	Only occur in exceptional circumstances, < 1% probability

Table 4.3 Key Aspects, Potential Impacts and Risk Analysis for the proposed project

Aspect	Potential impact	Current Risk Category	Mitigation Measure	Revised Risk Category
Vegetation clearing and Grubbing	Impacts to threatened species	High	• Conduct accurate pre-clearance surveys and clearly identify vegetation that is to be retained for retention. • Relocate fauna out of potential habitat prior to clearing. • Toolbox construction crew and subcontractors on presence of threatened species and endangered ecological communities. *(More mitigation measures listed in the Terrestrial and Aquatic Ecology management plans)*	Medium
	Impact on terrestrial fauna and their habitats	High	• Engage a suitably qualified ecologist to monitor clearing of vegetation and to inspect hollow bearing trees. *(More mitigation measures listed in the Terrestrial and Aquatic Ecology management plans)*	Medium
Construction phase (bulk earthworks, site preparation, site offices, pipeline excavation)	Topsoil stripping is not carried out in accordance with agreed methodology resulting in the mixing of topsoil and subsoil layers	High	• Construction crew are to be tool-boxed on the methodology of stripping topsoil and the importance of separating topsoil from subsoils. • Only strip topsoil where absolutely necessary	Medium
	Weeds are spread from infested areas into weed free areas	Extreme	• M2G team and subcontractors to strictly adhere to the Weed Management Procedure (Appendix D) and to observe wash down procedures for the project. • Toolbox construction crew and subcontractors on presence of weed species, wash down procedures, weed management strategies and to notify environment personnel should they discover weeds in weed free area.	High
	Reinstatement of soil material not according to agreed methodology – resulting in mixing of topsoils with subsoils	High	• Construction crew are to be tool-boxed on the methodology of reinstating topsoil to the backfilled pipe and the importance of separating topsoil from subsoils.	Medium

Aspect	Potential impact	Current Risk Category	Mitigation Measure	Revised Risk Category
Post construction (Rehabilitation phase)	Poor germination of native and/or exotic species	High	• Investigate options for irrigating areas during drought periods. • Assess seeding methodology (incl. treatment of seed) and re-sow with same or alternative method depending on the assessment. • Hold off on sowing areas until there is adequate soil moisture and/or chance of precipitation occurring post sowing. • Where possible, avoid sowing during Summer months when rainfall is infrequent. • Assess risk of erosion potential and take appropriate action in consultation with M2G Soil Conservationist.	Medium
	Infestation of weeds along the pipeline route	High	• Take appropriate action in accordance with the Weed Management Strategy • Toolbox construction crew and subcontractors on presence of weed species, wash down procedures, weed management strategies and to notify environment personnel should they discover weeds in weed free areas	Medium
Post Rehabilitation	Poor germination of native and/or exotic species	High	• Investigate options for irrigating areas during drought periods. • Assess seeding methodology (incl. treatment of seed) and re-sow with same or alternative method depending on the assessment. • Hold off on sowing areas until there is adequate soil moisture and/or chance of precipitation occurring post sowing. • Where possible, avoid sowing during Summer months where rainfall is infrequent. • Assess risk of erosion potential and take appropriate action in consultation with M2G Soil Conservationist.	Low

Aspect	Potential impact	Current Risk Category	Mitigation Measure	Revised Risk Category
	Infestation of weeds along the pipeline route	High	• Take appropriate action in accordance with the Weed Management Strategy • Toolbox construction crew and subcontractors on presence of weed species and to notify environment personnel should they discover weeds in weed free area	Medium
	Landholder feedback with respect to landscape rehabilitation	Medium	• CESM Manager to engage with landholder throughout all phases of rehabilitation to gauge their feedback on success, or otherwise, of the rehabilitation • Within reason, landholder requests are to be considered and acted upon.	Low

4.2 The existing environment and land uses.

An assessment of terrestrial and aquatic ecology was carried out by Biosis Research as part of the EIS. A summary of this assessment is provided below.

4.2.1 Terrestrial Ecology

The assessment found that the pipeline route contains a mixture of exotic and native vegetation.

Of the native vegetation that occurs within the study area, three threatened plant species were identified (*Swainsona recta*, *Leucochrysum albicans* var *tricolor* and *Swainsona sericea*) as well as three endangered ecological communities (Box Gum Grassy Woodland (BGGW), Natural Temperate Grassland (NTG) and Snow Gum Grassy Woodland).

Further to this, eight threatened animal species were identified within the study area, namely:

- Pink Tailed Worm Lizard – *Aprasia parapulchella* (NC Act, TSC Act, EPBC Act)
- Gang Gang Cockatoo – *Callocephalon fimbriatum* (TSC Act)
- Speckled Warbler – *Chtohonichloa sagittata* (TSC Act)
- Diamond Firetail – *Stagonopleura guttata* (TSC Act)
- White-winged Triller – *Lalage sueurii* (NC Act)
- Varied Sitella – *Daphoenositta chrysoptera* (NC Act and proposed listing TSC Act)
- Large footed Myotis – *Myotis macropus* (TSC Act), and
- Eastern Bent-wing Bat – Miniopterus schreibersii oceanensis (TSC Act)

The rehabilitation of both BGGW and NTG provides challenges due to:

1. the slow nature of germination and rehabilitation of native species;
2. the shallow depth of the topsoil and low organic matter;
3. the high number of weeds along the pipeline route (particularly in adjoining non-native areas); and
4. the compaction of soil along a linear route of this nature.

The timing of rehabilitation of the native grasslands is paramount and is addressed in Section 5.3 of this LRMP.

4.2.2 Vegetation communities

The following vegetation communities follow those identified by Biosis Research in their Ecological Assessment Report for the M2G pipeline (Biosis Research, March, 2009). They are:

- Natural Temperate Grassland;
- Box Gum Grassy Woodland;
- Dry Sclerophyll Woodland – other native vegetation;
- Snow Gum Grassy Woodland; and
- Non-native vegetation (mainly exotic pastures).

Species relevant to each of the above communities can be evidenced in Appendix B, the Landscape Reinstatement Plan

Indicative total area for rehabilitation for each of the above communities is shown in table 4.4:

Table 4.4 Vegetation communities and estimated areas of impact

VEGETATION TYPE	AREA
Box Gum Grassy Woodland	11.34 ha
Natural Temperate Grassland	1.30 ha
Snow Gum Grassy Woodland	0.04 ha
Other Native Vegetation*	4.76 ha
Non-native vegetation	23.8 ha
Total Native Vegetation (Habitat Areas)	**17.7 ha**
TOTAL AREA	**40.5 ha**

*- other native vegetation includes native pastures, Kunzea/Acacia shrubland and *Eucalyptus bridgesiana – E. dives – E. mannifera* woodland.

5 Environmental Controls and Mitigation Measures

5.1 Rehabilitation Methodology

Typical rehabilitation practices that will be adopted for each of the construction phases are shown in Table 5.1.

Table 5.1 Typical rehabilitation practices to be undertaken

Work Phase	Activity to be Undertaken	Responsibility
Pre-Construction and Property Plan Development	Survey of alignment for all elements identified • Topsoil and landforms • Drainage • Vegetation type & weeds • Environmentally Sensitive Areas	Project Ecologist M2G Land and Compliance Manager
	Survey of alignment including cross sections to record existing surface level and contours. This survey will include the locations of rivers, creeks and drainage lines (waterways).	Site Superintendent Surveyors
	Surveys of all rivers and creeks to be encountered along the pipeline route identifying key features such as vegetation, existing erosion and clean water flow paths leading to the creek or drainage line.	Site Superintendent Surveyors
	Undertake relevant flora and fauna surveys including (but not limited to): • Presence of *Swainsona recta* along the pipeline route • Tagging of trees to be removed and/or retained • Seek expert advice from DECCW (Threatened Species Unit) regarding the translocation of rare and threatened species where applicable • Weed mapping	M2G Land and Compliance Manager Project Ecologist Botanist
	Development of Environmental Work Method Statements (EWMS') to ensure that appropriate mitigation measures will be deployed throughout the construction activities.	Site Superintendent Land and Compliance Manager
	Obtaining a "Permit to Enter Site" prior to construction commencing – to be issued by the Construction Manager. The "Permit to Enter" system outlines the specific approvals, documentation and pre construction activities that must be completed prior to works commencing in an area. This system ensures that the pre-construction activities identified above are complete prior to works commencing.	Site Superintendent M2G Land and Compliance Manager
	Development of site specific rehabilitation plans in consultation with Councils, landowners, state agencies as well as Project Ecologist, Soil Conservationist and key interest groups such as Friends of Grassland (FoG) and Landcare groups.	M2G Land and Compliance Manager Project Ecologist Landscape Design Manager CESM Manager

Work Phase	Activity to be Undertaken	Responsibility
During Construction	Protection of public landscape assets	Site Superintendent
	Establish vehicles/ plant wash down facilities along the project route.	Site Superintendent
	Undertake weed spraying where identified in the Weed Management Strategy two weeks prior to clearing and grubbing commencing.	Site Superintendent Land and Compliance Manager
	Ensure that clearing is minimised where possible and works are confined to the approved corridor (constrained and unconstrained areas).	Site Superintendent Supervisors Land and Compliance Manager
	Clearing and stockpiling of site topsoil for reuse during rehabilitation works. Ensure that stockpiles are covered as appropriate and that appropriate erosion and sediment controls are in place to avoid erosion and sediment runoff. Weed infested topsoil will be kept separate from weed free topsoil.	Site Superintendent Supervisors Land and Compliance Manager
	Undertake weekly inspections and complete weekly inspection checklist to ensure that areas of disturbance are being minimised and that effective controls are being implemented to minimise environmental impact.	M2G Land and Compliance Manager
	Ensure backfilled areas are shaped and prepared appropriately for rehabilitation, including mounding of the backfilled pipeline to allow for settlement and the construction of graded banks or mulched rip lines, at predetermined intervals (based on soil type and slope gradient), across the pipeline easement where the pipe line easement is perpendicular to the existing slope.	Site Superintendent Supervisors M2G Land and Compliance Manager
	Ongoing liaison with landowners and key stakeholders regarding progress of rehabilitation	CESM Manager M2G Land and Compliance Manager
	Progressive rehabilitation to be undertaken in accordance with specific Site Environment Plans.	Site Superintendent Project Ecologist M2G Land and Compliance Officer Back-end Crew
Post Construction	Vehicles will be confined to designated maintenance access tracks within the nominated Right of Way (ROW) if still present.	Operator
	Undertake monitoring and maintenance as required on rehabilitated areas to ensure long term stabilisation.	Operator
	Implement corrective actions where necessary if performance objective is not being achieved. This will include replanting of species which have not survived, weed control, installation of additional controls if erosion is occurring etc.	Operator

5.2 Soil management

Managing topsoil is important in re-establishing all vegetation types following disturbance of the soil profile. It will also help promote natural recruitment of native species as part of vegetation rehabilitation. Topsoil along the M2G pipeline route is a scarce commodity, so the management of topsoil from stripping to reinstatement has to be carried out precisely and without mixing topsoil and subsoil layers together.

It is recommended that the topsoil immediately above the pipe trench and the haul road (ROW) be scraped to a maximum depth of 100mm (or less depending on topsoil profile) and stockpiled separately for later reinstatement. Appendix A, Typical Pipeline Easement Layouts, provides clarification on topsoil stripping, placement of topsoil and subsoil during the construction activities, the placement of key infrastructure (ROW, pipe stringing, pipe trench) and the construction layout impacts on areas of vegetation (both native and non-native vegetation). An Environmental Work Method Statement (EWMS) for Topsoil Stripping and Stockpiling (BWA-M2G-EN-EWMS-002) has been prepared to specifically manage environmental and rehabilitation related impacts associated with this activity.

To alleviate compaction following construction, the depth to which the compaction extends is determined and then a depth just below the compaction zone is cultivated to enable the soil to be opened up enabling greater oxygen intake and water infiltration into the soil profile. The depth will be as shallow as possible to overcome the compaction and ripping up and down steeper slopes will be avoided. The practice is not recommended where sub-soils are dispersible.

For the intent of managing weeds on site, it is important that soil from weed affected areas be used only within those areas. Under no circumstances is top soil from weed affected areas allowed to enter high conservation grassland/woodland areas. Refer to Appendix D for further information on managing weeds.

5.3 Establishment techniques

5.3.1 Non-native areas (paddocks and areas of roadside verge)

Direct seeding

Direct seeding using a tractor drawn, narrow-tyne seeder will be the preferred method of sowing all exotic pasture seed along the pipeline route. Trees, shrubs, sedges and forbs will only be hand planted using tube stock to complement seeding activities in adjacent disturbed areas. Non-native pastures, especially areas where hard-seeded Weeds of National Significance such as Paterson's Curse (*Echium plantagineum)* & Serrated Tussock *(Nasella trichotoma)* are present, will be replaced with persistent perennial pasture species as outlined in Appendix B.

Prior to reinstatement of the topsoil layer, compacted areas will be cultivated to a depth suitable to alleviate this compaction. To ensure that seed and plant species are given the best chance of germinating and establishing, sowing will occur when there is adequate moisture in the soil so as to provide a favourable seedbed for germination. Seeding directly after rain may create soil compaction if the soil is too wet. Weeds, if present, will need to be sprayed out prior to sowing. Spot spraying of weeds will be undertaken if necessary.

Starter fertilizer is recommended to get non-native seedlings off to a good start and to address soil deficiencies (generally nitrogen, phosphorus & sulphur) at sowing. Note: where native seed is used in concert with cover crop species, then starter fertiliser is only recommended in exceptional circumstances.

Hydro mulching

The Bulk Water Alliance will need to utilise the technique of applying seed (exotic, cover crop or native seed) to disturbed areas where tractor drawn direct seeders cannot access either due to difficult terrain (steep

slopes) or sensitive locations such as within or adjacent to waterways . Table 5.2 specifies an approximate application using the method of hydromulching.

Table 5.2 Hydromulching application rates (per hectare)

Material	Rate per hectare
Water	35,000 litres
Organic fertiliser	100kg/ha (only in non-native areas)
Seed	Refer to Appendix B, for sowing rates
Cellulose fibre mulch[1] (sugar cane mulch mixed with 20% (by weight) shredded paper)	3,500kg
Binder: granulated 'Guar gum'	60kg
Biodegradable green dye	As recommended
Anionic bitumen emulsion (to be applied in drainage lines and steep slopes)	3.75litres / m^2

Figure 5.1 Typical hydromulching application along a drainage line and its verge using straw mulch and bitumen.

5.3.2 Areas of high conservation value

There is approximately a total area of 13.1 ha of high conservation grassland or woodland along the pipeline route that will require careful and precise reinstatement. Table 4.4 provides additional information on areas of each vegetation community and Appendix B shows species to be sown within the respective vegetation communities.

It is common on large scale infrastructure projects such as this to apply a cover crop (sterile rye corn or Japanese millet) to the seed mix when seeding areas of native vegetation. This is usually undertaken to help stabilise the soil whilst the native vegetation germinates and becomes established.

[1] *Wood fibre mulch (as an alternative to sugar cane mulch) is to be applied at a rate of 2,500 kg/ha*

As well as using this traditional, sterile cover crop, the M2G project will look at using a native grass (e.g. *Microlaena* or *Bothriochloa*) to also act as a cover crop in the short and long term as well as applying mulch material (Themeda mulch or Rice Straw Mulch) to provide stabilisation to the soil surface. These methodologies are described in detail within this section of the LRMP and aim to provide the best opportunity for reinstatement of these areas of high conservation value.

Cultivation of soil profile

The soil profile will be cultivated to a depth of approximately 150mm to prepare the area for sowing of native seed species. As mentioned in Section 5.3, soil management will involve application of gypsum to the subsoil profile as well as a light cultivation of the topsoil once it has been reinstated to the preferred level.

Seed spreading

Due to the expense of cleaning native seed down to a pure clean seed able to be distributed through a typical direct drill seeding machine, investigation of alternative approaches to applying native seed to the ground is being undertaken. One of the methods being investigated is through spreading the seed out via a purpose built machine (refer to Figure 5.2) – a mulch wheel spreader for coarse mulch and Themeda. An air blower is used for spreading fine florets. This technique covers two key factors in successful native rehabilitation.

Firstly, the native seed can be harvested with stalks, awns and florets intact and applied to the prepared area as a mulch application. This does not damage the seed as the seed is protected at all times. Secondly, the native seed, particularly Kangaroo Grass (*Themeda australis*), is adapted to drilling into the soil profile through the use of its awn which acts like a corkscrew in burrowing into the soil profile. In essence this approach mimics natural regeneration and will provide the best chance of native grass rehabilitation.

To ensure that seed and plant species are given the best chance of germinating and establishing, sowing can occur at any time as the seed will be activated by later rain. Delays to seeding of these high conservation areas are discouraged due to potential for soil erosion and infestation of weeds within the bare areas.

Figure 5.2 Purpose built native seed spreader – sowing being undertaken on soils typical to that found on the M2G pipeline

A blanket of Themeda mulch with florets intact (*Themeda, Austrodanthonia, Austrostipa*) will be applied as a mulch (approximately 80kg/ha) over the disturbed area following direct seeding of the specific native seed. This technique mirrors natural regeneration efforts and has been used to establish native grasslands, especially Kangaroo Grass dominant woodlands, that are adapted to regeneration from seed following disturbance by fire or mechanical disturbance to the soil. Figure 5.3 below shows where this practice has been utilised on a smaller scale.

Figure 5.3 Typical application of Themeda mulch as part of rehabilitation activities on the M2G project.

An alternative option under review for revegetation, above and beyond the Themeda mulch cover only, is to utilise sterile, weed free rice straw mulch infused with native seed as a mulch material which can be readily applied via a tractor drawn spreader or blower (Figure 5.4). This resource is readily available out of the rice growing regions of the NSW Riverina and is seen as a good reuse of resources, is free of terrestrial weeds and although it breaks down over time the rice straw mulch maintains a highly durable layer outlasting other cereal straws whilst maintaining excellent stabilisation and moisture holding ability. The rice straw will be applied to the ground after the sowing of the native seed or as a separate mulch application.

Figure 5.4 Rice straw mulch covering similar to what will be delivered on the M2G project (*note*: this covering has not had a tacifier applied to help stabilise the mulch to the soil surface).

Depending on which technique is adopted, either of the mulch applications will need to be fixed to the ground using a light application of a tacifier (guar gum or posi-shell^{R}) that will be adequate enough to hold down the mulch for an extended period of time so that it doesn't blow away and will not impede native seed germination.

Air Seeding

The Bulk Water Alliance is investigating utilising another alternative technique to traditional direct drill operations in applying native seed to disturbed areas. The technique involves applying the seed to the bare soil through the use of an air seeding machine as depicted in Figure 5.5 below. This will be applied to the cultivated soil surface before the Themeda Florets and/or Rice Straw is applied. Native seed that can be distributed in this means include *Bothriochloa macra* (Red Grass), *Joycea pallida* (Red Anther Wallaby Grass), *Microlaena stipoides* (Weeping Grass), *Austrodanthonia (Wallaby Grasses)*, *Elymus scaber* (Wheatgrass) and *Austrostipa scabra* (Corkscrew Grass).

Figure 5.5 Air seeding on a major road infrastructure project in the South West Slopes of NSW (Photo courtesy of Natural Capital).

5.3.3 Drainage lines (ephemeral water courses)

The rehabilitation of watercourse crossings will be categorised using the Strahler System of stream order classification. As shown in Appendix B, the pipeline crosses:

- 6 first order watercourses;
- 7 second order watercourses;
- 1 third order watercourse and
- 2 fourth order watercourses.

Burra Creek is classified as a fifth order stream where the pipeline intersects it.

Table 5.3 outlines the rehabilitation methodology of watercourse crossings for each identified stream order.

The landscape treatment downstream of scour valves will replicate the treatment of a 4th order stream. That is,

- Protect downstream of pipeline with rock covering over backfill.
- Stream bed profile to tie in with existing upstream and downstream (except in the instance where there is active erosion occurring – then the bed profile will be shaped to prevent further erosion).
- Topsoil and revegetate with native grasses/ groundcovers as recommended in the Landscape Rehabilitation Management and Site Environment Plans.

The landscape treatments of both the Murrumbidgee River intake (Low Lift Pump Station) and Burra Creek discharge can be found within Appendix B, Landscape Design Details.

Table 5.3 Watercourse crossings and their corresponding method for rehabilitation.

Stream Order	Chainage Locations	Rehabilitation Methodology	Responsibility (implement/ coordinate)
First order	• ch. 450 • ch. 2900 • ch. 3320 • ch. 4350 • ch. 4700 • ch. 7570	• Topsoil, line drainage line with erosion matting and plant with native grasses as recommended in the Landscape Rehabilitation Management Plan. • Stream bed profile to tie in with existing upstream and downstream profile.	Superintendent M2G Land and Compliance Manager Landscape Contractor
Second Order	• ch. 2320 • ch. 5100 • ch. 5800 • ch. 6050 • ch. 7100 • ch. 10,800 • ch. 11250	• Topsoil, line drainage line with erosion matting and plant with native grasses as recommended in the Landscape Rehabilitation Management Plan. • Stream bed profile to tie in with existing upstream and downstream profile.	Superintendent M2G Land and Compliance Manager Landscape Contractor
Third Order	• ch. 9130	• Topsoil, line drainage line with erosion matting and plant with native grasses as recommended in the Landscape	Superintendent M2G Land and Compliance Manager

Stream Order	Chainage Locations	Rehabilitation Methodology	Responsibility (implement/ coordinate)
		Rehabilitation Management Plans. • Stream bed profile to tie in with existing upstream and downstream profile.	Landscape Contractor
Fourth order	• ch. 9950 • ch. 10350	• Protect pipeline with rock covering over backfill. • Stream bed profile to tie in with existing upstream and downstream (except in the instance where there is active erosion occurring – then the bed profile will be shaped to prevent further erosion. • Topsoil and revegetate with native grasses/ groundcovers as recommended in the Landscape Rehabilitation Management Plan.	Superintendent M2G Land and Compliance Manager Landscape Contractor

5.3.4 Sourcing native seed

Native seed consistent with those species found within the study area will be sourced and utilised to re-vegetate areas of native vegetation, particularly native grass. Kangaroo Grass (*Themeda australis*) is the dominant native grass species identified by the project ecologists between the Murrumbidgee River and the Goulburn-Bombala railway line, with Wallaby Grass (*Austrodanthonia* spp.) and Spear grasses (*Austrostipa* spp.) the dominant grasses between the railway line to the foot of the Gibraltar Saddle. Other significant native grass species are red grass (*Bothriocloa macra*) & wheatgrass (*Elymus scaber*) and seed of these species will be included in the native pasture seed mix. As native grass seed is difficult to harvest (although supply is sometimes abundant dependent on seasonal variability) and expensive, strategies to enhance germination and establishment success will be adopted including rigorous weed control before and after sowing. Refer to Appendix D, Weed Management Procedure for further details of the weed management proposed for the M2G project.

5.3.5 Erosion Control

During the rehabilitation of the disturbed areas, there is a potential for erosion until sufficient ground cover (usually around 70%) is established. The risk of erosion is increased along the backfilled pipe line due to the lower wet strength of the backfilled material compared to that of the adjacent in-situ soil material. This risk is exacerbated if there is subsidence of the backfilled material creating a linear depression for runoff to flow along. This can be mitigated by mounding the backfilled trench to allow for subsidence.

To help minimise the risk of erosion, the BWA will either:

- sow a sterile cover crop; or
- mulch the surface with a suitable seed species constitution ; or
- erosion matting/rice straw mulch over the area.

Other erosion control measures include the installation of graded banks or mulched rip lines across the pipeline route where it is perpendicular to the surrounding slope. These graded banks or mulched rip lines reduce the distance runoff has to flow thereby reducing velocity, increase infiltration (in the case of mulched rip lines) and reduce erosion. Graded banks must outlet onto a stable area and not onto the disturbed areas.

They are ideally constructed on a grade of 2 -3% to reduce the potential for erosion along the bank. One advantage of using mulched rip lines is that they conform to the existing topography which in the long term means there are no issues traversing the easement.

Key areas such as drainage lines will be stabilised with erosion matting or rock (refer to 5.3.3 above) to provide instant surface protection until the relevant vegetation becomes established.

5.3.6 Maintenance regime

A rigorous maintenance regime will be implemented following landscape rehabilitation activities. Maintenance will include the following activities:

Reinstatement of disturbed areas

Should areas along the pipeline route be damaged following a significant rainfall event (e.g. rilling of cut or fill batters or sheet erosion), then the affected area will be appropriately reinstated with topsoil and resown as per the prescribed methodology detailed in Section 5 of this plan.

Weed management

Weed management will be carried out prior to, during and following establishment of native vegetation and non-native vegetation along the pipeline route. Eradicating noxious weeds will be a priority of this weed management program. Appendix D of this document refers to a maintenance period of two years to ensure that weeds are being managed effectively and that the risk of weed seed germination is mitigated.

Watering

The Bulk Water Alliance will water areas to achieve suitable conditions prior to pasture sowing. However, watering of large revegetation projects of this nature is sometimes impractical and ineffective. This is why cover crops have been excluded from the high conservation areas as they have a tendency to be thirsty colonisers of a site, which is seen as being of benefit for soil protection, yet detrimental to the establishment of native seed as it draws available moisture from the soil profile thus inhibiting seed germination.

Reseeding of bare areas

Where areas fail to establish successfully, the BWA will re-seed these areas with the appropriate seed mix to ensure that areas are fully rehabilitated.

Replanting of planted areas

Where planted areas have not successfully established, replanting efforts will be undertaken to ensure that the final planting composition reflects the LRMP.

5.3.7 Protection of threatened species

Proposed actions to protect the habitats of species of National Environmental Significance (NES), as identified under the EPBC legislation *Aprasia parapulchella* (Pink Tailed Worm Lizard), *Swainsona recta* (Small Purple Pea) and *Leucochrysum albicans var. tricolor* (Hoary Sunray) will be referred to the Department of Environment, Water, Heritage and the Arts (DEWHA).

The BWA, in constructing the pipeline and associated pump stations, will manage the impacts on protected threatened species in accordance with mitigation measures and safeguards outlined in the Terrestrial Ecology Management Plan (TEMP).

5.4 Improvement of Terrestrial Flora and Fauna Values

The following practices will be followed in order to ensure terrestrial flora and fauna values are improved along the pipeline route:

- minimising the unnecessary removal of native vegetation by choosing and marking disturbed areas before construction commences for the siting of construction materials, machinery, stockpiles and associated lay down areas;
- providing physical protection measures (fencing) to avoid impact on existing public landscape assets or areas of vegetation;
- developing a weed management strategy to minimise and avoid the introduction and transportation of weeds in particular St. John's Wort (*Hypericum perforatum*), African Love Grass (*Eragrostis curvula*), Serrated Tussock (*Nassella trichotoma*), Paterson's curse (*Echium plantaginum*) and Horehound (*Marrubium vulgare*) into areas not infested. The weed management strategy will include the following elements: weed distribution maps, strict vehicle hygiene such as cleaning of tyres, wheel guards, plates beneath plant and base of machinery immediately before exiting areas of weed infestation and entry into weed free areas; weed spraying and an eradication program. (Refer to Appendix D for the M2G Weed Management Procedure);
- avoiding the mixing of soil horizons when excavating or reinstating the pipeline trench;
- avoiding stockpiling of soil and associated construction material on areas of high conservation value – construction footprint in and around high conservation value areas to be minimised and managed accordingly;
- inspecting the open trench for trapped fauna, particularly if the trench is left open for anymore than one night and prior to infilling of trench. Escape routes such as planks of wood or stout branches will be placed in the trenches overnight to allow any trapped fauna a means of escape;
- where practical, avoiding the removal of hollow bearing trees and branches to the greatest extent possible. Tree hollows will be inspected for resident fauna by a qualified ecologist prior to felling and trimming;
- where practical, retaining timber greater than 100mm in diameter as coarse woody debris for the purposes of providing habitat for ground dwelling fauna. Branches and limbs smaller than 100mm can be mulched for use on site (Refer to Appendix C for a prescription for Coarse Woody Debris relocation);
- installation of erosion and sediment control measures to prevent soil erosion and sedimentation of nearby waterways in accordance with NSW and ACT best practice management guidelines;
- engaging a suitably qualified Soil Conservationist to assist in the preparation of Erosion and Sediment Control Plans and to provide advice to the construction team in the management of soils along the pipeline route and in the construction of the pump station; and
- minimising impacts on existing natural drainage patterns.

6 Community & Stakeholder Consultation

6.1 Community Engagement and Stakeholder Management

Close community liaison will be maintained to ensure that local residents are aware of the times and durations when they may be affected by construction work and to provide an avenue for communication between the community and the Bulk Water Alliance.

All communication and consultation will be undertaken in accordance with the project Community Engagement and Stakeholder Management (CESM) Plan. The CESM Manager is responsible for the interface with the community. This includes (but is not limited to) notification of construction activity, notification of temporary road closures, community engagement regarding construction and the complaints process. The CESM Manager reports to the M2G Client representative whilst working in conjunction with the M2G Project Manager, M2G Construction Manager, Site Superintendent, M2G Land and Compliance Manager and Project Engineers.

In addition, consultation with government agencies will be undertaken regularly as described in the CEMP with the intention of reviewing the effectiveness of the LRMP, site management practices, monitoring results and any other relevant issues.

Table 6.1 Communication Network

Communication	
Project personnel including sub-contractors/suppliers	• A site induction and environmental training will be provided to all personnel and sub-contractors engaged to work on the site. • Feedback on environmental matters, new legislation etc. will be provided and encouraged. • Close communication will be maintained between the Construction Manager, M2G Land and Compliance Manager, Foremen and Environmental Officer.
Government agencies	**ACT** • Department of the Environment, Climate Change, Energy and Water (DECCEW) • Parks Conservation Service (TAMS) • ACT Heritage Unit **NSW** • Department of the Environment, Climate Change and Water (DECCW) • Department of Planning (DoP) • Australian Rail Track Corporation (ARTC)
Community and Landholders	• Individual landholders will be informed in advance of construction activity affecting them in accordance with the CESM Plan • Project information will be made available to the community in accordance with the CESM Plan through advertisements, community notices and newsletters. • A protocol for registering and responding to complaints will be established as detailed in the Complaints Management Procedure and CESM Management Plan.

6.2 Complaints management strategy

The Bulk Water Alliance is committed to managing landscape rehabilitation related complaints from affected residents or stakeholders in a proactive and conciliatory manner.

Relevant community and stakeholder groups will be progressively informed of the various stages of construction by the Community Engagement and Stakeholder Management (CESM) team, particularly prior to significant construction generating activities.

The community and stakeholder groups identified in the CESM Plan will be informed of the duration of the works, what impacts that they are likely to expect and they will be given a 1800 toll free number to contact the BWA CESM team should they wish to register a complaint regarding any aspect of the construction project.

The BWA CESM team will implement a process for registering and responding to the lodged complaint as per the Complaints Management Procedure. The CESM Manager will report back to the project team on impact and mitigation effectiveness on a weekly basis.

The Water Security Hotline phone number (6248 3563) is available during business hours for general questions, project updates and to provide feedback. A toll free number (1800 211 242) is available 24 hours a day for emergencies. Complaints and comments can also be sent via email to watersecurity@actew.com.au.

7 Training, Awareness and Competence

Three main forms of training will be implemented on site:

- site induction;
- environmental management training; and
- “toolbox” training

Records of all site inductions and on site training will be kept on a database, including details of the training topic(s) presented, participants and training dates. All participants will be required to “sign-off” that they have been informed and understand their environmental obligations at the conclusion of each training session.

Training will generally be prepared and delivered by the Environmental Officer, or by personnel delegated by the M2G Land and Compliance Manager.

7.1 Site Induction

Prior to working on site, all personnel and subcontractors will undertake a site induction detailing significant environmental and OHS requirements associated with the M2G project. The will include, but not be limited to, the following environmental components.

- the EMS and CEMP (purpose, objectives, etc) and the requirements of the LRMP;
- legal requirements including due diligence, duty of care and potential consequences of infringements;
- environmental responsibilities;
- conditions of licences, permits and approvals;
- BWA policies (including the Shared Road Policy);
- significant environmental issues and areas of the site, including the identification of project boundaries, location of refuse bins, washing, refuelling and maintenance of vehicles, plant and equipment;
- environmental management techniques for key environmental elements (soil and water, waste and recycling, flora and fauna, heritage etc);
- incident management and emergency plans;
- reporting process for environmental harm/incidents;
- protection and maintenance of environmental controls; and
- BWA sustainability objectives.

7.2 Environment Management Training

Targeted environmental management training will be provided to individuals responsible for environmental management on site, or groups who are undertaking activities which have been identified as “high risk”. This environmental training is designed to achieve a level of awareness and competence appropriate to their assigned activities.

Specific links will be made between environmental objectives and sustainability principles during training sessions (where possible). A comprehensive overview of sustainability may also need to be included (i.e. social, economic and environmental aspects, and inter-generational equity).

Records will be maintained on site of all training sessions conducted and personnel attendance. These records will be maintained by the Environmental Officer.

7.3 Toolbox Training

Toolbox training will help to ensure that relevant information is communicated to the workforce and that feedback can be provided on issues of interest or concern. Toolbox training will generally be prepared and delivered by the Project Engineers, Superintendent, Site Supervisors and/or the Environmental Officer and will reflect risks and concerns associated with construction Activities occurring on site.

Environmental Work Method Statements (EWMS') will draw reference to specific toolboxes based on risks associated with the proposed construction activity. The toolboxes will complement this LRMP by providing additional details on the management and mitigation of identified environmental impacts. Environmental toolbox training topics may include but are not limited to:

- working within or in close proximity to waterways;
- clearing and grubbing procedures;
- landscape Rehabilitation procedures;
- concrete washout procedures;
- dust control;
- protecting waterways and riparian zones;
- wastewater control;
- spills and leaks (including the application of remediation products);
- emergency response procedures;
- wet weather procedures and inspections;
- changes to recent legislation; and
- other general site issues.

8 Inspection, Auditing and Monitoring

8.1 Inspection and Auditing

To be consistent with the CEMP, the implementation of the LRMP will be monitored regularly by Environmental staff in conjunction with the appointed Landscape contractor and M2G construction staff. The appointed sub-contractors engaged to work on the landscape rehabilitation of the pipeline will have to comply with BWA's quality management system as well as specifications for landscape planting and revegetation according to the LRMP. A regular program of monitoring, auditing and review of the LRMP and its implementation, will be carried out in accordance with this LRMP and its specific designs, the CEMP and the M2G specific Quality Management Plan.

8.2 Monitoring of Landscape Rehabilitation Performance

The monitoring of rehabilitation performance will be largely covered under this LRMP and its overarching CEMP. Following a period of 1 year after completion of the project, the monitoring of landscape rehabilitation will transfer over to the Operational Environment Management Plan (OEMP) and its specific sub-plans. Monitoring will not be limited to weed infestations, but it will extend to all areas of landscape reinstatement such as vegetation cover (native vegetation and exotic/cover crop) from seeding initiatives, stability of riparian / waterway areas and success of landscape planting elements.

In order to assess success of the rehabilitation initiative, the performance targets listed in Table 8.1 are to be used to gauge successful rehabilitation of the site. Once these targets have been achieved within the property, the corresponding landholder will be notified and arrangements made to have fencing removed and the area to be continued to be managed by the landholder / leaseholder.

An updated vegetation condition assessment (Appendix E of this plan) has been undertaken to help guide the performance of rehabilitation initiatives on the M2G project.

Table 8.1 Key Performance Indicators for reinstatement of vegetation communities.

Vegetation community	Key Performance Targets
Non-native vegetation	**Ground cover** - > 70% vegetation cover of the species sown **Weeds** – better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown.
Native vegetation	**Ground cover** - > 70% vegetation cover of the native species sown. **Weeds** – better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown.
High conservation value woodland	**Ground cover** - > 70% vegetation cover of the native species sown and survival of native ground and tree species. **Weeds** – better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown. **Native species** (planting success) – all species listed for seeding and planting are present.

The performance of the M2G LRMP will be monitored through the use of plots (quadrats and transects) (refer to Figure 8.1 and Table 8.2), and photo reference points and will be undertaken by an independent and suitably qualified landscape ecologist. Results of monitoring will be made available to the landholders and to the respective NSW or ACT government agencies, on request.

As indicated earlier, the monitoring of vegetation establishment and reinstatement under this plan will occur for a period of one year post construction when it will transfer over to the Operational EMP and its corresponding Ecological Monitoring sub-plan.

The monitoring of threatened species (terrestrial and aquatic) richness or abundance is detailed in the Terrestrial Ecology Management Plan as well as the OEMP's Ecological Monitoring Sub-plan.

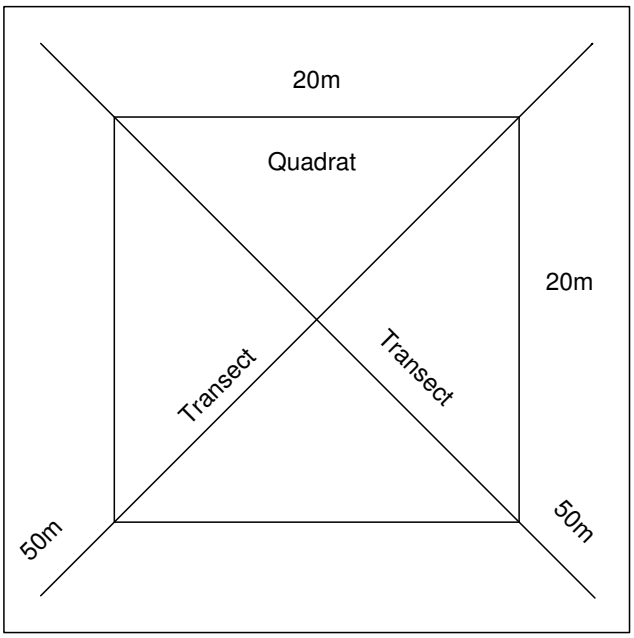


Figure 8.1 Plots proposed for monitoring of native and exotic vegetation – combination of 20m x 20m quadrat and two 50m transects.

Table 8.2 Monitoring schedule for the Rehabilitation of the M2G project.

Period	Monitoring Requirements	Frequency	Phase
1st Year after construction completion	Intense monitoring undertaken twice during the first year. Key areas of focus in the first year: Plots (quadrats and transects) to determine % of cover as well as % of native and non-native species germinating and establishing on site. The plots will also indicate the presence of declared weed species and status to inform their management. *Note: plots to be identified along the entire pipeline route with a minimum of one quadrat per*	Twice in 1st year*	Construction (covered under the CEMP)

Period	Monitoring Requirements	Frequency	Phase
	property and/or one quadrat per vegetation community on each property and to be undertaken by an independent and suitably qualified ecologist.		
2nd Year after construction completion	Repeat of first year monitoring at all identified quadrat locations.	Twice*	Operational (covered under the OEMP
3rd Year after construction completion	Repeat of first year monitoring at all identified quadrat locations.	Twice*	Operational
4th Year after construction completion	Repeat of first year monitoring at all identified quadrat locations.	Twice*	Operational
5th Year after construction completion	Repeat of first year monitoring at all identified quadrat locations.	Twice*	Operational

**monitoring to be undertaken in early spring and early summer or as agreed with ecological consultants*

The location of the fixed plots (quadrats and transects) will remain consistent throughout the 5 years of the monitoring program and once the plots identified have met the key performance targets stipulated in Table 8.1 and to the satisfaction of the landholder, the project then deems rehabilitation to be complete.

9 Review and Improvement of the LRMP

The outcomes of inspections, monitoring, audits and the completion of checklists will facilitate the identification of problems, recurring issues or areas for improvement. Where identified, the effectiveness of this LRMP will be reviewed and opportunities for improvement will be identified and discussed with site personnel.

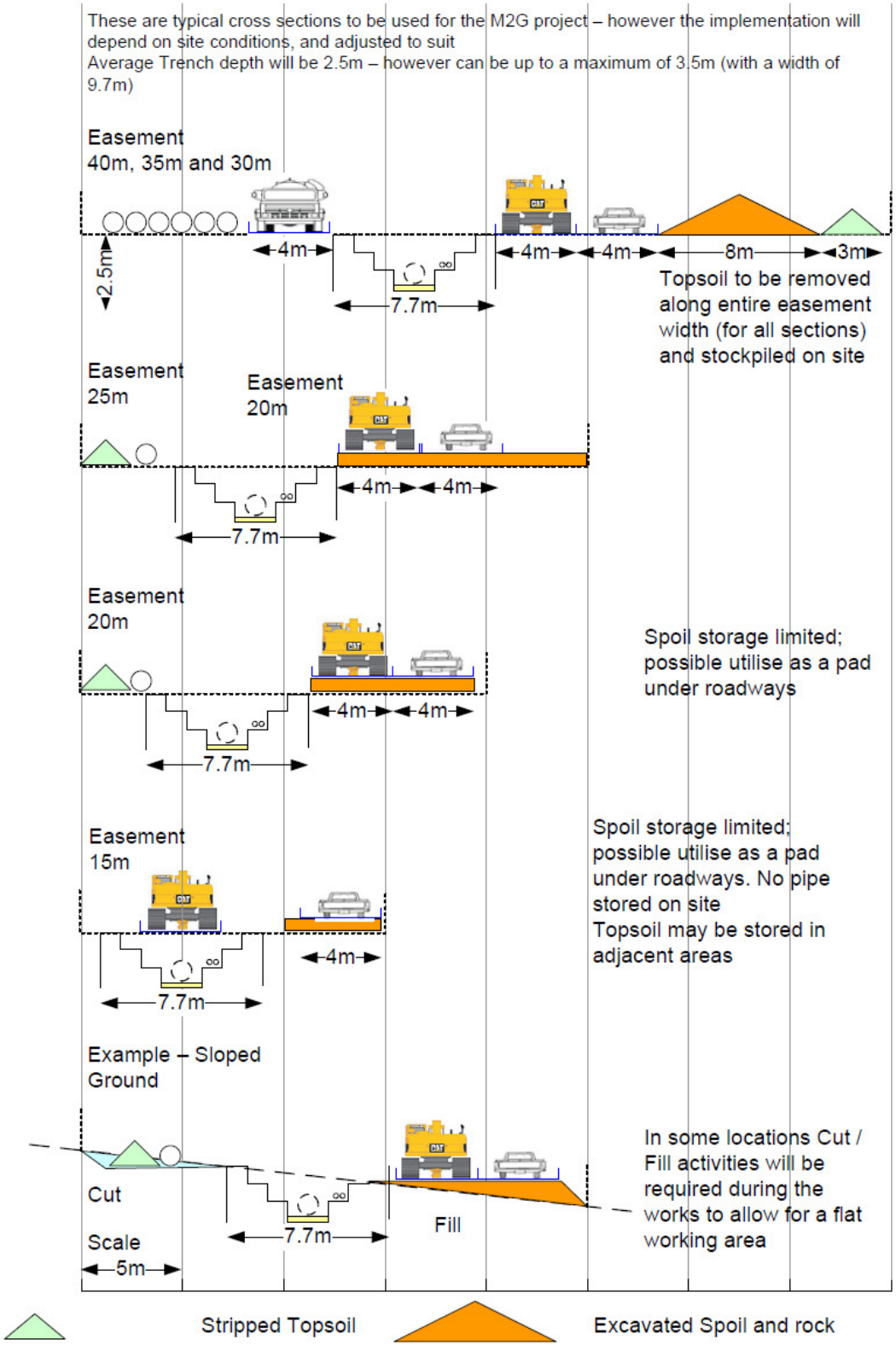
A system for the review and improvement of the environmental management system is described within the CEMP.

Table 9.1 Register of Significant LRMP Updates

Reference	Amendment Required	Date amended	Status
Appendix F	Incorporation of revegetation condition summary (Appendix E) into Landscape Rehabilitation Management Plan	11th March, 2011	Closed
Appendix E	Revision of Weed Management Maps	11th March, 2011	Closed
Appendix E	Revise Weed Management Maps and Strategy	13 April 2011	

Appendix A **Typical Pipeline Easement Layouts**

Bulk Water Alliance – Murrumbidgee to Googong
Typical Pipeline Easement Layouts



Appendix B **Landscape Design Details**

SCREEN PLANTING THAT REPLICATES LOCAL WOODLAND CHARACTER AND REDUCES THE VISUAL IMPACT OF THE HLPS INFRASTRUCTURE AND MICROWAVE TOWER TO ROAD USERS APPROACHING ANGLE CROSSING FROM THE NORTH, AND RECREATION USERS WITHIN THE MURRUMBIDGEE RIVER CORRIDOR TO BE USED.

RE-PROFILING OF THE LAND FORM TO ACHIEVE VISUAL AND PHYSICAL CONNECTION WITH THE SURROUNDING CONTOURS. STEEP SLOPES TO BE RREINSTATED / STABILISED WITH NATIVE/INDIGENOUS GRASS, GROUND COVER AND SMALL SHRUB SPECIES MIX TO REDUCE VISIBILITY OF EXPOSED EARTHWORKS AND STEEP SLOPES.

COPSES OF SCREEN PLANTING TREES TO REINFORCE EXISTING VEGETATION AND REDUCE THE VISUAL IMPACT OF THE HLPS INFRASTRUCTURE AND MICROWAVE TOWER TO ROAD USERS CROSSING THE CAUSEWAY AT ANGLE CROSSING, AND RECREATION USERS WITHIN THE MURRUMBIDGEE RIVER CORRIDOR.

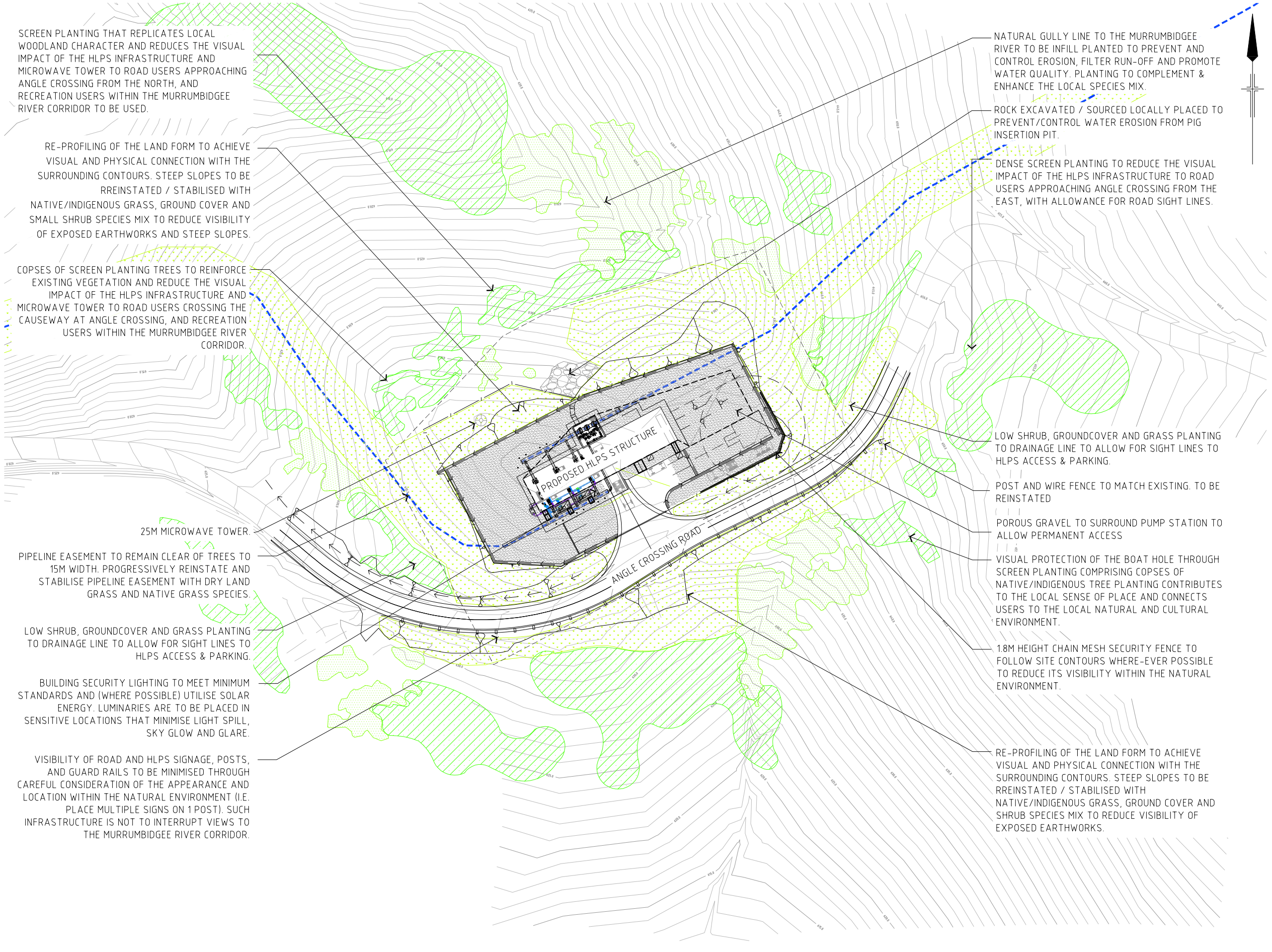
25M MICROWAVE TOWER.

PIPELINE EASEMENT TO REMAIN CLEAR OF TREES TO 15M WIDTH. PROGRESSIVELY REINSTATE AND STABILISE PIPELINE EASEMENT WITH DRY LAND GRASS AND NATIVE GRASS SPECIES.

LOW SHRUB, GROUNDCOVER AND GRASS PLANTING TO DRAINAGE LINE TO ALLOW FOR SIGHT LINES TO HLPS ACCESS & PARKING.

BUILDING SECURITY LIGHTING TO MEET MINIMUM STANDARDS AND (WHERE POSSIBLE) UTILISE SOLAR ENERGY. LUMINARIES ARE TO BE PLACED IN SENSITIVE LOCATIONS THAT MINIMISE LIGHT SPILL, SKY GLOW AND GLARE.

VISIBILITY OF ROAD AND HLPS SIGNAGE, POSTS, AND GUARD RAILS TO BE MINIMISED THROUGH CAREFUL CONSIDERATION OF THE APPEARANCE AND LOCATION WITHIN THE NATURAL ENVIRONMENT (I.E. PLACE MULTIPLE SIGNS ON 1 POST). SUCH INFRASTRUCTURE IS NOT TO INTERRUPT VIEWS TO THE MURRUMBIDGEE RIVER CORRIDOR.



NATURAL GULLY LINE TO THE MURRUMBIDGEE RIVER TO BE INFILL PLANTED TO PREVENT AND CONTROL EROSION, FILTER RUN-OFF AND PROMOTE WATER QUALITY. PLANTING TO COMPLEMENT & ENHANCE THE LOCAL SPECIES MIX.

ROCK EXCAVATED / SOURCED LOCALLY PLACED TO PREVENT/CONTROL WATER EROSION FROM PIG INSERTION PIT.

DENSE SCREEN PLANTING TO REDUCE THE VISUAL IMPACT OF THE HLPS INFRASTRUCTURE TO ROAD USERS APPROACHING ANGLE CROSSING FROM THE EAST, WITH ALLOWANCE FOR ROAD SIGHT LINES.

LOW SHRUB, GROUNDCOVER AND GRASS PLANTING TO DRAINAGE LINE TO ALLOW FOR SIGHT LINES TO HLPS ACCESS & PARKING.

POST AND WIRE FENCE TO MATCH EXISTING. TO BE REINSTATED

POROUS GRAVEL TO SURROUND PUMP STATION TO ALLOW PERMANENT ACCESS

VISUAL PROTECTION OF THE BOAT HOLE THROUGH SCREEN PLANTING COMPRISING COPSES OF NATIVE/INDIGENOUS TREE PLANTING CONTRIBUTES TO THE LOCAL SENSE OF PLACE AND CONNECTS USERS TO THE LOCAL NATURAL AND CULTURAL ENVIRONMENT.

1.8M HEIGHT CHAIN MESH SECURITY FENCE TO FOLLOW SITE CONTOURS WHERE-EVER POSSIBLE TO REDUCE ITS VISIBILITY WITHIN THE NATURAL ENVIRONMENT.

RE-PROFILING OF THE LAND FORM TO ACHIEVE VISUAL AND PHYSICAL CONNECTION WITH THE SURROUNDING CONTOURS. STEEP SLOPES TO BE RREINSTATED / STABILISED WITH NATIVE/INDIGENOUS GRASS, GROUND COVER AND SHRUB SPECIES MIX TO REDUCE VISIBILITY OF EXPOSED EARTHWORKS.

LEGEND

- PIPELINE & EASEMENT 15m WIDTH
- BUSHFIRE - ASSET PROTECTION ZONE
- PROPOSED WOODLAND
- GRASSLAND REINSTATEMENT
- EXISTING VEGETATION TO BE RETAINED, PROTECTED & ENHANCED
- ROCK PROTECTION
- REINSTATE RURAL FENCE TO ROADSIDE
- POROUS SURFACING TBC

NOTES
REFER ALSO TO NOTES ON DRAWING GHD-M2G-GEN-PL-SKT-1051
HLPS = HIGH LIFT PUMP STATION

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

PRELIMINARY

No.	REVISION	DATE	CKD	AUTH
A	ISSUE FOR DA APPROVAL			

BULK WATER ALLIANCE

ACTEW CORPORATION

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MURRUMBIDGEE TO GOOGONG RAW WATER TRANSFER PROJECT
HIGH LIFT PUMP STATION
LANDSCAPE REINSTATEMENT
GENERAL ARRANGEMENT

Scale: 1:500	Date: MAY 2010	Sheet No.:
ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 | ActewAGL Drg No. | Rev. A

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Date Plotted: 5/10/2010 CTB File: ActewAGL.CTB

GENERAL NOTES

1. THIS LANDSCAPE CONCEPT PLAN PROPOSES LANDSCAPE REINSTATEMENT STRATEGIES, POST INFRASTRUCTURE CONSTRUCTION.

2. THIS LANDSCAPE CONCEPT IS PENDING THE PRODUCTION OF A LANDSCAPE MANAGEMENT AND PROTECTION WORKS PLAN FOR CONSULTATION, SUBMISSION AND APPROVAL OF ALL WORKS BY PARKS, CONSERVATION AND LAND (PCL) AND THE TERRITORY AND MUNICIPAL SERVICES (TAMS) ASSET ACCEPTANCE. THE LANDSCAPE MANAGEMENT PLAN Will DETAIL SPECIFICATIONS REGARDING: REMOVAL OF TREES WITHIN THE CONSTRUCTION FOOTPRINT; PREPARATION AND STOCKPILING OF TIMBER AND ORGANIC MATERIAL FOR RE-USE IN LANDSCAPE PROPOSALS; DEAD TREES TO BE MANAGED FOR HABITAT; PROTECTION OF EXISTING VEGETATION TO BE RETAINED; TREE PROTECTION ZONE FENCING; WEED CONTROL AREAS; EXCAVATION NEAR PROTECTED VEGETATION; WORKING WITHIN THE VICINITY OF TREE PROTECTION ZONES, AND; SITE PREPARATION WORKS FOR REINSTATEMENT.

3. ALL WORKS ARE TO COMPLY WITH THE TAMS GUIDELINES FOR THE PROTECTION OF PUBLIC LANDSCAPE ASSETS ADJACENT TO DEVELOPMENT WORKS, ISSUE 1 REVISION 2 (THE GUIDELINES) AND THE STANDARD SPECIFICATION FOR URBAN INFRASTRUCTURE WORKS EDITION 1 REVISION 0. THESE DOCUMENTS ARE AVAILABLE AT WWW.TAMS.ACT.GOV.AU. PROPOSED ACTIVITIES FOR WHICH APPROVAL SHOULD BE SOUGHT INCLUDE:

- REMOVAL OF TREES WITHIN THE CONSTRUCTION FOOTPRINT.

- WHERE TREES ARE TO BE RETAINED, MAINTENANCE ACTIVITIES SUCH AS PRUNING AND REMOVAL OF DEAD WOOD.

- WEED CONTROL AREAS.

- ANY OTHER SITE CLEARANCE AND/OR EARTHWORKS THAT MAY IMPACT THE MURRUMBIDGEE RIVER CORRIDOR.

4. DETAILED VEGETATION SURVEYS (INCLUDING CONDITION REPORT) ARE YET TO BE CONDUCTED. AS SUCH, THE PROPOSALS GENERALISE AREAS FOR REINSTATEMENT BASED UPON AERIAL PHOTOGRAPHY AND SITE ASSESSMENT.

5. GRASS REINSTATEMENT AREAS - DROUGHT TOLERANT DRY LAND GRASS COVER REINSTATEMENT (E.G. DWARF TYPE TALL FESCUE SUMMER DRY LAND GRASS SEED MIX, INCLUDING NATIVE SPECIES WHERE APPROPRIATE). RE-SEEDING SHOULD BE ALLOWED FOR ONE MONTH FROM ORIGINAL SEEDING WITH ALL SOWN AREAS ARE TO BE WATERED DURING THE ESTABLISHMENT PERIOD. GROUND SHOULD BE CULTIVATED TO A MAXIMUM DEPTH OF 50MM PRIOR TO SEEDING. TOPSOIL IS NOT TO BE REMOVED AND SOIL LEVEL IS NOT TO BE ALTERED. ALL NEWLY SOWN AREAS ARE TO BE PROTECTED WITH PEST PROOF FENCING UNTIL WELL ESTABLISHED.

6. ALL NEW PLANTING AREAS ARE TO BE PROTECTED WITH TEMPORARY FENCING UNTIL WELL ESTABLISHED.

7. IN SOURCING ALL LANDSCAPE MATERIALS (INCLUDING RE-USE AND RECYCLING), LOCAL PRODUCTS AND CONTRACTORS ARE TO TAKE PRECEDENCE OVER NON-LOCAL PRODUCTS.

8. STOCKPILE AND RE-USE TOPSOIL FROM THE ENTIRE SITE TO PRESERVE NATIVE SEED STOCK AND REDUCE THE NEED TO IMPORT TOPSOIL.

9. PROVIDE GRAPHICALLY CLEAR INTERPRETATION SIGNAGE THAT PROVIDES INFORMATION FOR USERS REGARDING NATURE AND RECREATION ACTIVITES WITHIN MURRUMBIDGEE RIVER CORRIDOR.

10. APPROVAL & OPPORTUNITIES FOR OFFSET PLANTING (OUTSIDE THE PROJECT BOUNDARY) TO COMPENSATE FOR TREE REMOVAL ARE AS PER OFFSET PLAN (YET TO BE FINALISED)

INDICATIVE PLANTING PALETTE

Botanical Name	Common Name	Planting Size	Density (per sq. m)
Trees			
Eucalyptus blakelyi	Blakely's Red Gum	tube stock	0.2/m^2
Eucalyptus manifera	Brittle Gum	tube stock	0.2/m^2
Eucalyptus melliodora	Yellow Box	tube stock	0.2/m^2
Callitris endlicheri	Black Cypress Pine	tube stock	0.2/m^2
Shrubs			
Kunzea ericoides	Burgan	tube stock	0.5/m^2
Bursaria lasiophylla	Hairy Bursaria	tube stock	0.5/m^2
Acacia siculiformis	Dagger Wattle	tube stock	0.5/m^2
Cassinia longifolia	Shiny Cassinia	tube stock	0.5/m^2
Indigofera australis	Austral Indigo	tube stock	0.5/m^2
Grass/Groundcover			
Austrostipa scabra	Spear Grass	seed mix	5/m^2
Austrodanthonia carphoides	Short Wallaby Grass	seed mix	5/m^2
Chrysocephalum apiculatum	Yellow Buttons	seed mix	5/m^2
Goodenia pinnatifida	Scrambled Eggs	seed mix	5/m^2
Leptorhyncos squamatus	Scaly Buttons	seed mix	5/m^2
Leucochrysum albicans var.tricolor.	Hoary Sunray	seed mix	5/m^2
Swainsona sericea	Silky Swainson Pea	seed mix	5/m^2
Themeda australis	Kangaroo grass	seed mix	5/m^2
Wahlenbergia stricta	Tall Bluebell	seed mix	5/m^2

NOTES

TOTAL TREE PLANTING AREA: 9170m^2
TOTAL GRASSLAND REINSTATEMENT AREA: 6040m^2

PRELIMINARY

No.	REVISION	DATE	CKD	AUTH
A	ISSUE FOR DA APPROVAL			

BULK WATER ALLIANCE

ACTEW CORPORATION

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Contractor's Drawing No.: GHD-M2G-GEN-PL-SKT-1051			
ACTEW - Owner's Chief Engineer:			

MURRUMBIDGEE TO GOOGONG RAW WATER TRANSFER PROJECT
HIGH LIFT PUMP STATION
LANDSCAPE REINSTATEMENT
GENERAL NOTES AND PLANTING SCHEDULE

Scale: N.T.S.	Date: MAY 2010	Sheet No.:
ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 ActewAGL Drg No. Rev. A

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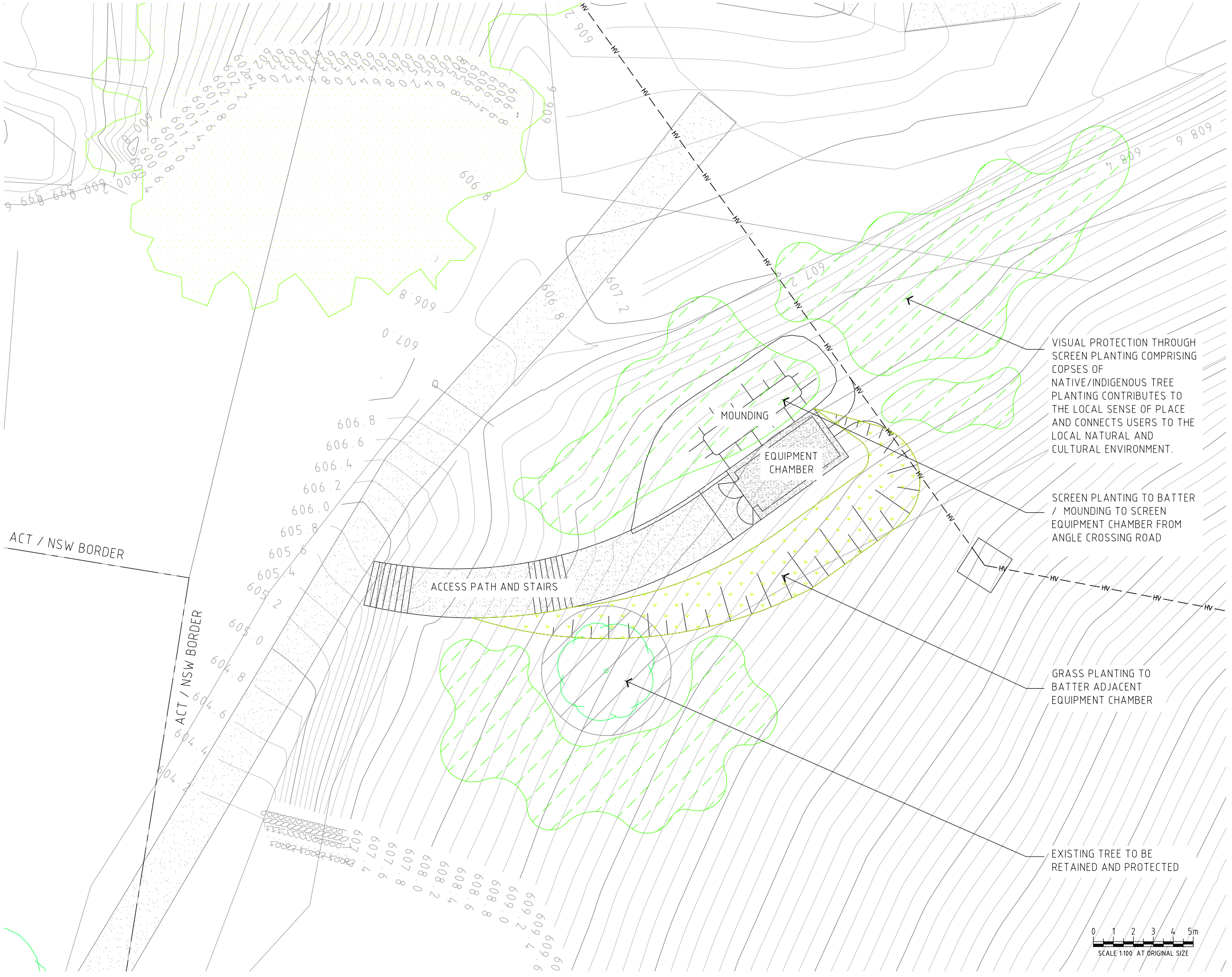

LEGEND

- HV CABLE ROUTE
- PROPOSED WOODLAND
- GRASSLAND REINSTATEMENT
- EXISTING VEGETATION TO BE RETAINED, PROTECTED & ENHANCED
- ACCESS PATH POROUS SURFACING TBC
- TREE PROTECTION ZONE

NOTES
REFER ALSO TO NOTES ON DRAWING GHD-M2G-GEN-PL-SKT-1051
HLPS = HIGH LIFT PUMP STATION

TREE PROTECTION ZONE (TPZ)
ALL TREES ON SITE ARE TO BE RETAINED UNLESS SHOWN OTHERWISE ON THE LANDSCAPE MANAGEMENT PLANS AND IN THE TREE ASSESSMENT REPORT. ALL TREES TO BE RETAINED ARE TO BE PROTECTED AND FENCED IN ACCORDANCE WITH THE LANDSCAPE MANAGEMENT PLAN. ALL CONSTRUCTION ACTIVITIES ARE TO BE OUTSIDE THE FENCED PROTECTION AREA.

ALL TREES ARE TO BE MONITORED FOR SIGNS OF STRESS AND REMEDIAL ACTION MUST BE TAKEN IMMEDIATELY.

ALL FENCING TO BE INSTALLED BEFORE CONSTRUCTION BEGINS AND REMOVED AT THE COMPLETION OF CONSTRUCTION WORKS AND COMMENCEMENT OF RESTORATIVE WORKS. ALL FENCING SHALL BE 1.8M HIGH CONTINUOUS CHAIN MESH FENCE WHICH IS COMPLIANT WITH THE AS4970 - PROTECTION OF TREES ON DEVELOPMENT SITES.

SED FENCE SHOULD BE USED AT THE BASE OF CHAIN MESH FENCE WHERE SEDIMENTATION IS LIKELY TO IMPACT ON THE TREE ROOT ZONE.

TPZ IDENTIFICATION SIGNS SHOULD BE INSTALLED AROUND THE EDGE OF THE TPZ IN COMPLIANCE WITH AS4970.

PRELIMINARY

No.	REVISION	DATE	CKD	AUTH
A	ISSUE FOR DA APPROVAL			

BULK WATER ALLIANCE

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MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
EQUIPMENT CHAMBER
LANDSCAPE REINSTATEMENT
GENERAL ARRANGEMENT / LANDSCAPE MANAGEMENT AND PROTECTION

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ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 | Rev. A

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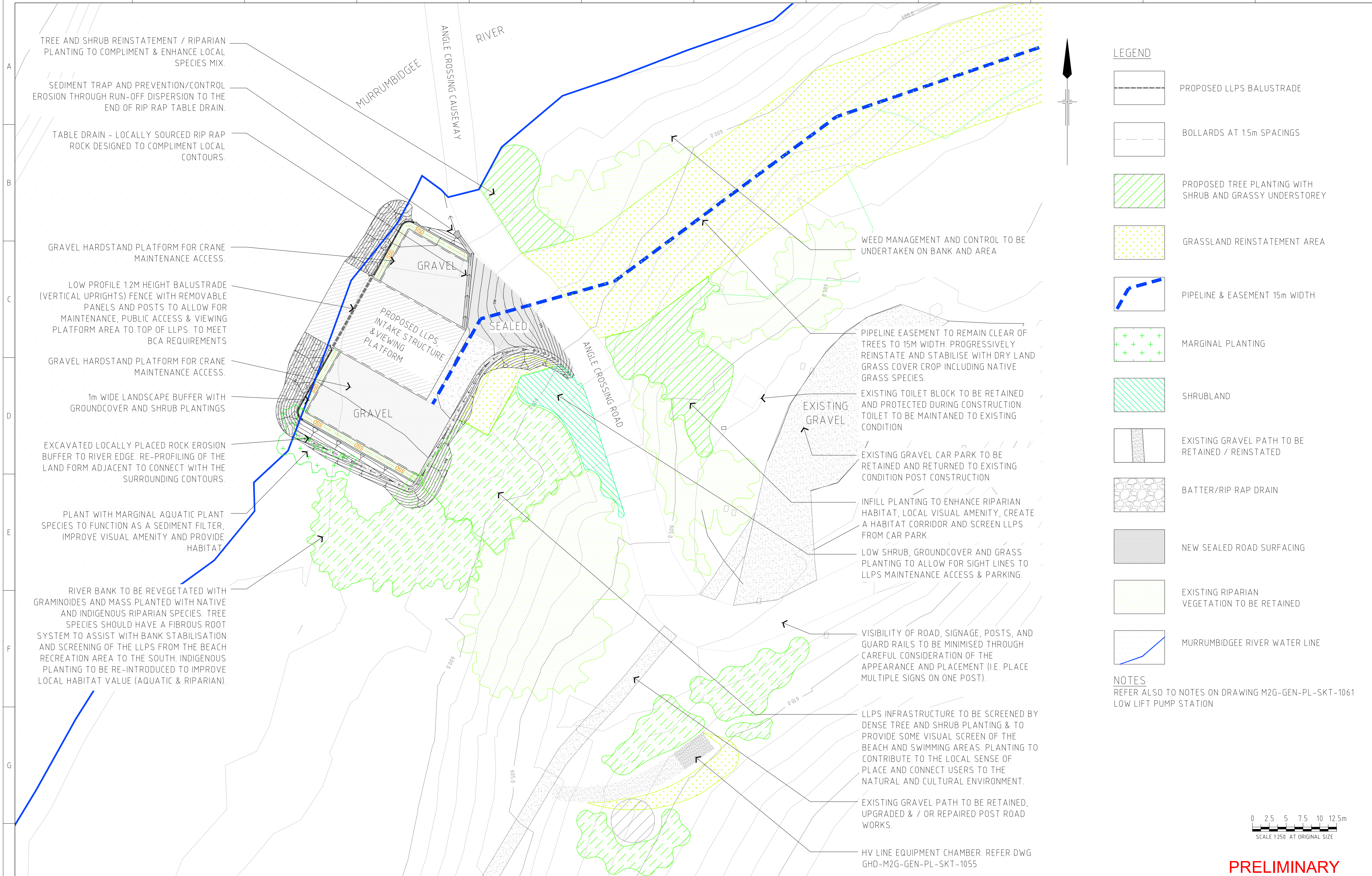
TREE AND SHRUB REINSTATEMENT / RIPARIAN PLANTING TO COMPLIMENT & ENHANCE LOCAL SPECIES MIX.
SEDIMENT TRAP AND PREVENTION/CONTROL EROSION THROUGH RUN-OFF DISPERSION TO THE END OF RIP RAP TABLE DRAIN.
TABLE DRAIN - LOCALLY SOURCED RIP RAP ROCK DESIGNED TO COMPLIMENT LOCAL CONTOURS.
GRAVEL HARDSTAND PLATFORM FOR CRANE MAINTENANCE ACCESS.
LOW PROFILE 1.2M HEIGHT BALUSTRADE (VERTICAL UPRIGHTS) FENCE WITH REMOVABLE PANELS AND POSTS TO ALLOW FOR MAINTENANCE, PUBLIC ACCESS & VIEWING PLATFORM AREA TO TOP OF LLPS. TO MEET BCA REQUIREMENTS
GRAVEL HARDSTAND PLATFORM FOR CRANE MAINTENANCE ACCESS.
1m WIDE LANDSCAPE BUFFER WITH GROUNDCOVER AND SHRUB PLANTINGS
EXCAVATED LOCALLY PLACED ROCK EROSION BUFFER TO RIVER EDGE. RE-PROFILING OF THE LAND FORM ADJACENT TO CONNECT WITH THE SURROUNDING CONTOURS.
PLANT WITH MARGINAL AQUATIC PLANT SPECIES TO FUNCTION AS A SEDIMENT FILTER, IMPROVE VISUAL AMENITY AND PROVIDE HABITAT.
RIVER BANK TO BE REVEGETATED WITH GRAMINOIDES AND MASS PLANTED WITH NATIVE AND INDIGENOUS RIPARIAN SPECIES. TREE SPECIES SHOULD HAVE A FIBROUS ROOT SYSTEM TO ASSIST WITH BANK STABILISATION AND SCREENING OF THE LLPS FROM THE BEACH RECREATION AREA TO THE SOUTH. INDIGENOUS PLANTING TO BE RE-INTRODUCED TO IMPROVE LOCAL HABITAT VALUE (AQUATIC & RIPARIAN).
MURRUMBIDGEE
RIVER
ANGLE CROSSING CAUSEWAY
GRAVEL
PROPOSED LLPS INTAKE STRUCTURE & VIEWING PLATFORM
SEALED
GRAVEL
ANGLE CROSSING ROAD
EXISTING GRAVEL
WEED MANAGEMENT AND CONTROL TO BE UNDERTAKEN ON BANK AND AREA
PIPELINE EASEMENT TO REMAIN CLEAR OF TREES TO 15M WIDTH. PROGRESSIVELY REINSTATE AND STABILISE WITH DRY LAND GRASS COVER CROP INCLUDING NATIVE GRASS SPECIES.
EXISTING TOILET BLOCK TO BE RETAINED AND PROTECTED DURING CONSTRUCTION. TOILET TO BE MAINTANED TO EXISTING CONDITION
EXISTING GRAVEL CAR PARK TO BE RETAINED AND RETURNED TO EXISTING CONDITION POST CONSTRUCTION
INFILL PLANTING TO ENHANCE RIPARIAN HABITAT, LOCAL VISUAL AMENITY, CREATE A HABITAT CORRIDOR AND SCREEN LLPS FROM CAR PARK.
LOW SHRUB, GROUNDCOVER AND GRASS PLANTING TO ALLOW FOR SIGHT LINES TO LLPS MAINTENANCE ACCESS & PARKING.
VISIBILITY OF ROAD, SIGNAGE, POSTS, AND GUARD RAILS TO BE MINIMISED THROUGH CAREFUL CONSIDERATION OF THE APPEARANCE AND PLACEMENT (I.E. PLACE MULTIPLE SIGNS ON ONE POST).
LLPS INFRASTRUCTURE TO BE SCREENED BY DENSE TREE AND SHRUB PLANTING & TO PROVIDE SOME VISUAL SCREEN OF THE BEACH AND SWIMMING AREAS. PLANTING TO CONTRIBUTE TO THE LOCAL SENSE OF PLACE AND CONNECT USERS TO THE NATURAL AND CULTURAL ENVIRONMENT.
EXISTING GRAVEL PATH TO BE RETAINED, UPGRADED & / OR REPAIRED POST ROAD WORKS.
HV LINE EQUIPMENT CHAMBER. REFER DWG GHD-M2G-GEN-PL-SKT-1055
LEGEND
PROPOSED LLPS BALUSTRADE
BOLLARDS AT 1.5m SPACINGS
PROPOSED TREE PLANTING WITH SHRUB AND GRASSY UNDERSTOREY
GRASSLAND REINSTATEMENT AREA
PIPELINE & EASEMENT 15m WIDTH
MARGINAL PLANTING
SHRUBLAND
EXISTING GRAVEL PATH TO BE RETAINED / REINSTATED
BATTER/RIP RAP DRAIN
NEW SEALED ROAD SURFACING
EXISTING RIPARIAN VEGETATION TO BE RETAINED
MURRUMBIDGEE RIVER WATER LINE
NOTES
REFER ALSO TO NOTES ON DRAWING M2G-GEN-PL-SKT-1061 LOW LIFT PUMP STATION
0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

No.	REVISION	DATE	CKD	AUTH
A	ISSUE FOR DA APPROVAL			

BULK WATER ALLIANCE

ACTEW CORPORATION

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MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
LOW LIFT PUMP STATION
LANDSCAPE REINSTATEMENT
GENERAL ARRANGEMENT / LANDSCAPE MANAGEMENT AND PROTECTION

Scale: 1:250
Date: MAY 2010
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MURRUMBIDGEE TO GOOGONG

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GENERAL NOTES

1. THIS LANDSCAPE CONCEPT PLAN PROPOSES LANDSCAPE REINSTATEMENT STRATEGIES, POST INFRASTRUCTURE CONSTRUCTION.

2. THIS LANDSCAPE CONCEPT IS PENDING THE PRODUCTION OF A LANDSCAPE MANAGEMENT AND PROTECTION WORKS PLAN FOR CONSULTATION, SUBMISSION AND APPROVAL OF ALL WORKS BY PARKS, CONSERVATION AND LAND (PCL) AND THE TERRITORY AND MUNICIPAL SERVICES (TAMS) ASSET ACCEPTANCE. THE LANDSCAPE MANAGEMENT PLAN WOULD DETAIL SPECIFICATIONS REGARDING: REMOVAL OF TREES WITHIN THE CONSTRUCTION FOOTPRINT; PREPARATION AND STOCKPILING OF TIMBER AND ORGANIC MATERIAL FOR RE-USE IN LANDSCAPE PROPOSALS; DEAD TREES TO BE MANAGED FOR HABITAT; PROTECTION OF EXISTING VEGETATION TO BE RETAINED; TREE PROTECTION ZONE FENCING; WEED CONTROL AREAS; EXCAVATION NEAR PROTECTED VEGETATION; WORKING WITHIN THE VICINITY OF TREE PROTECTION ZONES, AND; SITE PREPARATION WORKS FOR REINSTATEMENT.

3. ALL WORKS ARE TO COMPLY WITH THE TAMS GUIDELINES FOR THE PROTECTION OF PUBLIC LANDSCAPE ASSETS ADJACENT TO DEVELOPMENT WORKS, ISSUE 1 REVISION 2 (THE GUIDELINES) AND THE STANDARD SPECIFICATION FOR URBAN INFRASTRUCTURE WORKS EDITION 1 REVISION 0. THESE DOCUMENTS ARE AVAILABLE AT . PROPOSED ACTIVITIES FOR WHICH APPROVAL SHOULD BE SOUGHT INCLUDE:

- REMOVAL OF TREES WITHIN THE CONSTRUCTION FOOTPRINT.
- WHERE TREES ARE TO BE RETAINED, MAINTENANCE ACTIVITIES SUCH AS PRUNING AND REMOVAL OF DEAD WOOD.
- WEED CONTROL AREAS.
- ANY OTHER SITE CLEARANCE AND/OR EARTHWORKS WITHIN THE MURRUMBIDGEE RIVER CORRIDOR.

4. GRASS REINSTATEMENT AREAS - DROUGHT TOLERANT DRYLAND GRASS COVER REINSTATEMENT (E.G. DWARF TYPE TALL FESCUE SUMMER DRYLAND GRASS SEED MIX, INCLUDING NATIVE SPECIES WHERE APPROPRIATE). RE-SEEDING SHOULD BE ALLOWED FOR ONE MONTH FROM ORIGINAL SEEDING WITH ALL SOWN AREAS ARE TO BE WATERED DURING THE ESTABLISHMENT PERIOD. GROUND SHOULD BE CULTIVATED TO A MAXIMUM DEPTH OF 50MM PRIOR TO SEEDING. TOPSOIL IS NOT TO BE REMOVED AND SOIL LEVEL IS NOT TO BE ALTERED. ALL NEWLY SOWN AREAS ARE TO BE PROTECTED WITH TEMPORARY RABBIT PROOF FENCING (AND REPELLENT IF AVAILABLE) UNTIL WELL ESTABLISHED.

5. ALL NEW PLANTING AREAS ARE TO BE PROTECTED WITH TEMPORARY FENCING UNTIL WELL ESTABLISHED.

6. IN SOURCING ALL LANDSCAPE MATERIALS (INCLUDING RE-USE AND RECYCLING), LOCAL PRODUCTS AND CONTRACTORS ARE TO TAKE PRECEDENCE OVER NON-LOCAL PRODUCTS.

7. STOCKPILE AND RE-USE TOPSOIL FROM THE ENTIRE SITE TO PRESERVE NATIVE SEED STOCK AND REDUCE THE NEED TO IMPORT TOPSOIL.

8. PROVIDE GRAPHICALLY CLEAR INTERPRETIVE SIGNAGE THAT PROVIDES INFORMATION REGARDING NATURE AND RECREATION USES WITHIN MURRUMBIDGEE RIVER CORRIDOR.

9. OPPORTUNITIES FOR OFFSETTING (OUTSIDE THE PROJECT BOUNDARY) TREE REMOVAL ARE AS PER OFFSET PLAN (YET TO BE FINALISED).

INDICATIVE PLANTING PALETTE

Botanical Name	Common Name	Planting Size	Density (per sq. m)
Trees			
Eucalyptus viminalis	Manna Gum	tube stock	0.2/m^2
Eucalyptus camaldulensis	River Red Gum	tube stock	0.2/m^2
Casuarina cunninghamiana	River Sheoak	tube stock	0.2/m^2
Shrubs			
Acacia dealbata	Silver Wattle	tube stock	0.5/m^2
Acacia genistifolia	Speading Wattle	tube stock	0.5/m^2
Bursaria spinosa	Blackthorn	tube stock	0.5/m^2
Callistemon sieberi	River Bottlebrush	tube stock	0.5/m^2
Hymenanthera dentata	Tree Violet	tube stock	0.5/m^2
Kunzea ericoides	Burgan	tube stock	0.5/m^2
Leptospermum continentale	Prickly Tea-tree	tube stock	0.5/m^2
Leptospermum obovatum	River Tea-tree	tube stock	0.5/m^2
Muehlenbeckia tuggeranong	Tuggeranong Lignum	tube stock	0.5/m^2
Grass/Groundcover			
Rubus parvifolius	Native Raspberry	seed mix	4/m^2
Marginal Plants			
Carex apressa	Tall Sedge	tube stock	4/m^2
Eleocharis acuta	Common Spike Rush	tube stock	4/m^2
Isolepis fluitans	Floating Club-rush	tube stock	4/m^2
Juncus usitatus	Common Rush	tube stock	4/m^2

NOTES

TOTAL TREE PLANTING WITH SHRUB AND GRASSY UNDERSTOREY AREA: 1070m^2
TOTAL SHRUB PLANTING ONLY AREA: 120m^2
TOTAL GRASSLAND REINSTATEMENT AREA: 1900m^2
TOTAL MARGINAL PLANTING AREA: 150m^2

PRELIMINARY

No.	REVISION	DATE	CKD	AUTH
A	ISSUE FOR DA APPROVAL			

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: J.MARTIN | Designed: K.MILBURN
Checked: | Checked:
Program Design Manager:
Contractor's Drawing No.: GHD-MG2-GEN-PL-SKT-1061
ACTEW - Owner's Chief Engineer:

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
LOW LIFT PUMP STATION
LANDSCAPE REINSTATEMENT
LANDSCAPE GENERAL NOTES AND PLANTING SCHEDULE

Scale: N.T.S. | Date: MAY 2010 | Sheet No.:
ACTEW Project No.: | Tender No.:
MURRUMBIDGEE TO GOOGONG
A1 | ActewAGL Drg No. | Rev. A

CADD File Name: C:\Arenium_Projects\23-12615_BWA\CADD\DRAWINGS\M2G\GHD-M2G-GEN-PL-SKT-1061.dwg

MURRUMBIDGEE TO GOOGONG RAW WATER TRANSFER PROJECT
PIPELINE LANDSCAPE REINSTATEMENT

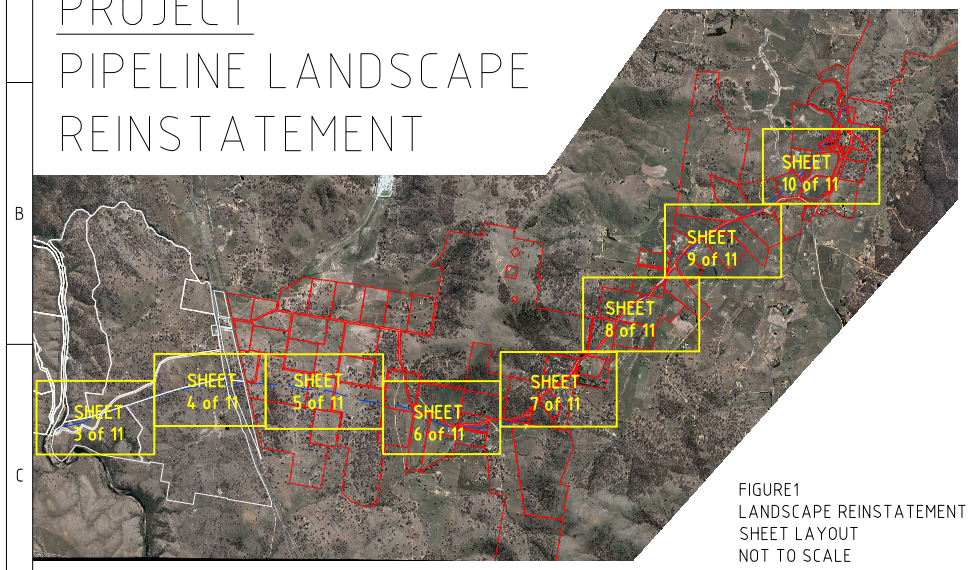


FIGURE1
LANDSCAPE REINSTATEMENT
SHEET LAYOUT
NOT TO SCALE

TABLE 1
NATURAL TEMPERATE GRASSLAND - TOTAL ESTIMATED AREA 1.7 HA

Species	Common Name	Seeding Rate (kg/ha)	Planting Type and Density[1]
Trees			
Eucalyptus blakelyi	Blakely's Red Gum		Hiko cell – 0.1 / m^2
Eucalyptus bridgesiana	Apple Box		
Eucalyptus dives	Broad leaved Peppermint		
Eucalyptus mannifera	Brittle Gum		
Shrubs			
Acacia mearnsii	Silver Wattle		Viro cell – 0.25 / m^2
Acacia dealbata	Black Wattle		
Cassinia longifolia	Shiny Cassinia		
Kunzea ericoides	Burgan		
Bursaria spinosa	Sweet Bursaria		
Grasses			
Austrostipa spp.	Spear Grass	1kg/ha	
Austrodanthonia spp.	Wallaby Grass	1kg/ha	
Elymus scaber	Wheat Grass	1kg/ha	
Poa sieberiana	Poa tussock	0.5 kg/ha	
Panicum effusum	Hairy Panic	0.5 kg/ha	
Bothriochloa macra	Red Grass	2 kg/ha	
Microlaena stipoides	Weeping Grass	1 kg/ha	
Themeda australis	Kangaroo Grass	5 kg/ha	
Forbs			
Chrysocephalum apiculatum	Yellow Buttons	No direct seeding of forbs	Viro cell – 2 / m^2
Convolvulus erubescens	Australian Bindweed		
Cymbonotus lawsoniana	Austral Bears-Ear		
Desmodium varians	Slender Trick Trefoil		
Goodenia pinnatifida	Scrambled Eggs		
Leptorhynchus squamatus	Scaly Buttons		
Aquatics			
Carex appressa	Tall Sedge		Viro cell – 2 / m^2
Eleocharis acuta	Common Spikerush		
Juncus usitatus	Common Rush		
Phragmites australis	Common Reed		
Eleocharis sp.			

GENERAL NOTES

1. THIS LANDSCAPE REINSTATEMENT PLAN PROPOSES LANDSCAPE REINSTATEMENT STRATEGIES, POST INFRASTRUCTURE CONSTRUCTION OF THE M2G PIPELINE.

2. THIS LANDSCAPE REINSTATEMENT PLAN SHOULD BE READ IN CONJUCTION WITH THE M2G LANDSCAPE REHABILITATION MANAGEMENT PLAN FOR CONSULTATION, SUBMISSION AND APPROVAL OF ALL WORKS BY PARKS, CONSERVATION AND LAND (PCL), THE TERRITORY AND MUNICIPAL SERVICES (TAMS) ASSET ACCEPTANCE AND PALERANG COUNCIL. THE LANDSCAPE REHABILITATION MANAGEMENT PLAN DETAILS OBJECTIVES REGARDING: REMOVAL OF TREES WITHIN THE CONSTRUCTION FOOTPRINT; PREPARATION AND STOCKPILING OF TIMBER AND ORGANIC MATERIAL FOR RE-USE IN LANDSCAPE PROPOSALS; DEAD TREES TO BE MANAGED FOR HABITAT; PROTECTION OF EXISTING VEGETATION TO BE RETAINED; TREE PROTECTION ZONE FENCING; WEED CONTROL AREAS; EXCAVATION NEAR PROTECTED VEGETATION; WORKING WITHIN THE VICINITY OF TREE PROTECTION ZONES, AND; SITE PREPARATION WORKS FOR REINSTATEMENT.

3. ALL WORKS IN THE A.C.T. ARE TO COMPLY WITH THE TAMS GUIDELINES FOR THE PROTECTION OF PUBLIC LANDSCAPE ASSETS ADJACENT TO DEVELOPMENT WORKS, ISSUE 1 REVISION 2 (THE GUIDELINES) AND THE STANDARD SPECIFICATION FOR URBAN INFRASTRUCTURE WORKS EDITION 1 REVISION 0. THESE DOCUMENTS ARE AVAILABLE AT WWW.TAMS.ACT.GOV.AU. PROPOSED ACTIVITIES FOR WHICH APPROVAL SHOULD BE SOUGHT INCLUDE:

- REMOVAL OF TREES WITHIN THE CONSTRUCTION FOOTPRINT.
- WHERE TREES ARE TO BE RETAINED, MAINTENANCE ACTIVITIES SUCH AS PRUNING AND REMOVAL OF DEAD WOOD.
- WEED CONTROL AREAS.
- ANY OTHER SITE CLEARANCE AND/OR EARTHWORKS WITHIN THE MURRUMBIDGEE RIVER CORRIDOR.

4. ALL SPECIES PROPOSED AS PART OF LANDSCAPE REINSTATEMENT ALONG PIPELINE CORRIDOR ARE TO BE CONSISTENT WITH IDENTIFIED VEGETATION COMMUNITIES AS MAPPED IN LANDSCAPE GENERAL ARRANGEMENTS ON DRAWINGS GHD-M2G-PIP-LA-DRG-0042 TO 0049.

5. LANDSCAPE REINSTATEMENT AND ENHANCEMENT AT AIR AND SCOUR VALVES IS TO CONSIST OF ROCK DISSAPATION STRUCTURES AND NATIVE CLUSTER PLANTINGS TO MITIGATE OVERLAND FLOW FROM VALVES. EXTENT OF ROCK DISSAPATION IS TO BE CONFIRMED BY BWA.

6. DRAINAGE LINES IMPACTED BY CONSTRUCTION OF PIPELINE CORRIDOR ARE TO BE REINSTATED TO CURRENT CONDITION OR BETTER TO ACHIEVE STABILISATION AND MINIMISE EROSION UTILISING ROCK, PLANTINGS AND GEOTEXTILE WHERE REQUIRED.

7. GRASS REINSTATEMENT AREAS - DROUGHT TOLERANT DRYLAND GRASS COVER REINSTATEMENT (E.G. DWARF TYPE TALL FESCUE SUMMER DRYLAND GRASS SEED MIX, INCLUDING NATIVE SPECIES WHERE APPROPRIATE). RE-SEEDING SHOULD BE ALLOWED FOR ONE MONTH FROM ORIGINAL SEEDING WITH ALL SOWN AREAS TO BE WATERED DURING THE ESTABLISHMENT PERIOD. GROUND SHOULD BE CULTIVATED TO A MAXIMUM DEPTH OF 50MM PRIOR TO SEEDING. TOPSOIL IS NOT TO BE REMOVED AND SOIL LEVEL IS NOT TO BE ALTERED. ALL NEWLY SOWN AREAS ARE TO BE PROTECTED WITH TEMPORARY RABBIT PROOF FENCING UNTIL WELL ESTABLISHED.

8. ALL NEW PLANTING AREAS ARE TO BE PROTECTED WITH TEMPORARY RABBIT AND/OR STOCK PROOF FENCING UNTIL WELL ESTABLISHED. THIS MAY BE REQUIRED FOR GROUPS OF PLANTING AND/OR INDIVIDUAL TREES.

9. IN SOURCING ALL LANDSCAPE MATERIALS (INCLUDING RE-USE AND RECYCLING), LOCAL PRODUCTS AND CONTRACTORS ARE TO TAKE PRECEDENCE OVER NON-LOCAL PRODUCTS.

10. STOCKPILE AND RE-USE TOPSOIL FROM THE ENTIRE SITE TO PRESERVE NATIVE SEED STOCK AND REDUCE THE NEED TO IMPORT TOPSOIL.

FIGURE 4 SIGNIFICANT ROADSIDE NATIVE GRASS STANDS TO BE PROTECTED & REINSTATED ROUTE WIDE USING LOCAL SEED STOCK WHERE POSSIBLE.

FIGURE 5 ROADSIDE GRASSLAND TO BE REINSTATED AND WEEDS MANAGED/REMOVED ALONG ROUTE.

TABLE 2
BOX GUM GRASSY WOODLAND - TOTAL ESTIMATED AREA 11.1 HA

Species	Common Name	Seeding Rate (kg/ha)	Planting Type and Density
Trees			
Eucalyptus blakelyi	Blakely's Red Gum	No direct seeding of trees	Hiko cell – 0.2 / m^2
Eucalyptus bridgesiana	Apple Box		
Eucalyptus dives	Broad Leaved Peppermint		
Eucalyptus mannifera	Brittle Gum		
Eucalyptus melliodora	Yellow Box		
Grasses			
Austrostipa spp.	Spear Grass	1kg/ha	
Austrodanthonia spp.	Wallaby Grass	1kg/ha	
Elymus scaber	Wheat Grass	1kg/ha	
Poa sieberiana	Poa tussock	0.5 kg/ha	
Panicum effusum	Hairy Panic	0.5 kg/ha	
Microlaena stipoides	Weeping Grass	2 kg/ha	
Themeda australis	Kangaroo Grass	5 kg/ha	
Forbs			
Chrysocephalum apiculatum	Yellow Buttons	No direct seeding of forbs	Viro cell – 2 / m^2
Convolvulus erubescens	Australian Bindweed		
Cymbonotus lawsoniana	Austral Bears-Ear		
Desmodium varians	Slender Trick Trefoil		
Goodenia pinnatifida	Scrambled Eggs		
Hypericum gramineum	Small St. John's Wort		
Leptorhynchus squamatus	Scaly Buttons		

FIGURE 2 GRAZING AMONGST BOX WOODLAND

FIGURE 3 EXISTING SIGNIFICANT TREES ON GRAZING LAND TO BE PROTECTED & ENHANCED THROUGH GROUPS OF PLANTING ADJACENT.

PRELIMINARY

No.	REVISION	DATE	CKD	AUTH
D	REVISED PIPELINE ALIGNMENT	29.03.2010		
C	REVISED REINSTATEMENT STRATEGY FOR TOC	04.03.2009	S.M	R.F
B	TOC DESIGN FREEZE	25.02.2009	✱S.M	✱R.F
A	CONCEPT PLAN - ISSUED FOR 60% REVIEW	13.02.2009	S.M	G.M

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: J.MARTIN	Designed: J.MARTIN / KMM		
Checked:	Checked:		
Program Design Manager:			
Contractor's Drawing No.: GHD-M2G-PIP-LA-DRG-0040			
ACTEW - Owner's Chief Engineer:			

MURRUMBIDGEE TO GOOGONG RAW WATER TRANSFER PROJECT
PIPELINE
LANDSCAPE REINSTATEMENT - GENERAL NOTES & PLANT SCHEDULE
SHEET 1 OF 11

Scale: N/A	Date: FEB 2009	Sheet No.: 1
Project No.: 2312634-03	Tender No.: N/A	

MURRUMBIDGEE TO GOOGONG

A1 ActewAGL Drg. No. | Rev. D

CADD File Name: C:\Arenium_Projects\23-12615_BWA\CADD\DRAWINGS\M2G\GHD-M2G-PIP-LA-DRG-0040.dwg
Date Plotted: 3/30/2010 CTB FILE: ActewAGL.CTB

TABLE 3
OTHER NATIVE VEGETATION - TOTAL ESTIMATED AREA 3.6 HA

Species	Common Name	Seeding Rate (kg/ha)	Planting Type and Density
Trees			
Eucalyptus blakelyi	Blakely's Red Gum	No direct seeding of trees	Hiko cell – 0.2 / m^2
Eucalyptus bridgesiana	Apple Box		
Eucalyptus dives	Broad Leaved Peppermint		
Eucalyptus mannifera	Brittle Gum		
Eucalyptus melliodora	Yellow Box		
Shrubs			Hiko cell – 0.5 / m^2
Hardenbergia violacea	Native Sarsparilla		
Hibbertia obtusifolia	Grey Guinea Flower		
Bursaria spinosa	Sweet Bursaria		
Senecio quadridentatus	Groundsel		
Daviesia genistifolia	Spiny Bitter Pea		
Kunzea ericoides	Burgan		
Indigofera australis	Austral Indigo		
Cassinia longifolia	Shiny Cassinia		
Grasses			
Austrostipa spp.	Spear Grass	1kg/ha	
Austrodanthonia spp.	Wallaby Grass	1kg/ha	
Elymus scaber	Wheat Grass	1kg/ha	
Joycea pallida	Redanther Wallaby Grass	0.5kg/ha	
Poa sieberiana	Poa tussock	0.5 kg/ha	
Panicum effusum	Hairy Panic	0.5 kg/ha	
Microlaena stipoides	Weeping Grass	2 kg/ha	
Themeda australis	Kangaroo Grass	5 kg/ha	
Forbs			
Chrysocephalum apiculatum	Yellow Buttons	No direct seeding of forbs	Viro cell – 2 / m^2
Convolvulus erubescens	Australian Bindweed		
Cymbonotus lawsoniana	Austral Bears-Ear		
Desmodium varians	Slender Trick Trefoil		
Goodenia pinnatifida	Scrambled Eggs		
Hypericum gramineum	Small St. John's Wort		
Leptorhynchus squamatus	Scaly Buttons		

TABLE 5
COVER CROP

Seed Species	Seeding Rate (kg/ha)
Japanese Millet (Sep - Mar only)	35 kg/ha
Sterile Rye Corn (Apr - Aug only)	35 kg/ha
Eclipse Rye	25 kg/ha
Red Clover	5 kg/ha
Total	65 kg/ha

FIGURE 6
BOX /GUM WOODLAND (EAST OF THE MONARO HIGHWAY)
TO BE PROTECTED, ENHANCED & CONNECTED WITH INDIGENOUS PLANTING

FIGURE 7
BOX /GUM WOODLAND (WEST OF THE MONARO HIGHWAY)
TO BE PROTECTED, ENHANCED & CONNECTED WITH INDIGENOUS PLANTING

FIGURE 8
ERODED GULLY LINES TO BE STABILISED WITH NEW PLANTING / GEOTEXTILE WHERE POSSIBLE / APPROPRIATE

FIGURE 9
BURRA CREEK RIPARIAN ZONE TO BE STABILISED WITH NEW PLANTING / GEOTEXTILE WHERE POSSIBLE / APPROPRIATE. NEW PLANTING DOWNSTREAM OF THE DISCHARGE IS TO RESPOND TO PROPOSED INCREASED ENVIRONMENTAL FLOWS.

TABLE 4
SNOW GUM GRASSY WOODLAND - TOTAL ESTIMATED AREA 11.1 HA

Species	Common Name	Seeding Rate (kg/ha)	Planting Type and Density
Trees			
Eucalyptus bridgesiana	Apple Box	No direct seeding of trees	Hikc cell – 0.2 / m^2
Eucalyptus pauciflora ssp. pauciflora	Snow Gum		
Eucalyptus rubida	Candle Bark		
Shrubs			Hikc cell – 0.5 / m^2
Hardenbergia violacea	Native Sarsparilla		
Hibbertia obtusifolia	Grey Guinea Flower		
Bursaria spinosa	Sweet Bursaria		
Senecio quadridentatus	Groundsel		
Daviesia genistifolia	Spiny Bitter Pea		
Kunzea ericoides	Burgan		
Indigofera australis	Austral Indigo		
Cassinia longifolia	Shiny Cassinia		
Grasses			
Austrodanthonia spp.	Wallaby Grass	1kg/ha	
Elymus scaber	Wheat Grass	1kg/ha	
Joycea pallida	Redanther Wallaby Grass	1kg/ha	
Poa sieberiana	Poa tussock	0.5kg/ha	
Microlaena stipoides	Weeping Grass	2 kg/ha	
Themeda australis	Kangaroo Grass	5 kg/ha	
Forbs			
Chrysocephalum apiculatum	Yellow Buttons	No direct seeding of forbs	Viro cell – 2 / m^2
Convolvulus erubescens	Australian Bindweed		
Cymbonotus lawsoniana	Austral Bears-Ear		
Desmodium varians	Slender Trick Trefoil		
Goodenia pinnatifida	Scrambled Eggs		
Hypericum gramineum	Small St. John's Wort		
Leptorhynchus squamatus	Scaly Buttons		
Pimelea curviflora	Curved Rice Flower		
Plantago varia	Variable Plantain		
Aquatics			Viro cell – 2 / m^2
Carex appressa	Tall Sedge		
Eleocharis acuta	Common Spikerush		
Juncus usitatus	Common Rush		
Phragmites australis	Common Reed		
Eleocharis sp.			

TABLE 6
NON-NATIVE VEGETATION - TOTAL ESTIMATED AREA 23.83 HA

Species	Common Name	Seeding Rate
Lolium perenne	Eclipse Rye	1 kg/ha
Phalaris aquatica	Phalaris	4.5 kg/ha (50:50 mix of Aust II or similar & Landmaster)
Dactylis glomerata	Cocksfoot	1.5 kg/ha
Trifolium subterraneum	Sub Clover	4 kg/ha
	Starter Fertiliser	80 kg/ha

FIGURE 10
THE ENCLOSED WOODLAND CHARACTER OF WILLIAMSDALE ROAD TO BE REINSTATED THROUGH TREE PLANTING.

FIGURE 11
THE GIBRALTAR RANGE WOODLAND REQUIRES A SPECIFIC PLANT SPECIES LIST TO RESPOND TO LOCAL ENVIRONMENTAL CONDITIONS.

FIGURE 12
EXISTING INTACT WOODLAND VEGETATION STRATA & SPECIES MIX TO THE EASTERN ASPECT OF THE MURRUMBIDGEE RIVER CORRIDOR TO BE REPLICATED TO SLOPES NORTH & EAST OF THE HIGH LIFT PUMP STATION.

FIGURE 13
GULLY TO THE NORTH OF THE PROPOSED HIGH LIFT PUMP STATION TO BE REHABILITATED TO ACCOMMODATE INCREASED RUN-OFF FROM THE PUMP STATION SITE OPERATIONS. THIS WILL ASSIST IN LINKING HABITAT, STABILISATION OF LOCAL SOILS, IMPROVING RUN-OFF WATER QUALITY TO THE MURRUMBIDGEE AND VISUALLY SCREENING THE PUMP STATION.

PRELIMINARY

No.	REVISION	DATE	CKD	AUTH
D	REVISED PIPELINE ALIGNMENT			
C	REVISED REINSTATEMENT STRATEGY FOR TOC	04.03.2009	S.M	R.F
B	TOC DESIGN FREEZE	25.02.2009	✱S.M	✱R.F
A	CONCEPT PLAN - ISSUED FOR 60% REVIEW	13.02.2009	S.M	G.M

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: J.MARTIN/KMM | Designed: J.MARTIN / KMM
Checked: | Checked:
Program Design Manager:
Contractor's Drawing No.: GHD-M2G-PIP-LA-DRG-0041
ACTEW - Owner's Chief Engineer:

MURRUMBIDGEE TO GOOGONG RAW WATER TRANSFER PROJECT
PIPELINE
LANDSCAPE REINSTATEMENT - GENERAL NOTES & PLANT SCHEDULES
SHEET 2 OF 11

Scale: N/A | Date: FEB 2009 | Sheet No.: 2
Project No.: 2312634-03 | Tender No.: N/A
MURRUMBIDGEE TO GOOGONG
A1 | ActewAGL Drg. No. | Rev. D

CADD File Name: C:\Arenium_Projects\23-12615_BWA\CADD\DRAWINGS\M2G\GHD-M2G-PIP-LA-DRG-0041.dwg
Date Plotted: 3/30/2010 CTB FILE: ActewAGL.CTB

Appendix C **Coarse Woody Debris Guidelines**

Coarse Woody Debris Relocation Criteria

(Adapted from DECC's guidelines for the Hume Highway Duplication projects, 2007)

Definitions

Term	Definition
Coarse Woody Debris (CWD)	the total length of wood at least 10cm in diameter and at least 0.5m long
Existing cleared areas	where the tree layer is absent, and >90% of vegetation in the ground layer is either crop, ploughed fallow or almost exclusively perennial or annual exotic pasture
Isolated Paddock Trees	native vegetation having an over-storey projected foliage cover <25% of the lower projected foliage cover for the vegetation community and the ground-layer is either crop, ploughed fallow or almost exclusively perennial or annual exotic pasture (90% of cover is exotic species). (DNR, 2005)
Low Condition Native Vegetation	native woody vegetation with an over-storey percent foliage cover <25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, *and*, <50% of vegetation in the ground layer is indigenous species or >90% is ploughed or fallow
Moderate to High Condition Native Vegetation	native woody vegetation with an over-storey percent foliage cover >25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, OR, > 50% of vegetation in the ground layer is indigenous species
Retained native vegetation	vegetation within the construction corridor

1. Method for calculating CWD

The diameter of CWD is estimated with a measuring tape (or callipers if available) held horizontally immediately above the log, and the length is estimated to the nearest metre by measuring with a tape, or pacing, along the part of the log that is at least 10cm diameter. If estimating length by pacing then the actual length of a sample of logs will be measured regularly with a tape so the assessor can calibrate their estimate derived from pacing (Gibbons *et al*. 2005).

2. Allocation of wood to CWD requirements

Where possible, all cleared native vegetation with the appropriate dimensions will be allocated towards meeting CWD requirements. The BWA recognises, however, that there are competing demands for timber resources resulting from this project (e.g. mulch material for erosion control and riparian restoration projects). The following priority order for the allocation of CWD will be followed (the minimum length requirement of the CWD definition of 0.5m is also appropriate in this instance).

- Logs between 500 mm and 100 mm diameter – put into suitable adjacent habitat within the pipeline easement and on private and public land as course woody debris

- Logs in excess of that required as course woody debris and material less than 100 mm diameter – mulched for landscaping or reused on site as mulched windrows.

3. Allocation of tree parts to CWD requirements

All tree parts are suitable for use in meeting CWD requirements, including the root ball, trunk/stem and branches (see Figure C.1) Where seed is present in the upper branches, a small percentage of this material (about 10%) will be added to CWD requirements.

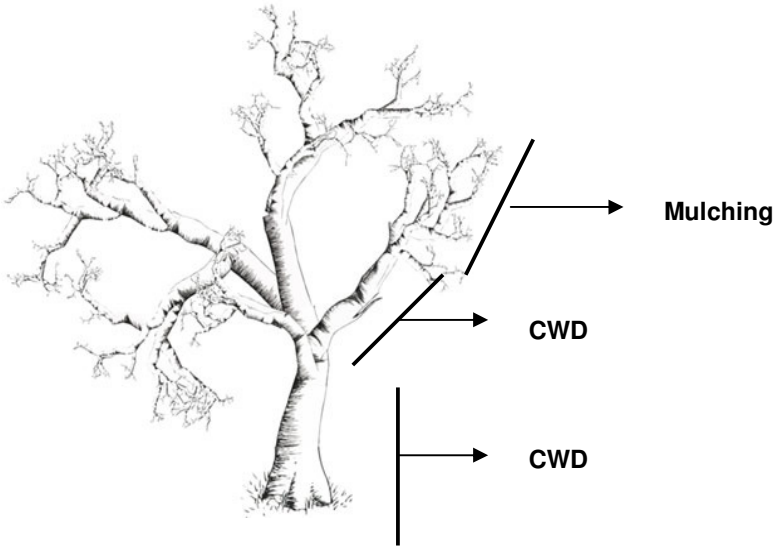


Figure C.1 Break up of allocations from a typical tree for CWD**.**

4. Management of CWD on site

The removal, stockpiling and transportation of native vegetation for use as CWD must not disturb retained native vegetation, including over-storey, shrubs and ground-layer species. Further, topsoil within areas of retained native vegetation must not be disturbed. The storage/stockpiling of this material is not permitted below the drip-line of retained native vegetation.

When removing native vegetation for CWD relocation, soil material from within the cleared area must not be collected and transported with the CWD material into relocation areas.

5. Relocation of CWD

When placing CWD into relocation areas, topsoil disturbance must be kept to a minimum.

Any topsoil that is removed during the CWD placement process must be respread over the area it was removed from, minimising disturbance to other areas. Specifically, topsoil must not be heaped up against CWD because of the potential to provide harbour for rabbits.

When positioning CWD within retained areas, existing native shrubs and the tree layer must not be disturbed. For example, the placement of CWD must not cause damage to the butt, stem or branches of retained trees and shrubs.

When positioning CWD within retained areas, disturbance to the ground layer, including soil, grass, herbs and low shrubs must be kept to the minimum necessary for placing CWD.

CWD material must not be heaped into windrows. Rather, it will be placed evenly across the site.

No existing standing dead trees, fallen timber or rocks must be moved to make way for CWD.

References

- Gibbons, P., Ayers, D., Seddon, J., Doyle, S. and Briggs, S. 2005. Biometric Version 1.8: a terrestrial biodiversity assessment tool for the NSW Property Vegetation Plan Developer. NSW DEC.
- New South Wales Department of Natural Resources, 2005. Native Vegetation Regulation 2005 Environmental Outcomes Assessment Methodology. NSW DNR, Sydney.

Appendix D **Weed Management Procedure**

Bulk Water Alliance

M2G Weed Management Procedure

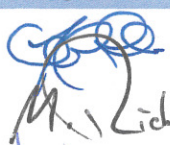
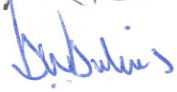
BWA-M2G-EN-EWMS-024-1

20th May, 2011

securing **water** for life

Certificate of approval for issue of documents

Document number	BWA-M2G-EN-EWMS-024-1
DM5 number	
Title	M2G Weed Management Procedure
Revision	1
Document status	Final
Date of issue	20th May, 2011

	Position	Name	Signature	Date
Prepared by	M2G Land and Compliance Manager	John Turville		20/5/11
Reviewed by	M2G Construction Manager	Matthew Richardson		23/5/11
Approved by	M2G Project Manager	Jason Julius		23/5/11.

Document revision control

Version	Author	Date	Description	Approval
A	P. Sheehan	12.03.11	Initial Draft	JJ
0	P. Sheehan	04.04.11	Final Draft for internal review	JJ
1	J Turville	20.05.11	Final revision for dissemination	JJ

Contents

List of tables

List of figures

1 Purpose

The purpose of this weed management procedure is to outline and describe the controls that will be placed along the construction corridor to prevent the transfer of noxious or environmental weeds from external sources or between landholder's properties during the construction phase of the M2G project.

Many landholders spend considerable time and money on weed management and reducing weed populations on their land. The M2G project is committed to uphold a social responsibility to practically manage weeds within its construction corridor.

It is acknowledged that weeds may be spread by other means such as animals and wind outside of the control of the Bulk Water Alliance. However, this does not negate the need for the M2G project to proactively manage weeds within its defined corridor through various techniques and management measures prior to commencing construction, during construction and post construction.

The movement of tracked and soft tyred vehicles along the corridor may transfer weeds to areas that were previously weed free or from high infestation to moderate or low infestation. The procedure will assist to prevent the importation of weed species between properties.

The spread of weeds by vehicles can occur through three main methods.

- Weed seeds and other plant debris caught in vehicles, plant and machines.
- Burrs and fruits can adhere to tyres and tracks.
- Seeds carried in soil that is lodged on machines.

Weed Control Maps {BWA-M2G-EN-WM-001 to BWA-M2G-EN-WM-018 (Appendix C)} have been prepared by the BWA to assist in the management of weeds within the M2G project. These maps classify weed areas as:

- Low weed presence
- Moderate weed presence
- High weed presence

The relevant weed maps will accompany any Permit to Enter Site prior to entry to a specific property and will be tool-boxed to site personnel as required. BWA staff and relevant sub-contractors engaged to work on the M2G project will be provided with up to date weed maps (including accurate weed wash-down locations) if they are working within the construction corridor.

1.1 Legislation

Table 1.1 Key Environmental Legislation

Legislative Jurisdiction	Relevant Act
Commonwealth	*Environmental Protection and Biodiversity Conservation Act 1999*
Territory (ACT)	*Environmental Protection Act 1997*
	Pest Plant and Animals Act 2005
	Nature Conservation Act 1980
New South Wales (NSW)	*Protection of the Environment Operations Act 1997*
	National Parks and Wildlife Act 1974

Legislative Jurisdiction	Relevant Act
	Noxious Weeds Act 1993

1.2 Reference Documents

Table 1.2 Existing documents relevant to this procedure.

Number	Title
BWA-M2G-EN-PLN-001	Construction Environmental Management Plan
BWA-M2G-EN-ECP-002	Soil and Water Management Plan
BWA-M2G-EN-ECP-007	Terrestrial Ecology Management Plan
BWA-M2G-EN-ECP-008	Landscape Rehabilitation Management Plan (incorporating Weed Management Strategy and Weed Management Maps)
BWA-M2G-EN-EWMS-002	Environmental Work Method Statement - Topsoil Stripping and Stockpiling
BWA-M2G-EN-ESP-001 to 027	Erosion and Sediment Control Plans (pipeline and ancillary infrastructure)

1.3 Responsibilities

The primary responsibility for the management of weeds on the M2G project will be the M2G superintendent and relevant supervisors as well as the M2G Environmental Officers. However, it is the responsibility of all M2G employees and subcontractors to comply with this weed management procedure. Table 1.3 outlines the key positions for the M2G project and their corresponding responsibilities.

Table 1.3 Personnel responsible for approving and reviewing weed management activities

Position	Responsibilities
M2G Construction Manager	The M2G Construction Manager is responsible for delivery of the construction phase of the project. This position is responsible for ensuring that adequate measures and resources are available so that weed control procedures can be followed.
M2G Land and Compliance Manager	To manage landholder expectations in relation to the management of weeds on their respective properties; To drive and manage compliance with this management procedure in consultation with M2G staff, subcontractors and external parties.
M2G Project Engineers	Project (and site) Engineers are responsible for ensuring that weed management considerations are integral to the decision making for all construction activities. They are responsible for ensuring their sub-contractors follow the weed management procedures and they provide training to employees and subcontractors on the pipeline corridor.
M2G Superintendent and Supervisors	Responsible for the implementation of weed management measures outlined in this procedure in consultation with the Project Engineer and the Environmental Representative. Where applicable, the Superintendent/Supervisors will be responsible for ensuring that

Position	Responsibilities
	any work performed by external parties meets with the requirements of the Weed Management Procedure. Provide training to employees and subcontractors on the pipeline corridor.
M2G Environmental Officer	Available on a consultative basis with the Construction Team and Project Engineers. Undertake adequate monitoring and surveillance to ensure this plan is adhered with and understood. Training and communication to the project staff and subcontractors. Provide training to employees and subcontractors on the pipeline corridor.
Ecologist / Agronomist	To advise the M2G project on key areas of weed management such as weed identification, weed infestation and weed management techniques (herbicide, topsoil management, cultivation requirements, etc.)
Weed management contractor	To provide weed management services to the BWA throughout the various phases of construction – prior to, during and post construction.

2 Management Measures

The pipeline has been surveyed for weed species by a qualified agronomist as well as an ecologist with the high, moderate and low weed infestations identified and detailed on the weed control maps (BWA-M2G-EN-WM-001 to 018). These maps will be used as the basis for weed management decisions, but observation will take place during general construction activities to ascertain if the maps are still current.

The measures for managing weeds on the M2G project include the following.

2.1 Application of Herbicide

The M2G project has contracted professional weed management contractors to assist the project to manage and control weeds within the M2G project. The application of herbicide will be tailored to the seasons and risks associated with spread of the weed through wind dispersal and the movement of soil (refer to Appendix A, Weed Species Characteristics and Management). The most suitable herbicide will be applied to adhere to the requirements and seasons on advice from the weed management contractor or agronomist/ecologist.

2.2 Slashing or Physical removal

Where applicable, the corridor will be slashed to reduce the risk of weeds spreading through vehicle movements. Slashers will be thoroughly cleaned (including mowing section) prior to operations and before going to a new work zone in accordance with the weed management maps (Appendix C). African Love Grass (*Eragrostis curvula*) will be marked and not slashed because slashing will spread the seed – the management of this particular species will be either fencing off of infested areas, herbicide application or physical removal.

Larger weeds such as briar rose or blackberry may be mechanically removed and disposed of accordingly.

2.3 Vehicle and Plant Washing

All light vehicles and heavy vehicles (excavators, tip trucks, graders, etc.) arriving on site, for the purpose of entering the construction corridor, will have an initial inspection to ensure that they do not contain any potential weed seed (Refer to Appendix D, Vehicle Weed Inspection Form). *Note: the entry of vehicles to site offices or laydown areas that have a hardstand surface are exempt from this inspection requirement*. Any vehicle that fails this initial inspection and/or shows signs of soil or vegetative matter must be washed down prior to entering the corridor.

Once on site and working within the corridor, the weed management maps (Appendix C) have identified various weed wash down locations based on weed species and their presence, landholder sensitivity and construction scheduling.

A Vehicle Weed Inspection Sheet (BWA-M2G-EN-2F-007), Appendix B, is to be completed after washing a piece of machinery or prior to entering a landholder's property where the weed management maps indicate a weed wash down location or inspection point. The locations of both the weed wash down bays and inspection points are summarised in Table 4.1.

There are five designated weed wash locations along the M2G project corridor with a further option of washing down at the main site office. Only two of these are set up as permanent wash down bays. The three remaining wash down bays will utilise a weed wash trailer (Figure 2.1) that will be moved from location to location in coordination with the works program.

To prevent the transfer of carp eggs, water from the Murrumbidgee River for use in weed wash sites will not be used on the Eastern side of Gibraltar Range, i.e. not beyond chainage 7,000. Signs will be placed on the corridor notifying construction personnel of this requirement.

Figure 2.1 One of two weed wash trailers employed on the M2G project.

Figure 2.2 Typical weed wash down bay.

Figure 2.2 is taken of weed wash down bay W4 – ch. 4900, where an inspection point is also required before entry into the neighbouring property to the west. The design of this weed wash down is provided in Appendix D of this document. Signage will be provided at weed wash down bays to assist those washing down vehicles.

Table 2.1 M2G Weed Wash and Inspections Points.

Wash Number	Weed Control Map	Chainage	Purpose
W1	BWA-M2G-EN-WM-001	200	Weed wash down for heavy vehicles. Inspection point for light vehicles.
W2	BWA-M2G-EN-WM-005	2720	Weed wash down for heavy vehicles. Inspection point for light vehicles.
Inspection Point	BWA-M2G-EN-WM-005	2,900	Inspection Point for light vehicles.
W3	BWA-M2G-EN-WM-005	2,950	Weed wash down for heavy vehicles.
W4	BWA-M2G-EN-WM-008	4,900	Weed wash down for heavy vehicles.
Inspection Point	BWA-M2G-EN-WM-008	4,850	Inspection Point for light vehicles.
W5	BWA-M2G-EN-WM-009	5,775	Weed wash down for heavy vehicles. Inspection point for light vehicles.
W6	BWA-M2G-EN-WM-010	6,300	Weed wash down for heavy vehicles. Inspection point for light vehicles.
Inspection Point	BWA-M2G-EN-WM-012	7,550	Inspection Point for light vehicles.
W7	BWA-M2G-EN-WM-013	7,900	Weed wash down for heavy vehicles. Inspection point for light vehicles.

2.4 Weed Inspection Points

To aid in the management of weeds within the M2G project corridor, a number of Weed Inspection Points have been identified along the M2G project boundary. The inspection points coincide with the location of a weed wash down facility and will be utilised by the M2G project team to assess whether a light or heavy vehicle requires a wash down prior to entry to a site. If the vehicle fails this inspection, a wash down of the vehicle will need to be undertaken. Once the wash down has occurred, an inspection of the vehicle will be required before the vehicle can progress forward.

2.4.1 Repeated Processes

The weed inspection points will also be utilised by the M2G project team to determine if a piece of plant or equipment, when moving in and out of a property on a number of occasions where a weed wash down has been identified, requires a further wash after having been initially washed. An example of this is when a machine transporting pipes along the corridor from laydown area 5 to weed wash down 3 to string out the pipes ready for installation. The repeat visits to and from the property to the west of laydown area 5 does not warrant a wash down on every occasion it intends to enter this property. However, a more pragmatic approach to vehicle hygiene will be to give the vehicle or machine in question an initial and thorough wash down at the commencement of each working day and thereafter, a visual assessment of the machine prior to entry to site. Once the vehicle has been inspected and is not continuing to come into contact with soil material or weed infested areas, then the vehicle does not need to repat the inspection on every occasion.

Should the machine have picked up soil due to exposed areas of ground then the assessment should deem the vehicle to be potentially carrying weed seed and that this vehicle will require a wash down prior to entry to a particular weed free property.

2.5 Topsoil Stripping and Stockpiling

The topsoil of high and moderate weed areas will be stockpiled within those areas and reused for the pipeline rehabilitation in the same zone. An Environmental Work Method Statement, EWMS, (BWA-M2G-EN-WSEP-002 Topsoil Stripping and Stockpiling) will be developed to guide this approach to managing weed infested topsoil. Topsoil will only be stripped where necessary and stockpiled in accordance with the EWMS and the relevant erosion and sediment control plans (ESCPs).

The topsoil stockpiles will be identified with chainage, low, moderate or high weed presence and if African Love Grass has been identified in the area it will be marked.

2.6 Communications and Training

The M2G construction crew and subcontractors will be trained on the presence of weed species, wash down procedures, weed management strategies and to notify environment personnel should they discover weeds in weed free area.

Construction crew are, also, to be trained on the methodology of reinstating topsoil to the backfilled pipe and the importance of not contaminating weed free topsoil with weed infested topsoil.

Targeted training on this weed management procedure will be provided to the M2G construction team.

The M2G Land and Compliance Manager will maintain contact with landholders on the progress and planning of M2G's weed management strategy and procedures and their satisfaction with implemented measures.

2.7 Education

To assist the M2G construction team to know how to inspect and clean a vehicle or machine in accordance with best practice management standards, a one day training course offered by the NSW Department of Primary Industry titled Weed Movement, Machinery Inspection and Cleaning will be conducted.

This course is designed for people working with plant and machinery and provides an understanding of the threat of weeds, identification of weeds, and ways to reduce the risk of spreading weeds. Participants will be required to formally inspect machinery for material that may contribute to the spread of weeds, pests or disease. The course also covers options for the best location and equipment needed for cleaning machinery and plant.

3 Monitoring

The M2G Environmental Representative, Project Engineers and Supervisors are responsible for ensuring that weed management procedures are followed and that adequate records are maintained.

Vehicle weed inspection checklists (Appendix B of this document) will be provided at each of the five wash down / weed inspection points so that operators of machinery, plant or vehicles use these sheets to track vehicle hygiene. Random audits and inspections will be undertaken by M2G staff as well as subcontractors to monitor adherence to and compliance with the Weed Management Procedure.

Any non-conformances or observations of concern will be managed and recorded in accordance with the M2G Construction Environment Management Plan and relevant BWA procedures.

Appendix A **Weed Species Characteristics and Management**

Weed species	Seed Type	Flowering and seeding time	Seed production numbers	Seed Viability	Method of dispersion/ spread	Management measures
Serrated tussock 	Hard seed	October to March Plants at least 2 years old before flowering	120 000 seed'/ plants/ year	Seed dormant for 1st 6 months Survives in soil at least 20 years	• Wind – can travel up to 15km from source. • Seedheads also get caught on vehicles, machinery.	**Pre-construction -** Spot spray[1] plants in Winter 2010 with 745g/L Glyphosate active ingredient (a.i.) at a 1:100 herbicide to water mix to prevent flowering. Spray the entire tussock and 10-15 cm of ground around each tussock. **During construction** • Prevent movement of soil laden with seed, either as spoil or lodged on machinery into clean (low risk) areas at all times. • Avoid movement of seed-heads post flowering (Oct- April) with good machinery and vehicle hygiene – thoroughly clean down before moving to an area with no serrated tussock). **Post rehabilitation -** Spot spray seedlings with 150mls glyphosate (360g/L a.i.)/ 15L water (1:100) when actively growing & not frosted (Oct-May).
African Lovegrass 	Hard seed	December to May Plants can flower in 1st year.	100,000 seeds/ plants/ year	Seed dormant for 1st 6 months Survives in soil at least 17 years	• Wind blown seedheads. • Seedheads also get caught on vehicles, machinery. • Seed in soil moved mechanically via graders, excavators etc	**Pre-construction –** Spot spray actively growing plants only, in November with 540g/L glyphosate (a.i.) at a 1:100 herbicide to water mix to prevent flowering. **During construction –** • Prevent movement of soil laden with seed, either as spoil or lodged on machinery into clean (low risk) areas at all times. • Avoid movement of seed-heads post flowering (Jan- May) with good machinery and vehicle hygiene – thoroughly clean down before moving to an area with no African Lovegrass. **Post rehabilitation -** Spot spray seedlings "as above" annually with glyphosate when actively growing & not frosted, November – May.

[1] *All herbicides to be applied as per manufacturer's label*

Weed species	Seed Type	Flowering and seeding time	Seed production numbers	Seed Viability	Method of dispersion/ spread	Management measures
St John's Wort 	Tiny seeds in sticky capsules	• Suckering– throughout year • Flowering – Nov to Feb • Seeds – Feb to May	30 000 seed/ plant	Survives in soil up to 12 years	• Capsules adhere to clothing, machinery and animals. • Suckering of lateral roots.	**Pre-construction / early construction** Prevent seed formation by boom spraying patches with 1.8L/ha Starane Advanced™ + 1L/ha Uptake in 200L water /ha in November (early flowering). **During construction** • Prevent movement of soil laden with seed, either as spoil or lodged on machinery into clean (low risk) areas at all times. • Avoid movement of seed-heads post flowering (Jan- May) with good machinery and vehicle hygiene – thoroughly clean down before moving to an area with no St John's wort. **Post rehabilitation -** Spot - spray seedlings annually with a 20mls glyphosate (360g/L a.i.) + 1g Brush off™ per 10L water when flowering (Nov-Jan).
Blackberry 	Produce seed in edible fruit	Spring Summer		Survives in soil up to 7 years	• Birds, and animals that eat fruit and spread through their droppings/ dung. • Self propagating by vegetative pieces. • Easily spread by machinery in winter when soil wet.	**Pre-construction** • Remove mechanically in winter and mulch. **During construction** • Monitor during summer months and spot spray any regrowth/ seedlings the following autumn with a translocated herbicide such as glyphosate 360 at the rate of 120mls/10 L of water. **Post rehabilitation** • Spot spray seedlings annually with Cut-out™ from January to April (1 x 95g pack mixes with 100L water).

Weed species	Seed Type	Flowering and seeding time	Seed production numbers	Seed Viability	Method of dispersion/ spread	Management measures
Briar Rose/ Sweet Briar 	Produce seed in edible fruit	November to January but fruits remain on the bushes until after leaf fall in May-June		Survives in soil up to 7 years	• Birds, and animals that eat fruit and spread through their droppings/ dung. • Self propagating by vegetative pieces - easily spread by machinery in winter when soil wet.	**Pre-construction / early construction** • Mechanically remove in winter when soil is wet or at least before flowering in November and mulch in one large pile per paddock or property. **During construction** Take care to avoid spreading the mulched material out of the mulch heaps. **Post rehabilitation -** Spot spray seedlings and re-growth annually with Cut-out™ from January to April (1 x 95g pack mixes with 100L water).
Chilean Needle Grass 	• Panicle seed (seed head) • Stem seed • Basal seed	Flowering generally occurs in November to December but the grass has the capacity to flower Year-round if soil moisture is favourable.	20 000 seed/m^2	Many years	Seed rain around existing plants which can then be moved by adhering to clothing, water, animals, machinery or vehicles.	**Pre-construction – this weed has not been found along the construction corridor and it is vital that it is not introduced inadvertently.** **During construction** • Primary management tool - machinery and vehicle hygiene (e.g. clean down before coming onsite) at all times of the year. • Recognise any isolated plants – remove them by hand chipping before they flower and set seed. **Post rehabilitation –** annually inspect sites carefully in late spring and spot spray any seedlings with a 1:100 mix of 360 g/L glyphosate & water when actively growing & not frosted Nov – May.

Weed species	Seed Type	Flowering and seeding time	Seed production numbers	Seed Viability	Method of dispersion/ spread	Management measures
Horehound 	Hard seed enclosed in burrs with hooks	Flowering over summer and autumn (November to May)		Survives in soil at least 10 years	Burrs adhere to clothing and animals, lodges in machinery	**Pre-construction** • Spot spray with Grazon DS ™ or hand chip isolated plants in early spring. **During construction** • Prevent movement of soil laden with seed, either as spoil or lodged on machinery into clean (low risk) areas at all times. • Avoid movement of seed-heads post flowering (Dec- May) with good machinery and vehicle hygiene – thoroughly clean down before moving to an area with no horehound. **Post rehabilitation -** Spot spray young mature plants from November to May with Kamba 500 ™ mixed 18mls/ 10L water plus a non-ionic wetting agent.
Scotch & Illyrian Thistles 	Hard seed 	December to February	Up to 7000 seeds per plant	Survives in soil up to 7 years	Mainly as seed rain around existing plants. Complete seedheads & branches can be moved by machinery or vehicles.	**Pre-construction** Spot spray or hand chip isolated plants in early spring; boom spray where density too great using a selective herbicide – 1-1.5L/ha MCPA 500 ™ + 50g/ha Lontrel ™+ non-ionic wetter **During construction** • Prevent movement of soil laden with seed, either as spoil or lodged on machinery into clean (low risk) areas at all times. • Avoid movement of seed-heads post flowering (Dec- May) with good machinery and vehicle hygiene – thoroughly clean down before moving to an area with no thistle. • Minimise the period with bare ground & establish >80% ground cover with perennial pastures ASAP after construction ends. **Post rehabilitation** • Spot or boom spray rozettes annually in August before stem elongation using a selective herbicide such as Kamba 500 ™ plus a non-ionic wetting agent, at the recommended rates. •

Weed species	Seed Type	Flowering and seeding time	Seed production numbers	Seed Viability	Method of dispersion/ spread	Management measures
Nodding Thistle 	Hard seed	January to March 	Up to 7000 seeds per plant	Survives in soil up to 7 years	Seed rain around existing plants, Complete seedheads & branches can be moved by machinery or vehicles.	**Pre-construction** • Hand chip or spot spray isolated rosettes in winter/spring with 25mls MCPA 500 TM + 5mls/ha Lontrel TM+ non-ionic wetter/ 15L knapsack. **During construction** • Prevent movement of soil laden with seed, either as spoil or lodged on machinery into clean (low risk) areas at all times. • Avoid movement of seed-heads post flowering (Dec- May) with good machinery and vehicle hygiene – thoroughly clean down before moving to an area with no thistle. **Post rehabilitation –** chip, spot spray or boom spray rozettes annually in December before stem elongation using the selective herbicide MCPA 500 TM plus a non-ionic wetting agent, at the recommended rates.
Saffron Thistle 	Hard seed	December to March	7000 seed per plant	Survives in soil up to 7 years	Seed rain around existing plants. Complete seedheads & branches can be moved by machinery or vehicles.	**Pre-construction** • Hand chip or spot spray isolated rozettes with MCPA 500 TM (20mls/15L water + wetting agent) in early spring before flowering **During construction** • Prevent movement of soil laden with seed, either as spoil or lodged on machinery into clean (low risk) areas at all times. • Avoid movement of seed-heads post flowering (Dec- Mar) with good machinery and vehicle hygiene – thoroughly clean down before moving to an area with no thistle. • Minimise the period with bare ground & establish >80% ground cover with perennial pastures ASAP after construction ends. **Post rehabilitation -** Spot spray seedlings annually with glyphosate when actively growing & not frosted Nov – May.

Weed species	Seed Type	Flowering and seeding time	Seed production numbers	Seed Viability	Method of dispersion/ spread	Management measures
Paterson's Curse   	Hard seed	When good summer rain occurs can start flowering in late winter & in good springs flower through into summer	5000 seeds/ plant - seed bank up to 30, 000 /m^2 Fewer plants germinate in spring than autumn/winter	Survives in soil up to 5 years	• Roughened seed heads adhere to clothing and animals, lodges in machinery. • Dispersed by water. • Animals (livestock, birds, ants) that eat seeds and spread through their droppings/ dung.	**Pre-construction** • Boom rosettes in spring before plants run to head & flower with 0.5L/ha MCPA 500 + 0.5L/ha Igran. **During construction** • DO NOT allow isolated plants to flower during construction – chip out. • Prevent movement of soil laden with seed, either as spoil or lodged on machinery into clean (low risk) areas at all times. • Avoid movement of seed-heads post flowering (Dec- May) with good machinery and vehicle hygiene – thoroughly clean down before moving to an area with no Paterson's Curse. • Minimise the period with bare ground & establish >80% ground cover with perennial pastures ASAP after construction ends. **Post rehabilitation** • This weed may have to be sprayed several times during the pasture establishment phase as it has the ability to smother new perennial grasses. The selective herbicide Jaguar™ is required when the pasture is young, applied to small Patto rosettes (< 4 leaves or 75mm diameter). • Later, in late winter apply 1L/ha MCPA 500 to kill later germinations and prevent any seeding. • Boom or spot spray rozettes in the new pasture annually in late winter with 1L/ha MCPA 500 to prevent any Patto from flowering. This process will need to continue for several years in areas where this weed was well established.

Appendix B **Vehicle Weed Inspection Form**

M2G Weed Management

M2G VEHICLE WASH CHECK SHEET

BWA-M2G-EN-2F-007-2

REV: 2

26TH MAY 2011

Vehicle Inspection Record Prior to Entering Landholder Site or After Washing

Date		Company	
Plant / Vehicle Description		Operator / Driver	
Type (circle type)	Soft Tyred / Tracked	Authorised Working Area	
Vehicle Registration		BWA Vehicle Number	
Area working in		Area moving to	

General standard

For general cleaning procedures the following standard applies:

- remove only those cover plates etc that can be quickly and easily removed and replaced
- no clods of dirt or loose soil should be present after wash down.
- No plant material hanging off fittings
- radiator, grills and the interior of vehicles should be free of accumulations of seed and other plant material

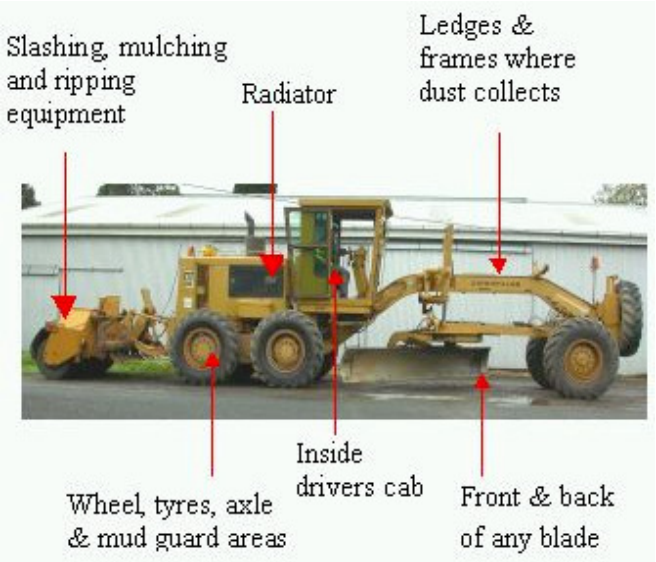


Figure 1 Key areas to inspect machinery for evidence of weed seeds or soil

Inspection Checklist

Systematically inspect and clean all areas listed in the table below

If any area is not acceptable, wash or rewash required

Area	Acceptable (Y/N) - Comment
Cabin floor, mats and under seats	
Engine radiators	
engine bay and grill	
Body hollow channels	
Inside bumper bars	
Crevices and ledges	
Underside	
Wheels inside and outside	
Between dual wheels if fitted	
Spare wheel	
Tray hollow channels	
Chassis	
Tracks	
Blades / buckets	
Tynes	
Under Guards / Cover plates	
Cab steps	
Trailers	
Machinery	
Other (specify)	

Inspected By		Passed	YES / NO
Sign		Date / Time	/
Verification			
BWA Supervisor		Passed	YES / NO
Sign		Date / Time	/

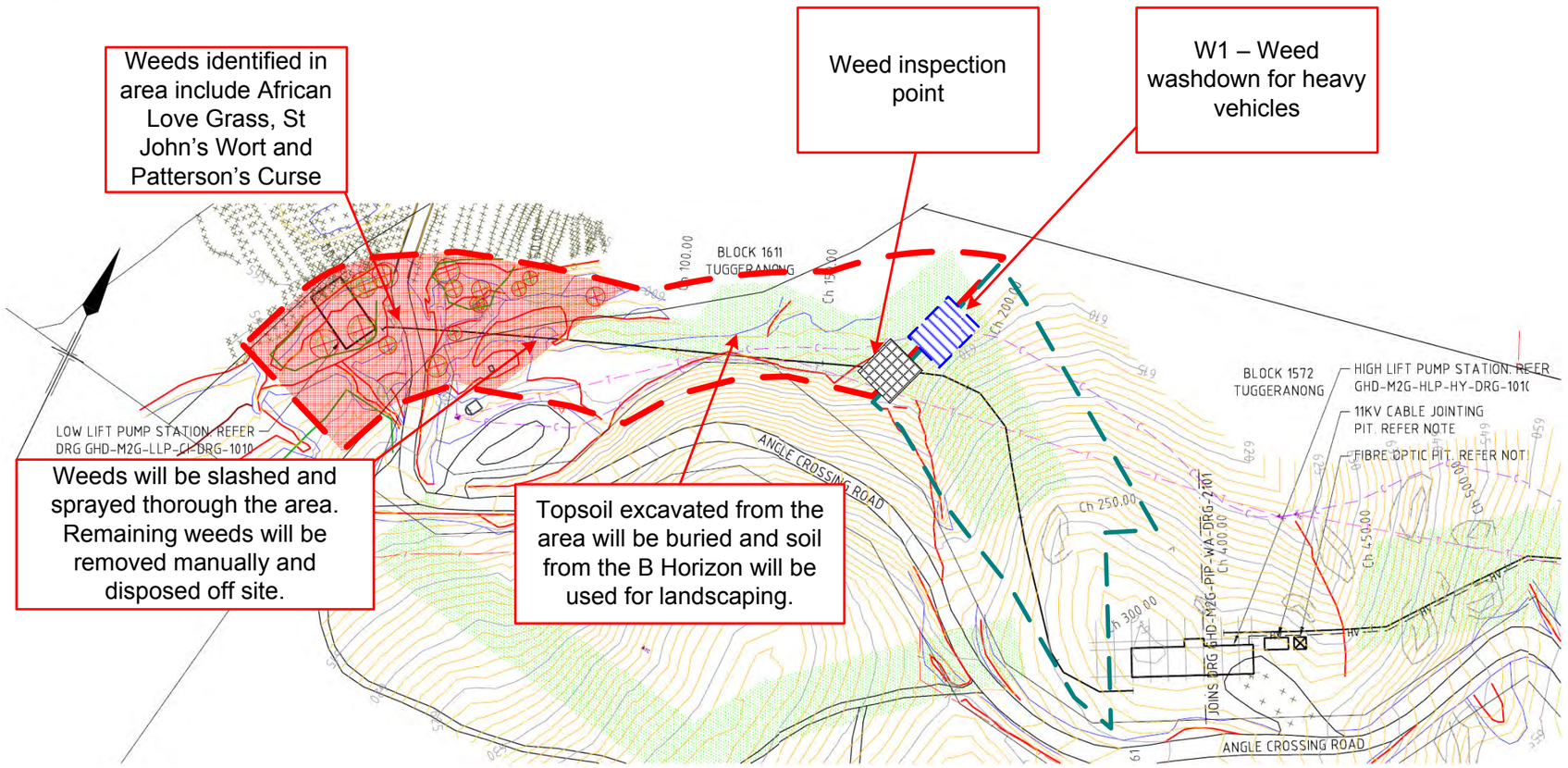
Appendix C **Weed Control Maps**

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-001-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point
Low weed risk represents a high risk of weed invasion	

Grass within the construction corridor to be kept short so as to reduce transfer of seeds into clothing or undercarriage of vehicles

GENERAL NOTES

- **Serrated Tussock –** Seeds dispersed by wind. Spot spray in winter 2010 followed by restricted movement of soil and good machinery/vehicle hygiene.
- **African Lovegrass –** Seeds dispersed by wind and mechanically. Spot spray in November followed by restricted movement of soil and good machinery/ vehicle hygiene.
- **St. John's Wort –** Seeds dispersed by humans and animals. Limit vehicle/machinery movement and good vehicle/machinery hygiene.
- **Blackberry -** Self propagating and easily spread by machinery. Remove mechanically in winter and spot spray any regrowth in the summer months.
- **Briar Rose/Sweet Briar -** Self propagating and easily spread by machinery. Remove mechanically in winter while soil is wet or before flowering in November. Spot spray any regrowth.
- **Chilean Needle Grass –** Seeds dispersed by humans and animals. Maintain vehicle/machinery hygiene and remove by hand. Herbicides as appropriate.
- **Horehound –** Seeds dispersed by humans and animals. Limit vehicle/machinery movement where possible, otherwise maintain good vehicle/machinery hygiene.
- **Scotch & Illyrian Thistles –** Seeds dispersed by wind, humans and animals. Maintain good vehicle/ machinery hygiene and spot spray or hand chipping of isolated plants. Establish suitable native replacements.
- **Nodding Thistle -** Seeds dispersed by wind, humans and animals. Maintain good vehicle/ machinery hygiene and spot spray or hand chipping of isolated plants. Establish suitable native replacements.
- **Saffron Thistle -** Seeds dispersed by wind, humans and animals. Maintain good vehicle/machinery hygiene and spot spray or hand chipping of isolated plants. Establish suitable native replacements.
- **Scotch Thistle -** Seeds dispersed by wind, humans and animals. Maintain good vehicle/machinery hygiene and spot spray or hand chipping of isolated plants. Establish suitable native replacements.
- **Patterson's Curse –** Seeds dispersed by humans, animals and water. Maintain good vehicle/machinery hygiene and spot spray or hand chip isolated plants.
- Tracked machinery will be washed at wash down bays along the pipeline alignment.
- Light Vehicles will be washed at wash down bays when there is a visible amount of soil or mud present

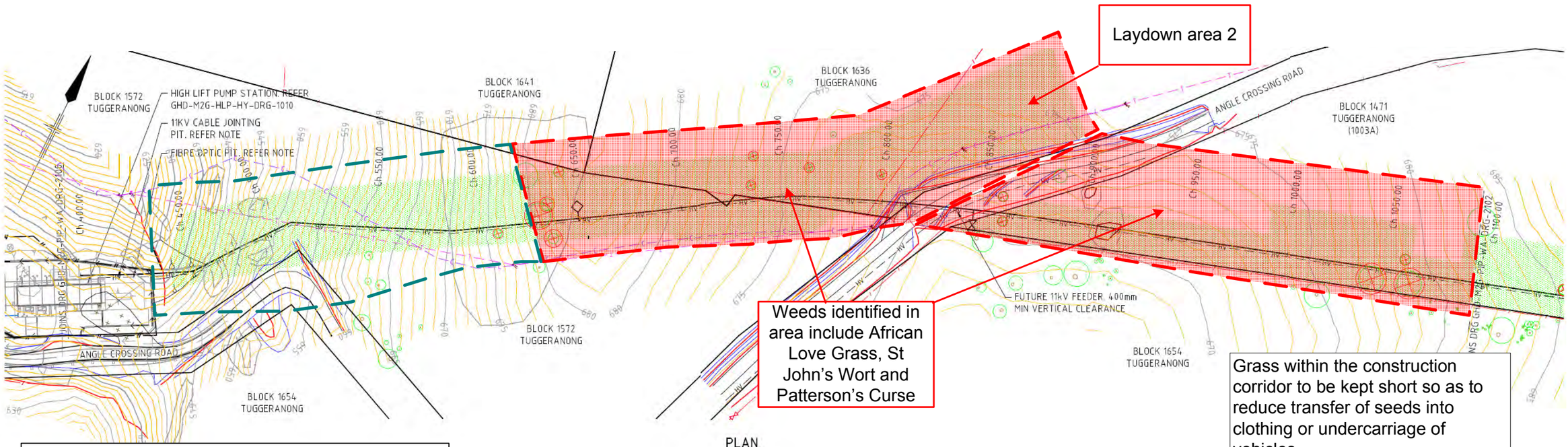
Developed By: Richard Hulse Date: 20/05/11 Approved By: John Turville Date: 20/05/11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-002-3

Revision: 3



PLAN
SCALE 1:1000

LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

Low weed risk represents a high risk of weed invasion

GENERAL NOTES

- **Serrated Tussock –** Seeds dispersed by wind. Spot spray in winter 2010 followed by restricted movement of soil and good machinery/vehicle hygiene.
- **African Lovegrass –** Seeds dispersed by wind and mechanically. Spot spray in November followed by restricted movement of soil and good machinery/ vehicle hygiene.
- **St. John's Wort –** Seeds dispersed by humans and animals. Limit vehicle/machinery movement and good vehicle/machinery hygiene.
- **Blackberry -** Self propagating and easily spread by machinery. Remove mechanically in winter and spot spray any regrowth in the summer months.
- **Briar Rose/Sweet Briar -** Self propagating and easily spread by machinery. Remove mechanically in winter while soil is wet or before flowering in November. Spot spray any regrowth.
- **Chilean Needle Grass –** Seeds dispersed by humans and animals. Maintain vehicle/machinery hygiene and remove by hand. Herbicides as appropriate.
- **Horehound –** Seeds dispersed by humans and animals. Limit vehicle/machinery movement where possible, otherwise maintain good vehicle/machinery hygiene.
- **Scotch & Illyrian Thistles –** Seeds dispersed by wind, humans and animals. Maintain good vehicle/machinery hygiene and spot spray or hand chipping of isolated plants. Establish suitable native replacements.
- **Nodding Thistle -** Seeds dispersed by wind, humans and animals. Maintain good vehicle/machinery hygiene and spot spray or hand chipping of isolated plants. Establish suitable native replacements.
- **Saffron Thistle -** Seeds dispersed by wind, humans and animals. Maintain good vehicle/machinery hygiene and spot spray or hand chipping of isolated plants. Establish suitable native replacements.
- **Scotch Thistle -** Seeds dispersed by wind, humans and animals. Maintain good vehicle/machinery hygiene and spot spray or hand chipping of isolated plants. Establish suitable native replacements.
- **Patterson's Curse –** Seeds dispersed by humans, animals and water. Maintain good vehicle/machinery hygiene and spot spray or hand chip isolated plants.
- Tracked machinery will be washed at wash down bays along the pipeline alignment.
- Light Vehicles will be washed at wash down bays when there is a visible amount of soil or mud present

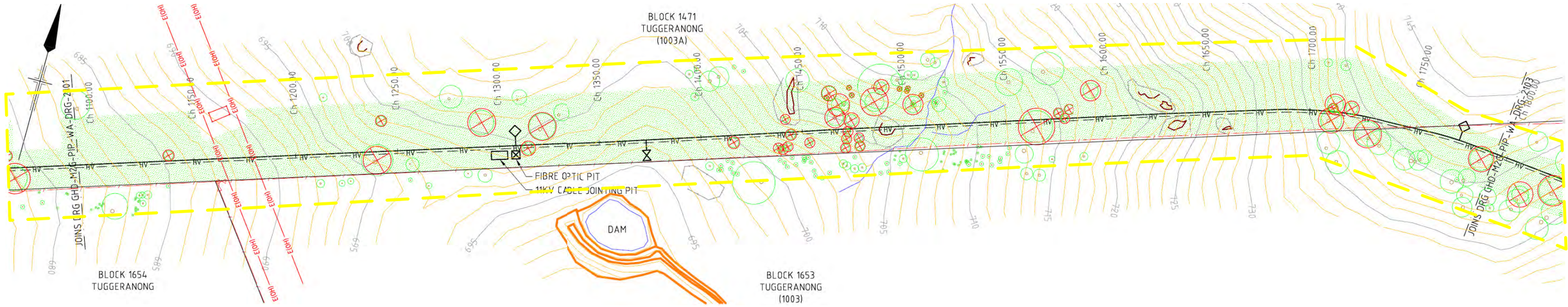
Developed By: Richard Hulse Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-003-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point
Low weed presence represents a high risk of weed invasion	

GENERAL NOTES

- **Serrated Tussock –** Seeds dispersed by wind. Spot spray in winter 2010 followed by restricted movement of soil and good machinery/vehicle hygiene.
- **African Lovegrass –** Seeds dispersed by wind and mechanically. Spot spray in November followed by restricted movement of soil and good machinery/ vehicle hygiene.
- **St. John's Wort –** Seeds dispersed by humans and animals. Limit vehicle/machinery movement and good vehicle/machinery hygiene.
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- Tracked machinery will be washed at wash down bays along the pipeline alignment.
- Light Vehicles will be washed at wash down bays when there is a visible amount of soil or mud present

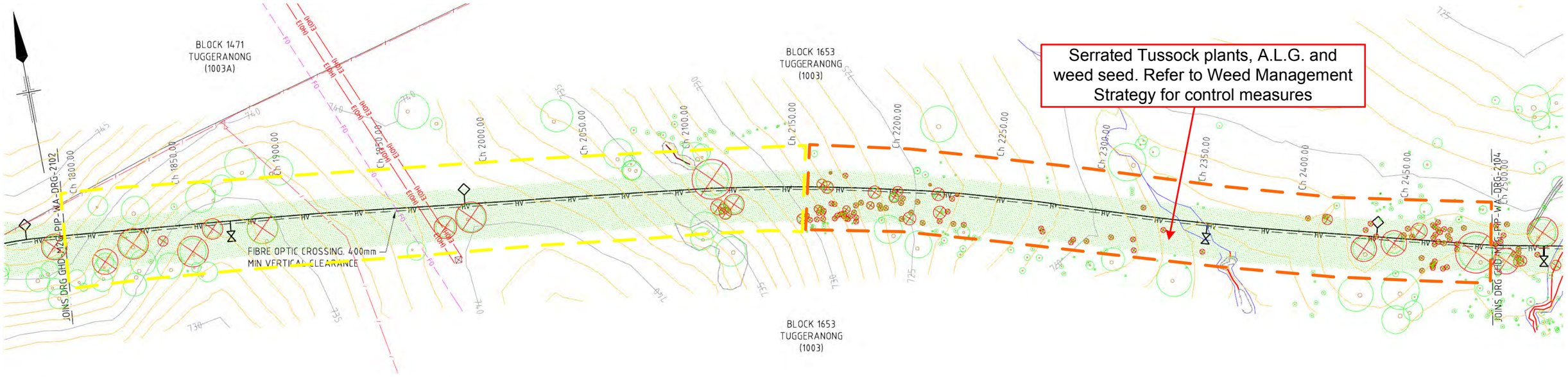
Developed By: Richard Hulse Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-004-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

Low weed risk represents a high risk of weed invasion

GENERAL NOTES

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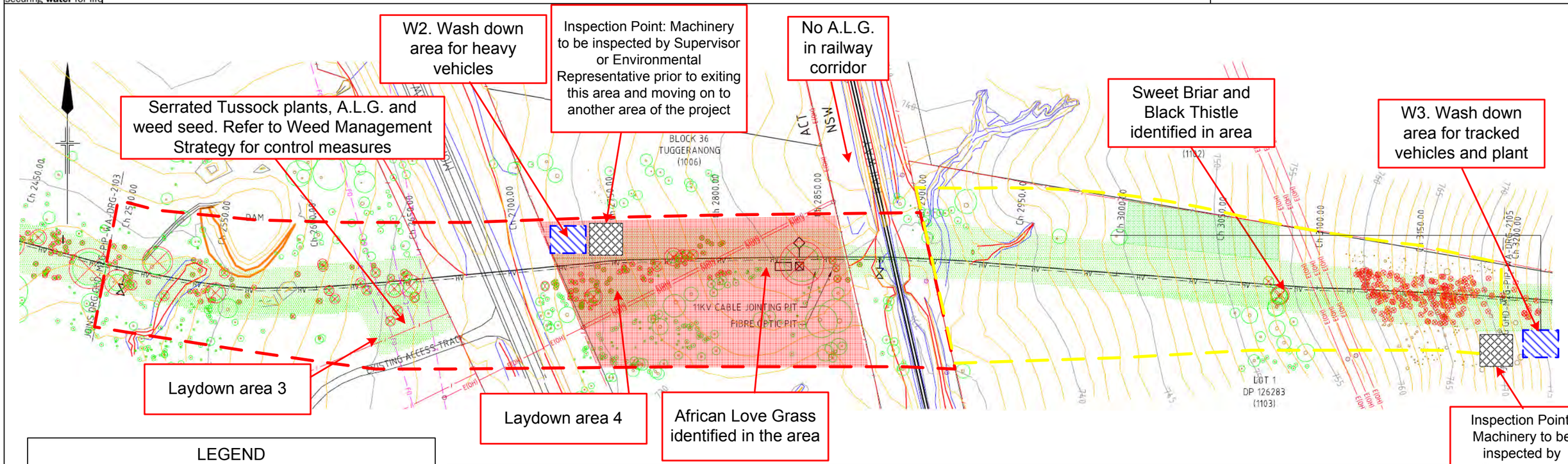
Developed By: Richard Hulse Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-WM-ESP-005-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

Low weed presence represents a high risk of weed invasion

GENERAL NOTES

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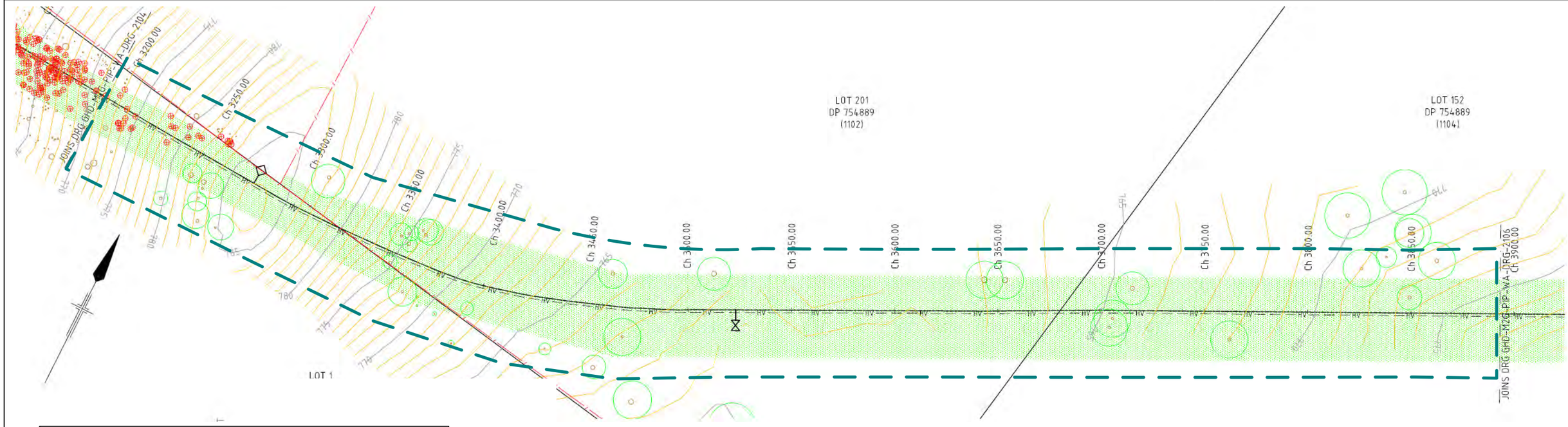
Developed By: Richard Hulse	Date: 20.05.11	Approved By: John Turville	Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-006-3

Revision: 3



LEGEND
Low weed presence / Washdown area
Moderate weed presence
High weed presence / Inspection Point
Low weed presence represents a high risk of weed invasion

GENERAL NOTES

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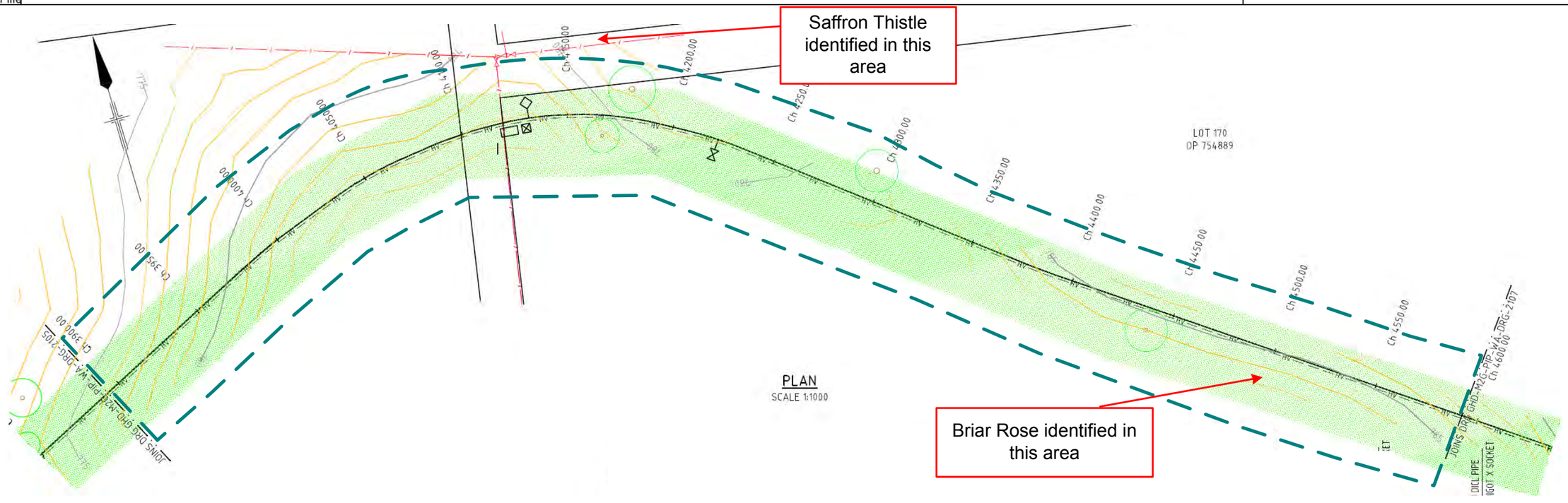
Developed By: Richard Hulse Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-007-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

Low weed presence represents a high risk of weed invasion

GENERAL NOTES

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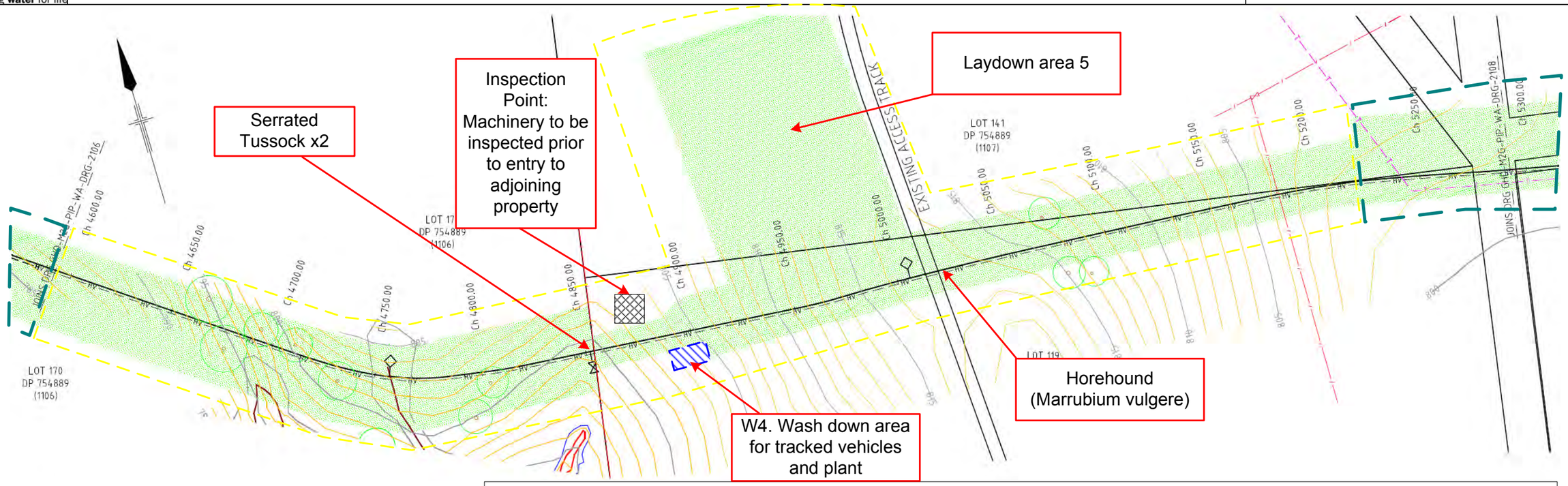
Developed By: Richard Hulse	Date: 20.05.11	Approved By: John Turville	Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-008-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

Low weed presence represents a high risk of weed invasion

GENERAL NOTES

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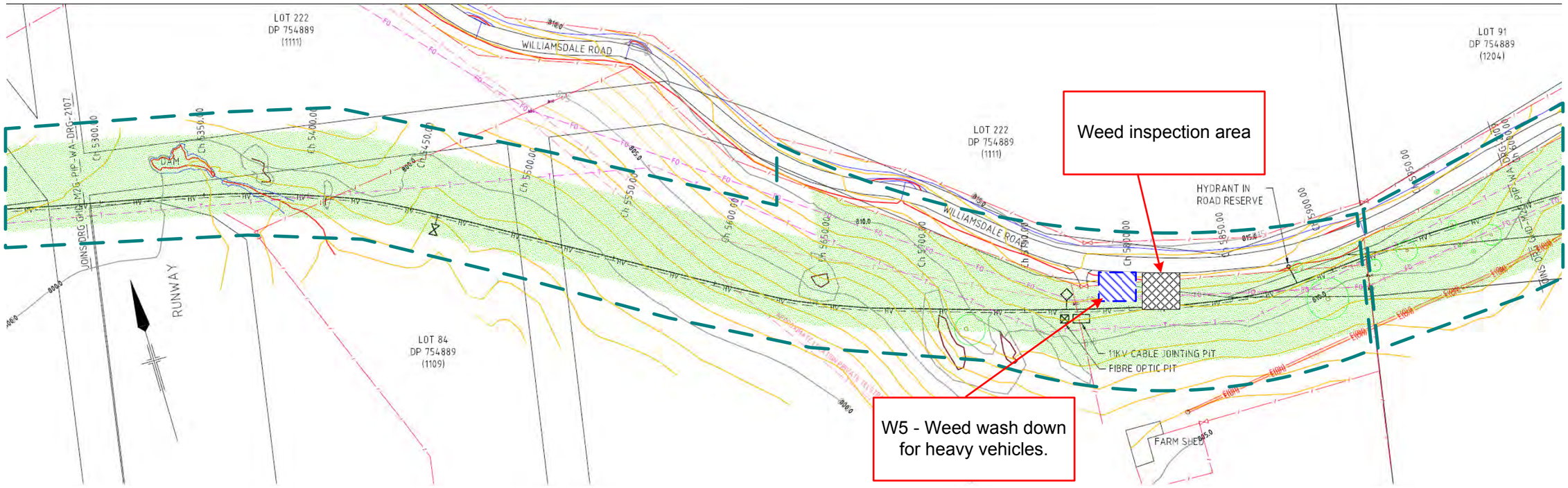
Developed By: Richard Hulse	Date: 20.05.11	Approved By: John Turville	Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-WM-ESP-009-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point
Low weed presence represents a high risk of weed invasion	

GENERAL NOTES

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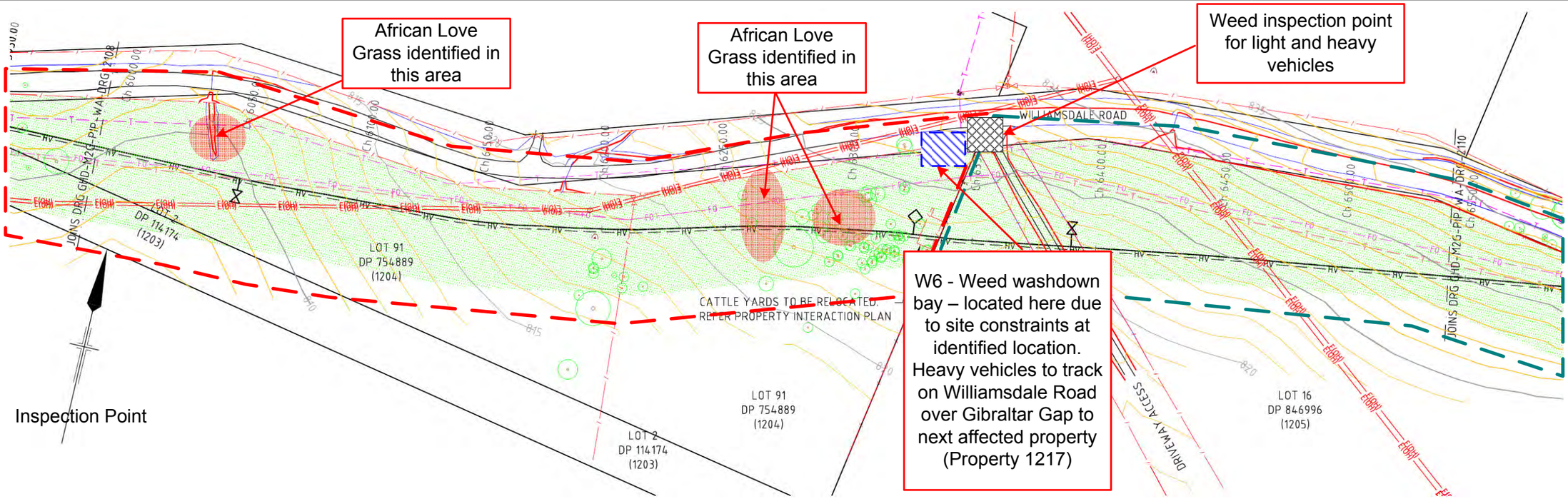
Developed By: Richard Hulse Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-010-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point
Low weed presence represents a high risk of weed invasion	

GENERAL NOTES

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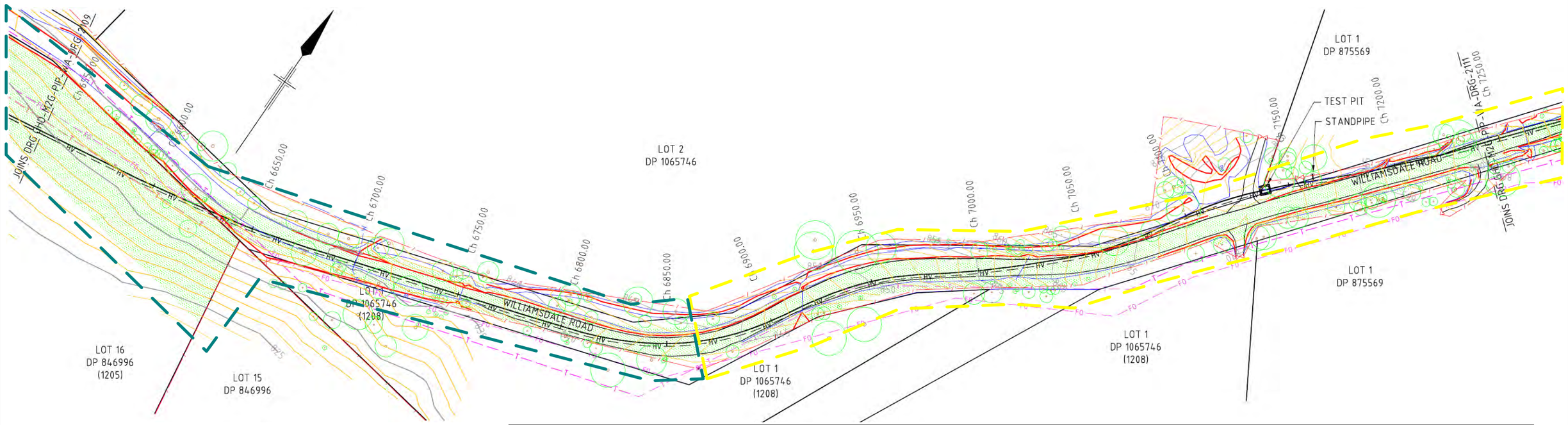
Developed By: Richard Hulse Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-011-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

Low weed presence represents a high risk of weed invasion

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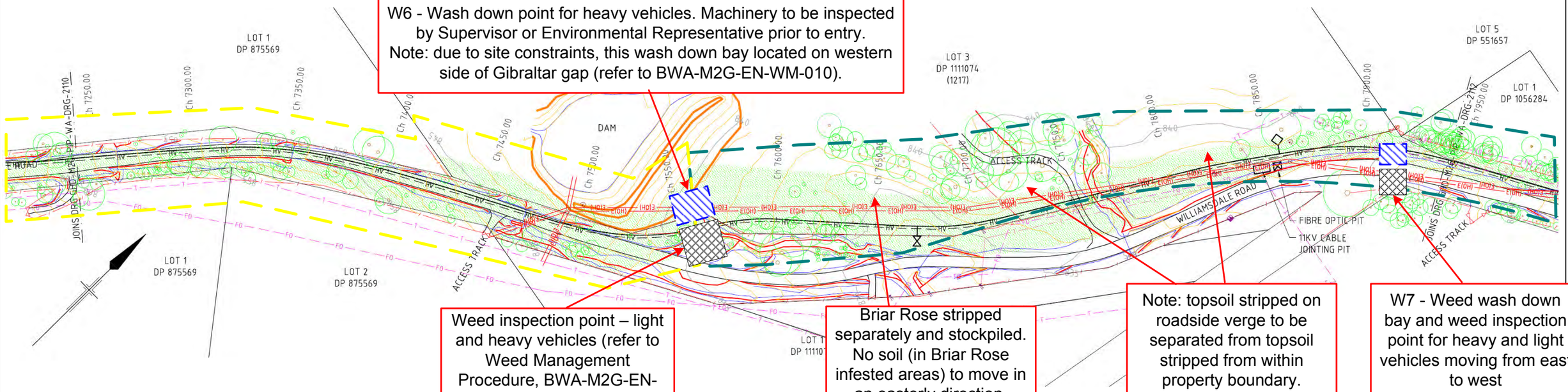
Developed By: Richard Hulse Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-012-3

Revision: 3



LEGEND	
Low weed risk	Washdown area
Moderate weed risk	
High weed risk	Inspection Point

Low weed presence represents a high risk of weed invasion

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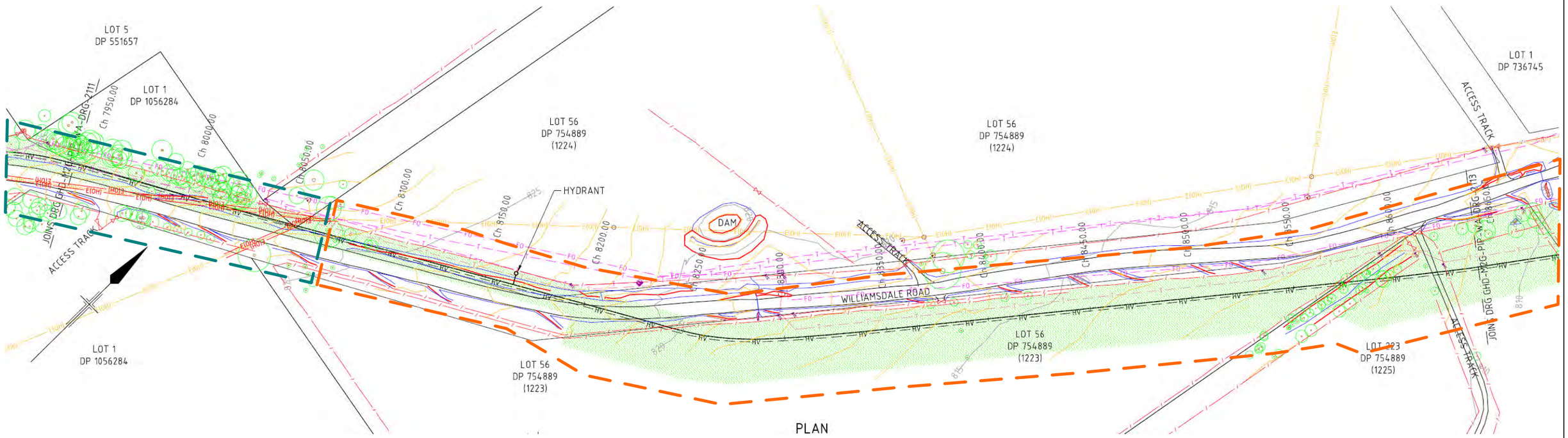
Developed By: Richard Hulse	Date: 20.05.11	Approved By: John Turville	Date: 20.05.11

Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-013-3

Revision: 3



PLAN

LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

Low weed presence represents a high risk of weed invasion

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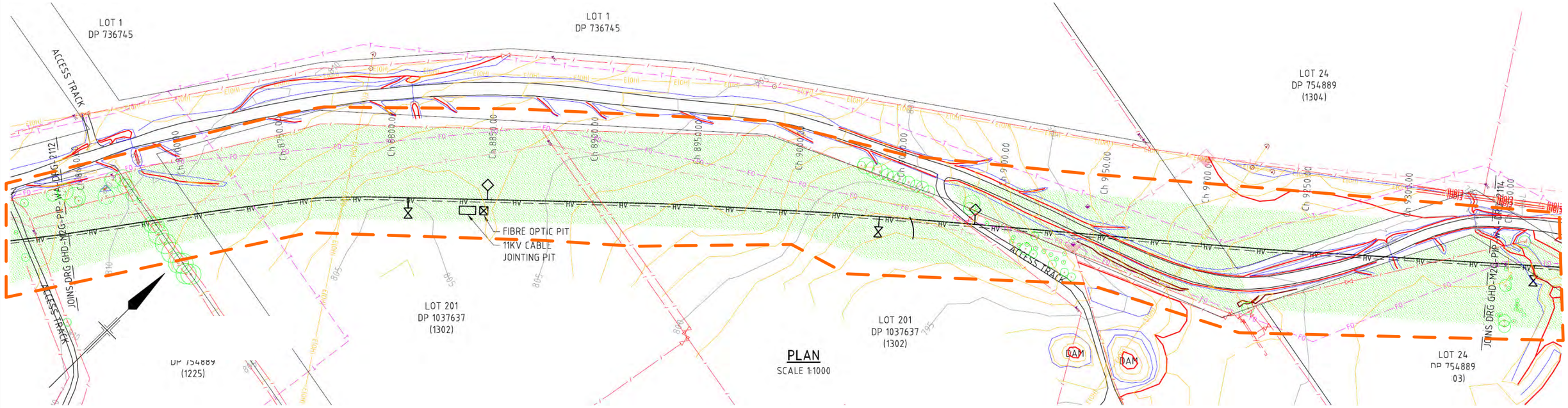
Developed By: Richard Hulse Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Weed Management Plan

M2G – Weed Map

Document Number: BWA-M2G-EN-WM-014-3

Revision: 3



LEGEND	
Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

Low weed presence represents a high risk of weed invasion

GENERAL NOTES

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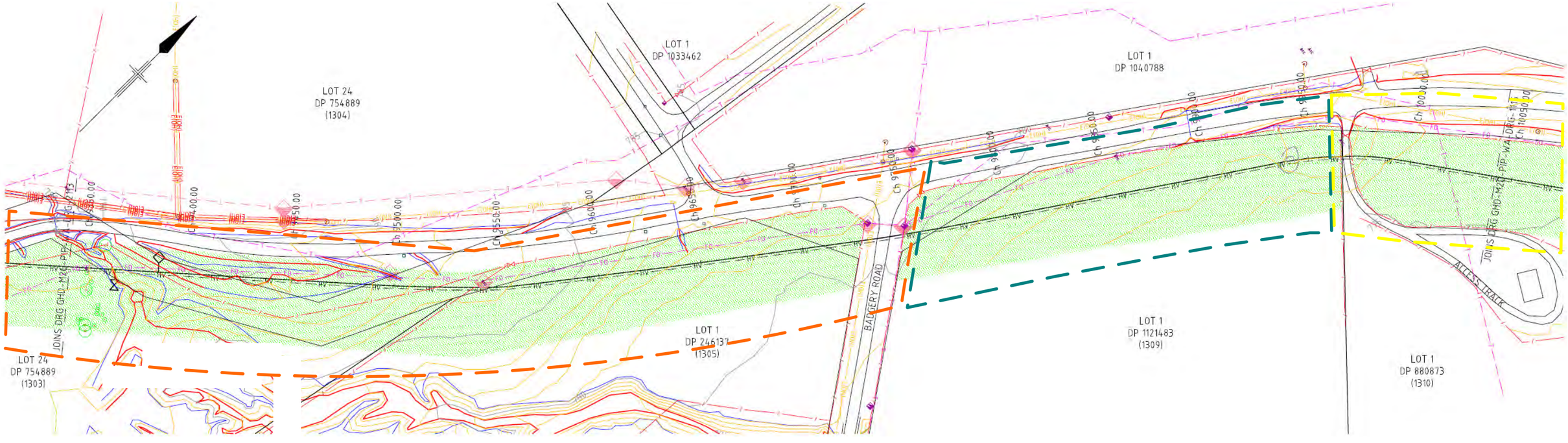
Weed Management Plan

M2G – Weed Control Map

Document Number: BWA-M2G-WM-ESP-015-3

Revision: 3



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Low weed presence	Washdown area
Moderate weed presence	
High weed presence	Inspection Point

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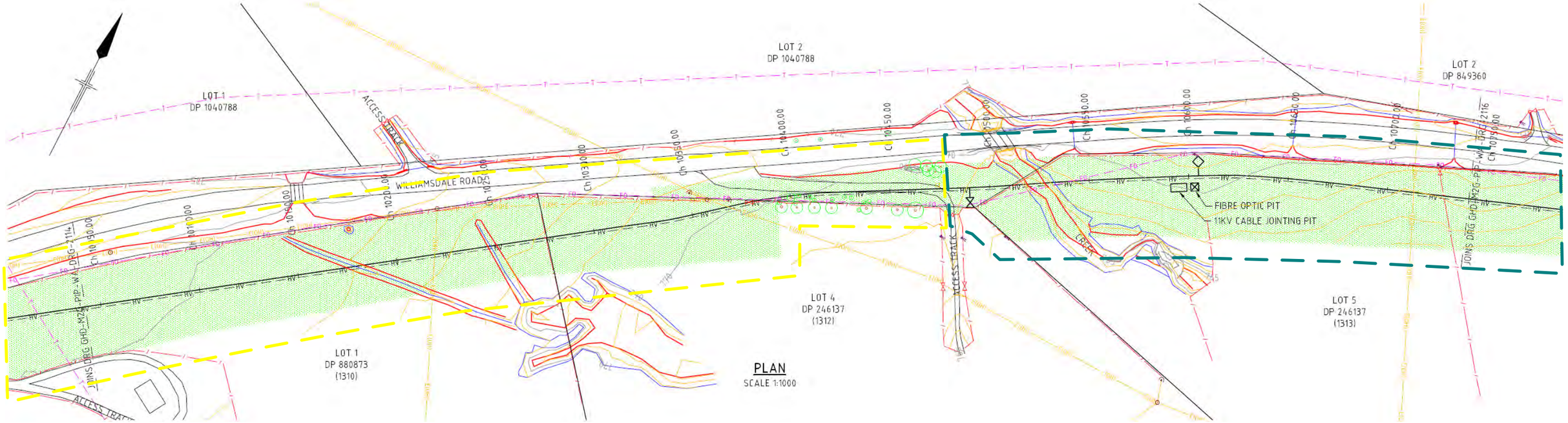

LEGEND	
Low weed risk	Washdown area
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High weed risk	Inspection Point

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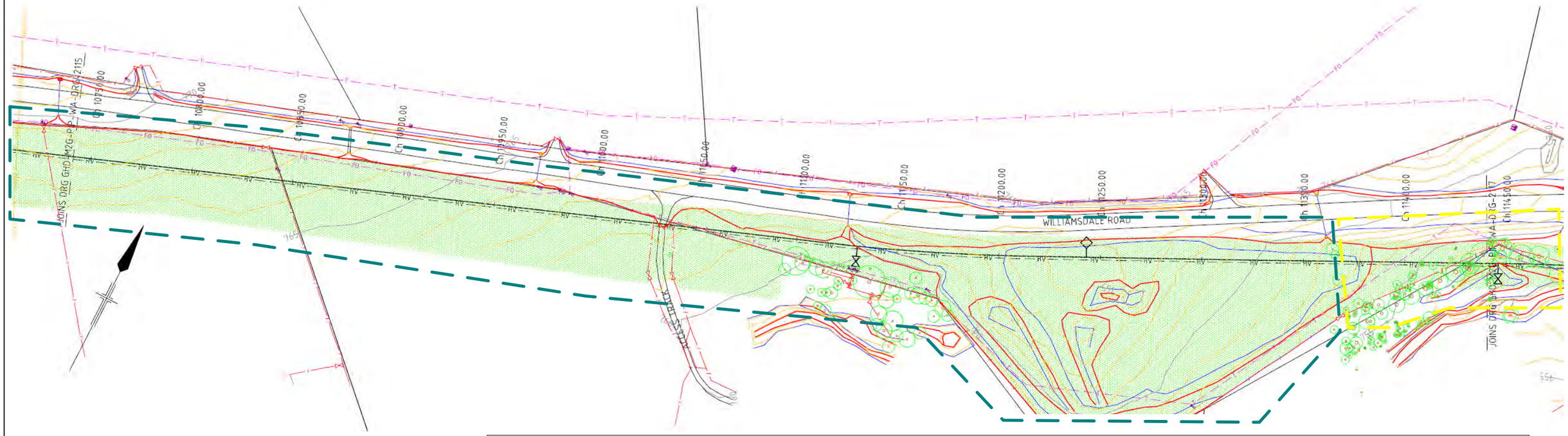

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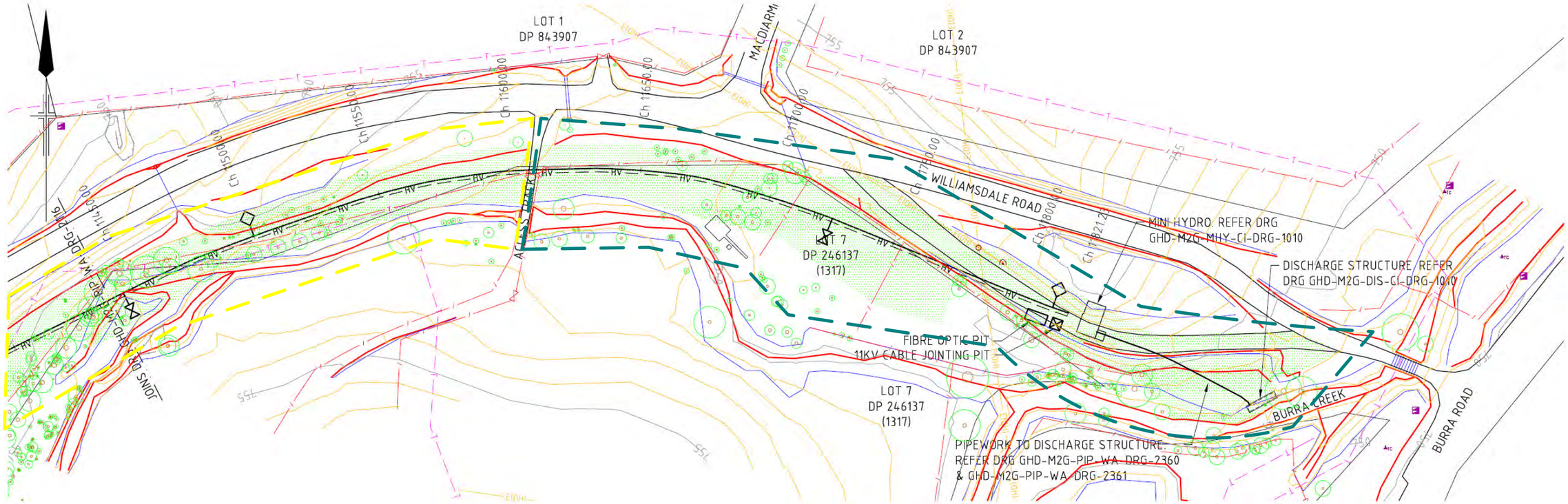
M2G – Weed Control Map

Document Number: BWA-M2G-EN-WM-018-3

Revision: 3



LEGEND

- Low weed presence
- Moderate weed presence
- High weed presence
- Washdown area
- Inspection Point

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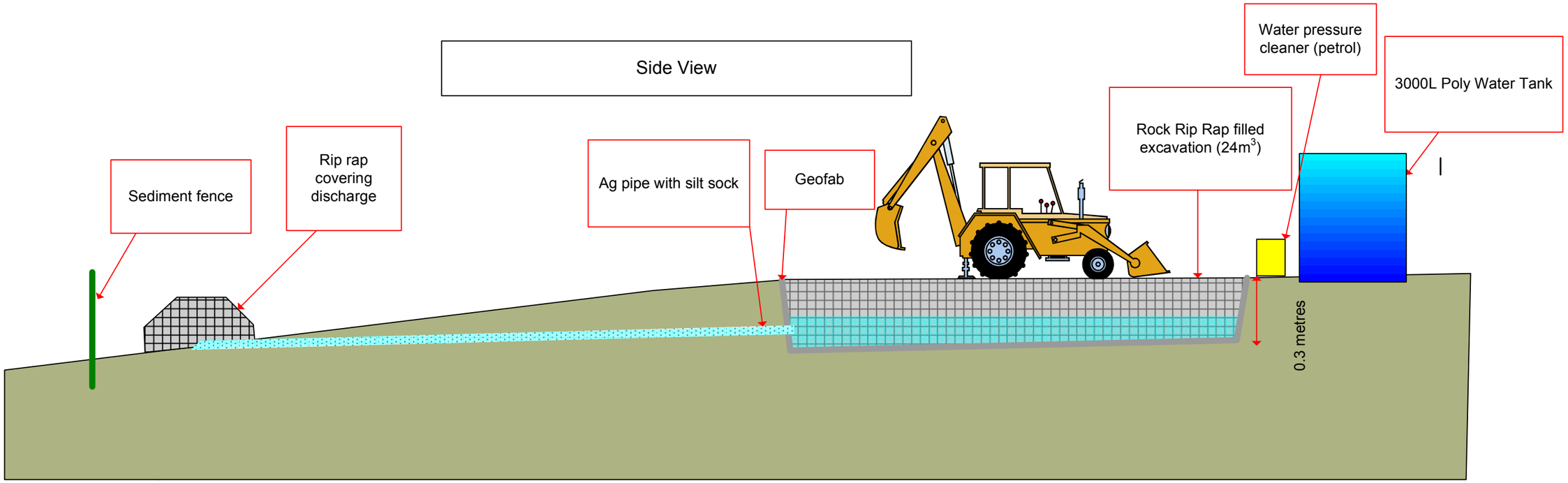
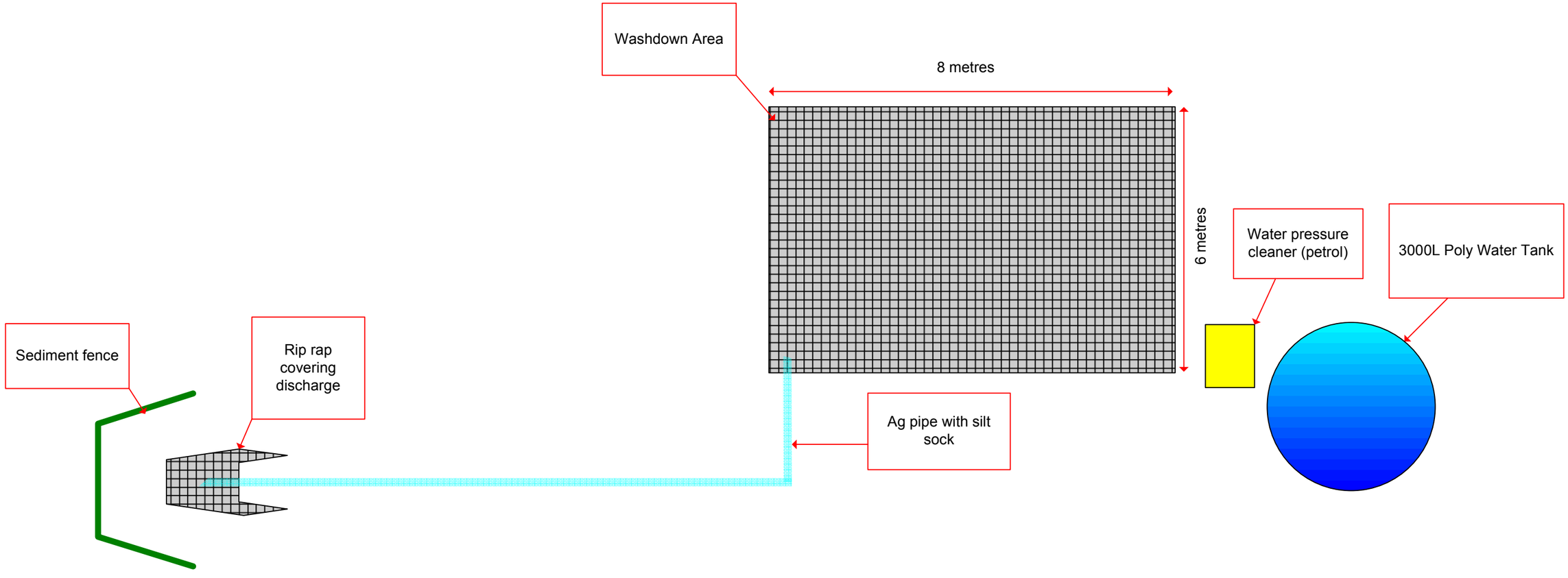
Developed By: John Turville Date: 20.05.11 Approved By: John Turville Date: 20.05.11

Appendix D **Permanent Weed Wash Down Design**

Side View



Plan View



Appendix E **Vegetation Condition Summary**

Summary of Existing Vegetation Condition – Murrumbidgee to Googong Water Transfer Project

Prepared for
Bulk Water Alliance Joint Venture

March 2011

DOCUMENT TRACKING

ITEM	DETAIL
Project Name	Summary of Existing Vegetation Condition – Murrumbidgee to Googong Water Transfer Project
Project Number	11CANECO-0002
Prepared by	Tom O'Sullivan
Approved by	Rohan Watson
Status	Draft
Version Number	V2
Last saved on	10 March 2011

ACKNOWLEDGEMENTS

This document has been prepared by Tom O'Sullivan (Blue Gum Ecological Consulting) on behalf of Eco Logical Australia Pty Ltd.

Contents

List of Figures

List of Tables

1 Introduction

This report provides a summary of the *existing* vegetation conditions within the proposed construction corridor (as at 21 February 2011) for the Murrumbidgee River to Googong Dam Water Transfer Pipeline (M2G).

The report has been prepared in response to the NSW Department of Planning's letter (dated 10 December 2010) requesting a summary of the *existing* vegetation conditions for inclusion in a revised Construction Environmental Management Plan (CEMP).

Principal documents used in the preparation of this report are:

- M2G Rapid Vegetation Assessment of the 'Hard Rock' Realignment route (Eco Logical Australia, February 2011);
- Murrumbidgee River to Googong Water Transfer - Construction Environmental Management Plan, BWA-M2G-EN-PLN-001-2 (Bulk Water Alliance, 6 December 2010);
- Murrumbidgee to Googong Water Transfer – Terrestrial Ecology Management Plan, BWA-M2G-EN-ECP-007-1 (Bulk Water Alliance, October 2010);
- Murrumbidgee to Googong Water Transfer – Landscape Rehabilitation Management Plan, BWA-M2G-EN-ECP-008-1 (Bulk Water Alliance October 2010);
- Murrumbidgee River to Googong Dam Water Transfer Pipeline: Terrestrial Flora & Fauna Impact Assessment (Biosis Research June 2009);
- Woodlands for Wildlife: *ACT Lowland Woodland Conservation Strategy. Action Plan 27* (ACT Government 2004); and
- A Vision Splendid of the Grassy Plains Extended: *ACT Lowland Native Grassland Conservation Strategy. Action Plan 28*. (ACT Government 2005).

2 Background

Vegetation surveys were conducted for the Environmental Assessment (EA) at various times between December 2006 and January 2009 (Biosis Research, June 2009). Methods used to determine vegetation type, extent and condition included random meanders, linear transects and plot-based vegetation sampling.

Floristic information gathered during the EA process was used to rank the vegetation according to the degree to which it resembled relatively natural undisturbed vegetation by assessing the following parameters.

- Species composition and cover abundance (i.e. species diversity and richness, degree of weed invasion) determined by either plot-based sampling, transects or random meanders;
- Vegetation structure (representation of each of the original layers of vegetation); and,
- Resilience - the capacity of a site for natural regeneration. The key determinant here is soil disturbance (i.e. tilled/cropped soil = low resilience).

Original estimates of vegetation loss (by type and condition) were presented in Section 5.2 of the EA report (Biosis Research, June 2009). A subsequent recalibration of vegetation loss was presented in Table 4.5 of the Terrestrial Ecological Management Plan (Bulk Water Alliance, October 2010) and Table 1, Appendix A of the CEMP (Bulk Water Alliance, December 2010). Although there were some minor differences in these estimates - attributed to changes in the pipeline alignment and corridor width - the proportional impact on each vegetation type was essentially the same.

3 Subject Area

The subject area includes both the ACT and NSW components of the proposed M2G construction corridor, which extends from the Murrumbidgee River at Angle Crossing to the discharge point at Burra Creek, south of the Williamsdale Road and Burra Road intersection.

Block (or paddock) numbers referred to in this report correspond to those used in the Murrumbidgee to Googong Water Transfer Project A1 Locality map (Job # 0821, dated 05/03/2010) provided by BWA.

4 Tasks

The following tasks were undertaken in the preparation of this summary report:

- A brief reading of the documents referred to in Section 1, above.
- A brief visual re-evaluation of the vegetation within the subject area on 21 February 2011. The only exception was the Cooma-Goulburn Railway corridor and the western section of Block 1103, both of which contained high conservation value BGGW derived secondary grassland and known or potential habitat for *Swainsona recta*.
- Walked transects were conducted within Blocks 1102, 1104, 1106, 1108, 1109, 1203, 1205 and 1217. Other Blocks were viewed from roadsides and vantage points.
- A review of the documents for the ACT component of the pipeline.

5 Methods

Criteria used to determine vegetation condition

Vegetation condition was categorised as disturbed, good, moderate or poor. The latter category (poor) has been divided into four sub-categories to provide a finer analysis of this level and is based on the degree and extent of groundcover modification (i.e. proportion of native and non-native grasses), presence of isolated or scattered trees and soil disturbance. Descriptions of each category are as follows:

Good: Contains a high diversity of native herbaceous and/or woody sub-canopy species. Weeds are either absent or occur in very low densities. Structural layers are broadly consistent with the community type, or if modified, the natural soil profile remains intact.

Moderate: Contains a moderate diversity of native herbaceous and/or woody sub-canopy species. There is an increase in the abundance and distribution of non-native grasses and forbs, which may be abundant in localised patches. Structural layers are broadly consistent with the community type, or if

modified, the natural soil profile remains intact, though it may show signs of minor disturbance i.e. stock trampling.

Poor: Native herbaceous and/or woody species are either absent, occur in scattered patches or, if widespread, occur in low density. May be represented by mixed native pasture, non-native pasture, plantation or entirely weed dominated. Soil structure may range from partially intact to highly modified due to tilling, cropping or repeated application of fertiliser. This group is divided into the following sub-categories.

- *Sub-category 1: Highly modified community. Soil profile altered, tilled and cultivated for exclusively non-native pasture crop i.e. Phalaris, Oats. May also be severely affected by weed invasion or stock.*
- *Sub-category 2: Contains a mixed pasture comprising predominately non-native grasses with scattered (grazing tolerant) native grasses i.e. Austrostipa* spp*. and Austrodanthonia* spp.*). Weeds may be common. Soil possibly tilled or fertilised.*
- *Sub-category 3: May contain isolated or scattered paddock trees of native origin. The understorey is highly modified and contains disturbance tolerant native grasses such as Austrostipa* spp*. and Austrodanthonia* spp*. but generally the groundcover is dominated by non-native pasture grasses and/or weeds. Soil possibly tilled or fertilised.*
- *Sub-category 4: Vegetation dominated by woody weeds or monospecific stands of pioneer woody shrubs such as Burgan (Kunzea ericoides), which have established in response to previous fire or soil disturbances.*

Disturbed: Highly modified. Original vegetation has been removed and may be reduced to bare ground. Soil profile is highly modified.

6 Results

Overview - ACT Component of the Pipeline Corridor

Existing vegetation conditions have been transcribed to a series of aerial photographs and are presented in **Figures 1-3**. The linear extent of each condition category has been calculated and is presented in Table 1.

Approximately 1.384 km (45%) of the linear extent of the pipeline corridor within the ACT contained vegetation that was in good condition, 0.287 km (9%) in moderate condition, 1.330km (44%) in poor condition and 50 m (2%) disturbed.

The linear extents of the three poor sub-category components occurring in the ACT section are as follows:

- Sub-category 2: 0.329 km (11%)
- Sub-category 3: 0.821 km (27%)
- Sub-category 4: 0.180 km (6%)

Box Gum Grassy Woodland and Natural Temperate Grassland

Box Gum Grassy Woodland (BGGW) in moderate to good condition accounted for about 32% of the lineal extent of the pipeline corridor within the ACT. Approximately 44 % of the total vegetation within ACT was in poor condition and corresponded to sub-category's 2, 3 and 4.

Natural Temperate Grassland (NTG) in moderate to good condition accounted for about 23.7% of the lineal extent of the pipeline corridor within the ACT.

Overview - NSW Component of the Pipeline Corridor

Existing vegetation conditions within the NSW component of the pipeline corridor have been transcribed to a series of aerial photographs and are presented in **Figures 4-6**. The linear extent of each condition category across each block has been calculated and is presented in **Table 1**.

Approximately 2.775 km (30%) of the linear extent of the pipeline corridor within NSW contained vegetation that is in good condition, 0.625 km (7%) that is in moderate condition and 5.726 km (63%) that is in poor condition.

The linear extents of each sub-component of the poor condition category occurring in the NSW section are as follows:

- Sub-category 1: 4.506 km (49%)
- Sub-category 2: 0.72km (8%)
- Sub-category 3: 0.5km (9%)

Box Gum Grassy Woodland

BGGW in moderate to good condition accounted for 34% of the total linear extent of the pipeline within NSW. Approximately 13.4 % of the total vegetation within NSW was in poor condition and corresponded to sub-category's 2 and 3.

Table 1: Existing vegetation conditions within each Block within the subject area.

	Condition (distances in metres)			
Block (Property) No.	**Disturbed**	**Poor**	**Moderate**	**Good**
1102 (NSW)		(1) 60m	185m	790m
1107 (NSW)		(3) 500m (1) 415m	440m	465m
1203 (NSW)		(2) 245m		
1205(NSW)		(2) 125m (1) 70m		105m
Road Easement (NSW)		(1) 1920m		945m
1217 (NSW)				470m
1223 (NSW)		(2) 350m		
1225 (NSW)		(1) 100m		
1302 (NSW)		(1) 415m		
1303 (NSW)		(1) 60m		
1305 (NSW)		(1) 165m		
1309 (NSW)		(1) 195m		
1310 (NSW)		(1) 310m		
1312 (NSW)		(1) 450m		
1315 (NSW)		(1) 186m		
1317 (NSW)		(1) 160m		
Total NSW		**5726m**	**625m**	**2775m**
1002A (ACT)		(2) 245		
1003 (ACT)	50m	(4) 168	41m	560m
1003A (ACT)		(2) 71m		154m

Block (Property) No.	Condition (distances in metres)			
	Disturbed	Poor	Moderate	Good
		(3) 664m		
1003B (ACT)		(3) 157m	216m	526m
1006 (ACT)				144m
Road Easement (ACT)		(2) 13m (4) 12m	30m	
Total ACT	**50m**	**1330m**	**287m**	**1384m**
Total pipeline length (ACT & NSW)	**50m**	**7056m**	**912**	**4159m**

7 Vegetation condition and variability

For the most part, vegetation across the proposed pipeline corridor, and more discretely within each block in the NSW component of the pipeline, has been influenced to varying degrees by past and present land management practices, including vegetation clearing, commercial stock grazing (high and low intensity), native macropod and feral rabbit grazing; cropping, pasture improvement and nature conservation.

Prior to February 2010, drought conditions had had a significant limiting effect on the vigour of individual plants and the condition of vegetation across most parts of the proposed pipeline corridor. Combined grazing pressures (stock, macropods and rabbits) quickly eliminated any new palatable foliage and further reduced the apparent condition of the vegetation. The onset of higher rainfall in the early part of 2010 and its subsequent continuation through to the present has had a positive effect on soil moisture and the amount of foliage growth of many herbaceous species, particularly grasses (both native and non-native). This contrasts with previous seasons where the herbaceous groundcover on some blocks (i.e. 1102) was generally sparse and heavily grazed to only a few cm in height.

A case in point is the southern portion of Block 1102, which initially comprised a low abundance of tussock grasses and forbs and was categorised as poor to moderate in condition. While the community met the TSC Act definition of BGGW it did not fulfil the EPBC Act minimum requirement. The assessment on 21 February 2011 revealed an estimated foliage cover of up to 80% of native tussock grasses, including Spear grass *Austrostipa bigeniculata*, *Panicum effusum*, *Austrodanthonia* spp. *Bothriochloa macra* and occasionally *Themeda australis* to about 1 m in height. There was also a moderate diversity of native forb species (some obscured by foliage cover) that were either not obvious or observed at very low densities during the original EA. There is a reasonable probability that this portion of Block 1102 would now rank as moderate in condition.

Three other Blocks in NSW also had their condition rank elevated as a result of the 21 February 2011 assessment, they are 1203, 1223 and a small proportion of 1217. Vegetation on 1203 and 1223 while remaining in poor condition was ranked sub-category 2, which was a better reflection of the mixed

quality of the groundcover that was now apparent. The front portion of Block 1217 was inaccurately mapped in the original EA and should have been categorised as BGGW in good condition.

The consequence of this is that the vegetation condition within any one particular paddock or block at any particular time is dependent upon the interplay of a range of factors, some of which are mentioned above. The exception being where vegetation has been converted to crop production and soil has been tilled, cultivated for stock crops (i.e. phalaris, oats) and the soil fertility increased with introduced legumes (i.e. clovers) and/or fertilizer. This was typical of many of the properties east of the Gibraltar 'saddle'.

Within the ACT component of the pipeline the effects of land management on groundcover vegetation were most apparent on Blocks 1003A and 1003B. The former block exhibited low species diversity, high proportion of non-native grass and forb, was heavily grazed at the time of the EA surveys and had probably been fertilised on a number of occasions. In contrast, Block 1003B (and 1006) despite having a history of stock grazing (which is unlikely to have been sustained high intensity) exhibited a high relative diversity of grass and forb species, low soil disturbance and maintenance and recruitment of upper canopy species.

Block 1003B also contained the larger proportion of moderate to good condition Box Gum Grassy Woodland.

Moderate to good condition *Themeda australis* grasslands (Natural Temperate Grassland) were typically found on Block 1003 (and in the western corner of Block 1003A). This area has, due to its condition and high forb diversity, been incorporated into the Murrumbidgee River Corridor reserve system and is now excluded from unregulated stock grazing.

8 Implications for rehabilitation

Groundcover vegetation identified as moderate to good in condition should be rehabilitated to the highest possible standard, with species of locally indigenous grass species selected from the following: *Austrostipa bigeniculata*, *Austrostipa scabra*, *Austrodanthonia carphoides*, *Austrodanthonia* spp., *Panicum effusum*, *Themeda australis*, *Elymus scaber*, *Chloris truncata*, *Microlaena stipoides*, *Bothriochloa macra*) and a cross section of native forbs including amongst others nitrogen fixing legumes from the family Fabaceae: i.e. *Desmodium varians*, *Glycine* spp., *Zornia dyctiocarpa*, *Lotus australis*, *Cullen tenax* and *Swainsona* sp.

Seed from some of the above mentioned species may be difficult to collect. As such, the following species may be considered as alternatives: *Bracteantha viscosa* (*Xerochrysum viscosum*), *Chrysocephalum apiculatum, Wahlenbergia* spp., *Convolvulus erubescens and Vittadinia cuneata.*

Poor condition vegetation in sub-category 2 and 3 that contain mixed grassy groundcovers would require the recovery of predominately disturbance and grazing tolerant native grasses such as *Austrostipa bigeniculata*, *Austrostipa scabra*, *Austrodanthonia carphoides*, *Bothriochloa macra*, *Austrodanthonia* spp. and *Panicum effusum*. The re-establishment of other native herbaceous species with low grazing tolerance such as *Themeda australis* and other forbs in these areas should be considered with respect to future land use and grazing regimes.

Previously tilled or sown blocks (poor condition sub-category 1) should be replanted with the appropriate pasture species.

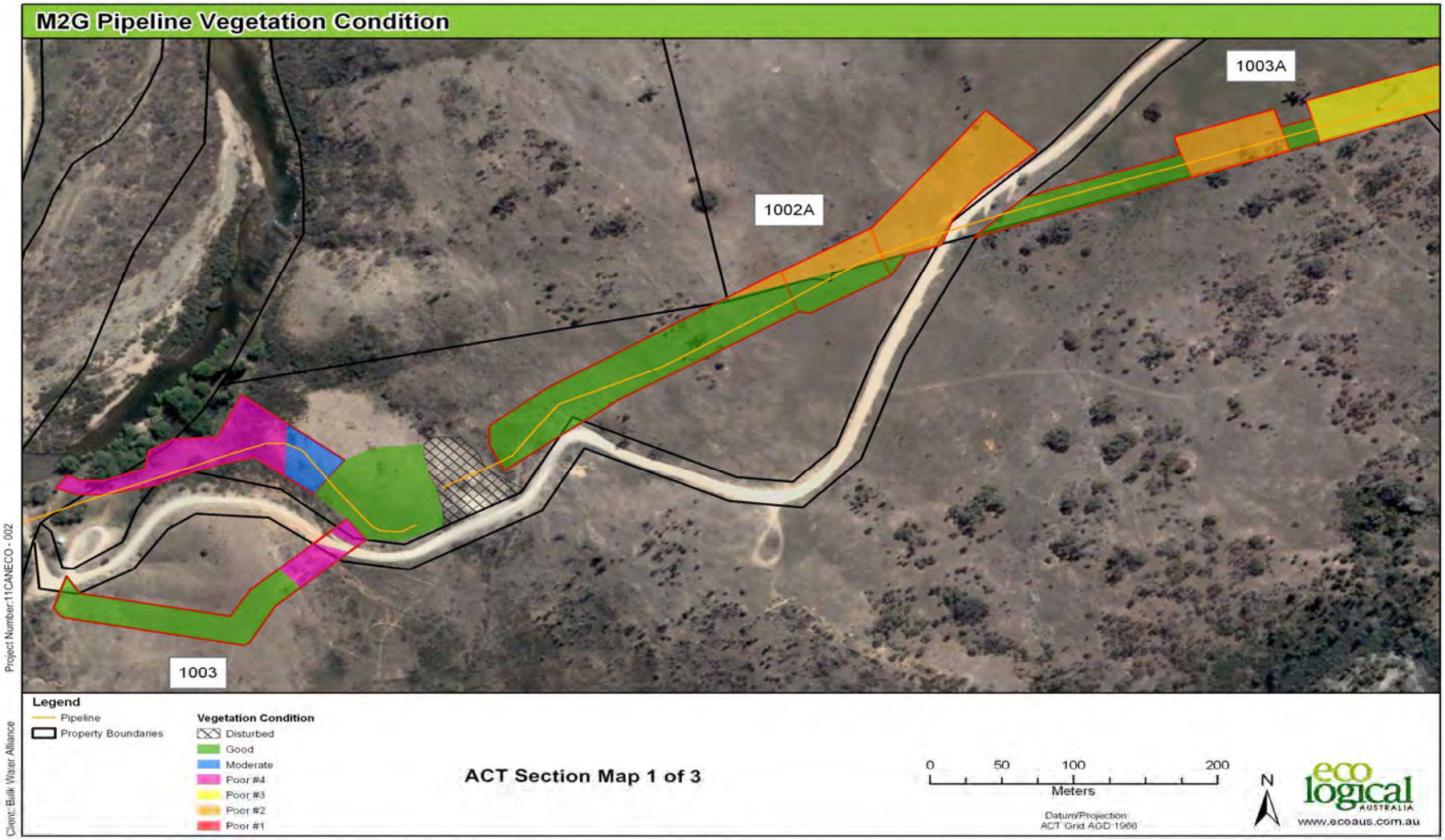


Figure 1: Western Section (ACT)

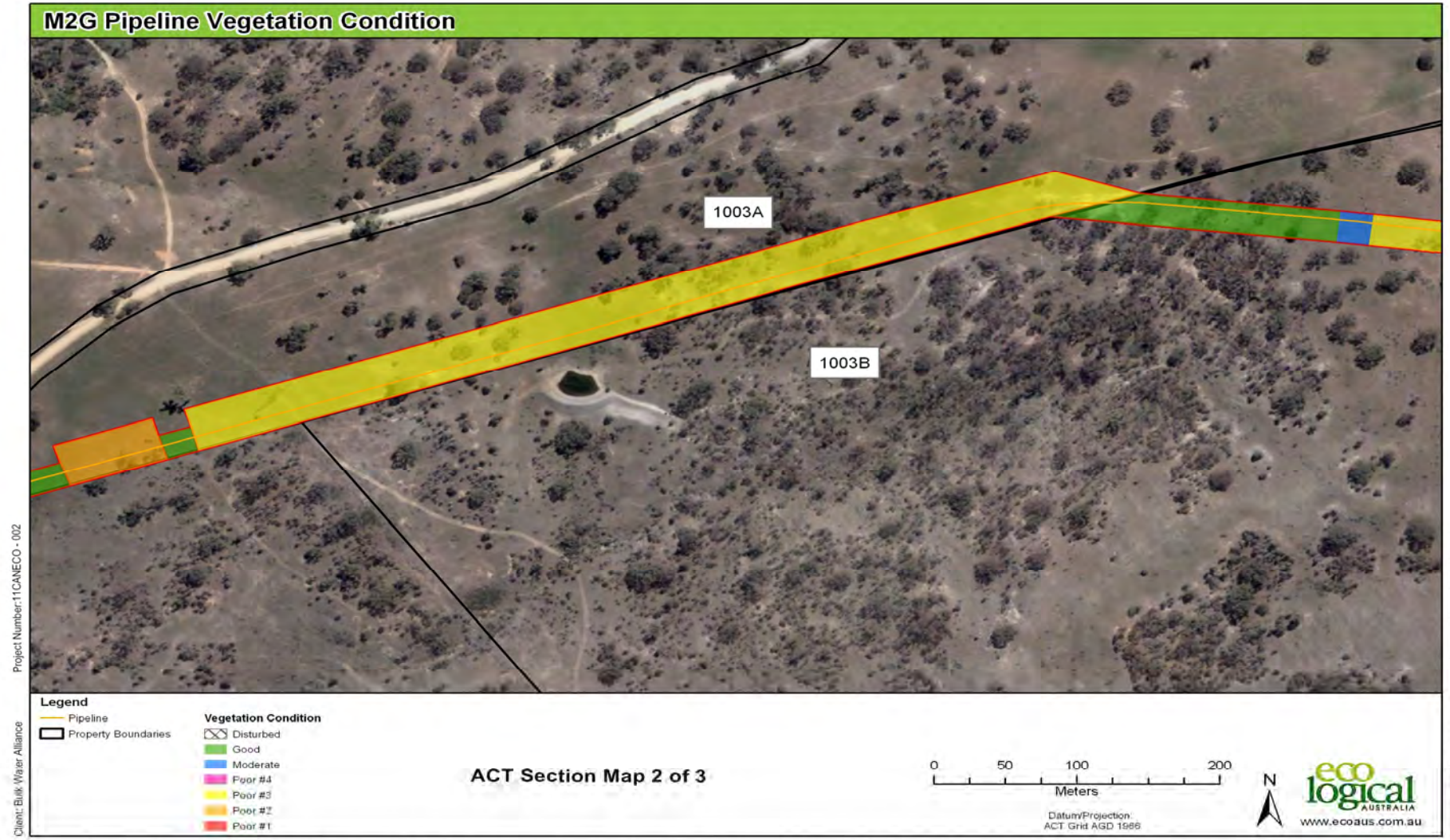


Figure 2: Central Section (ACT)

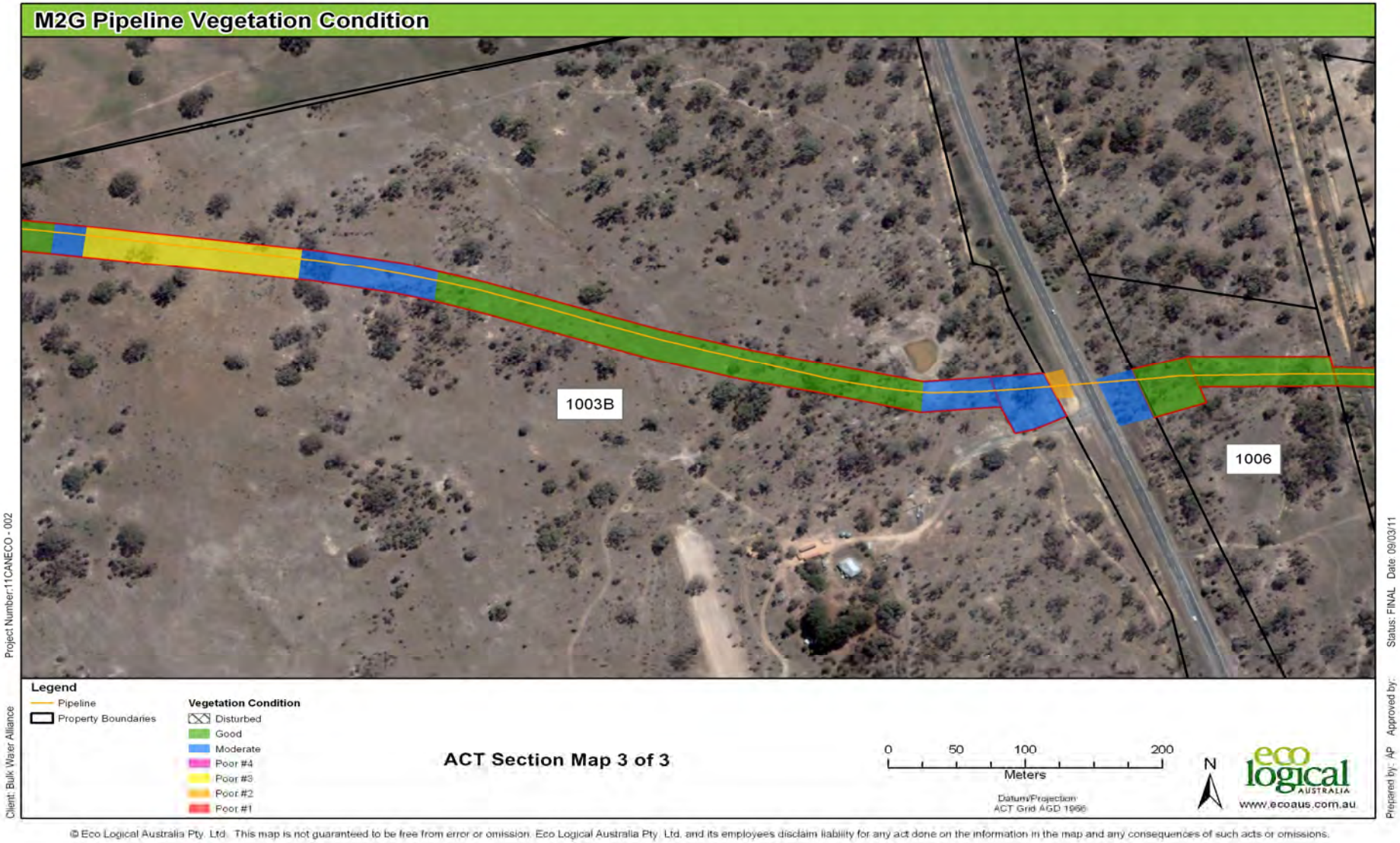


Figure 3: Eastern Section (ACT)

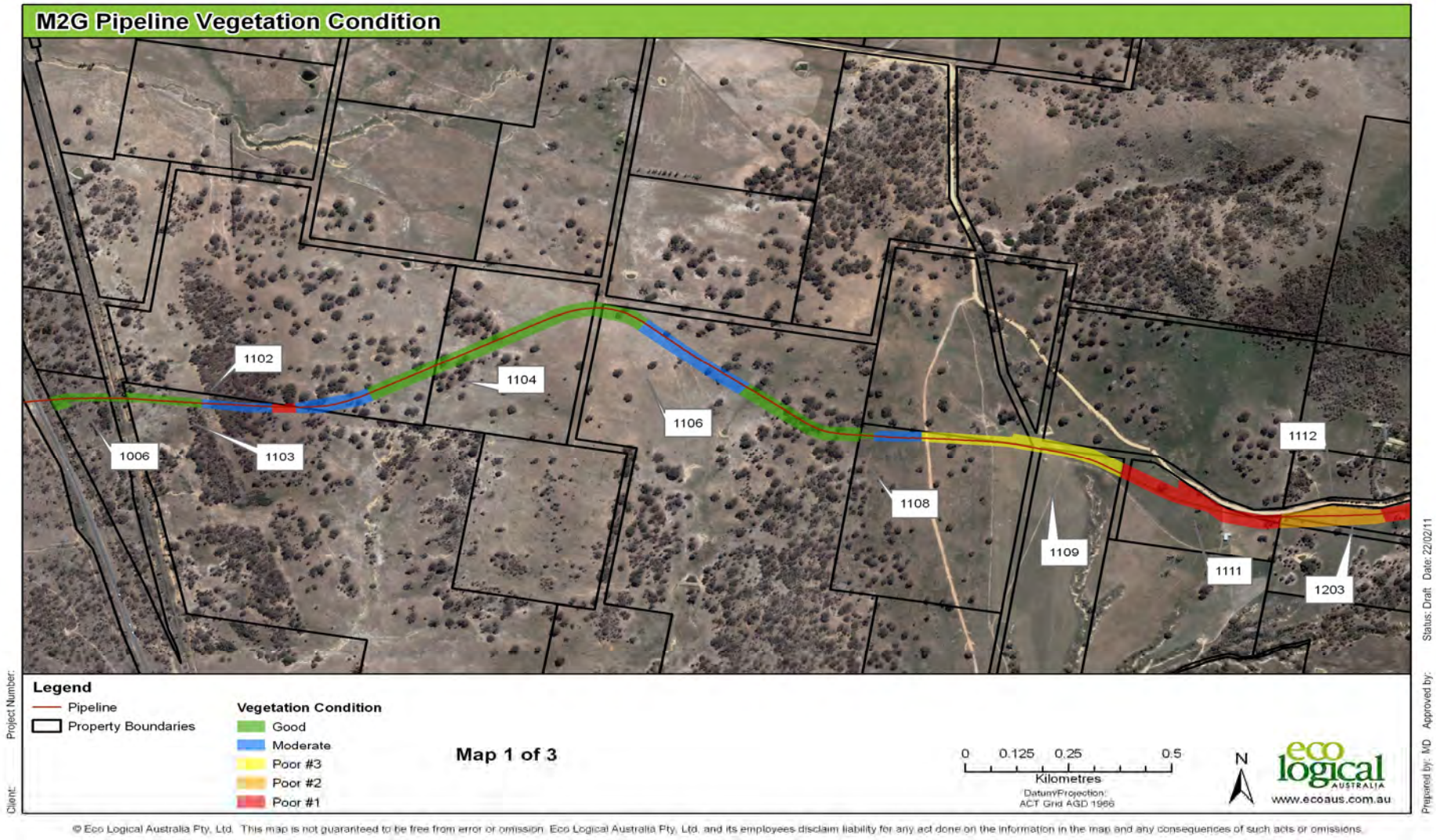


Figure 4: Western Section (NSW)

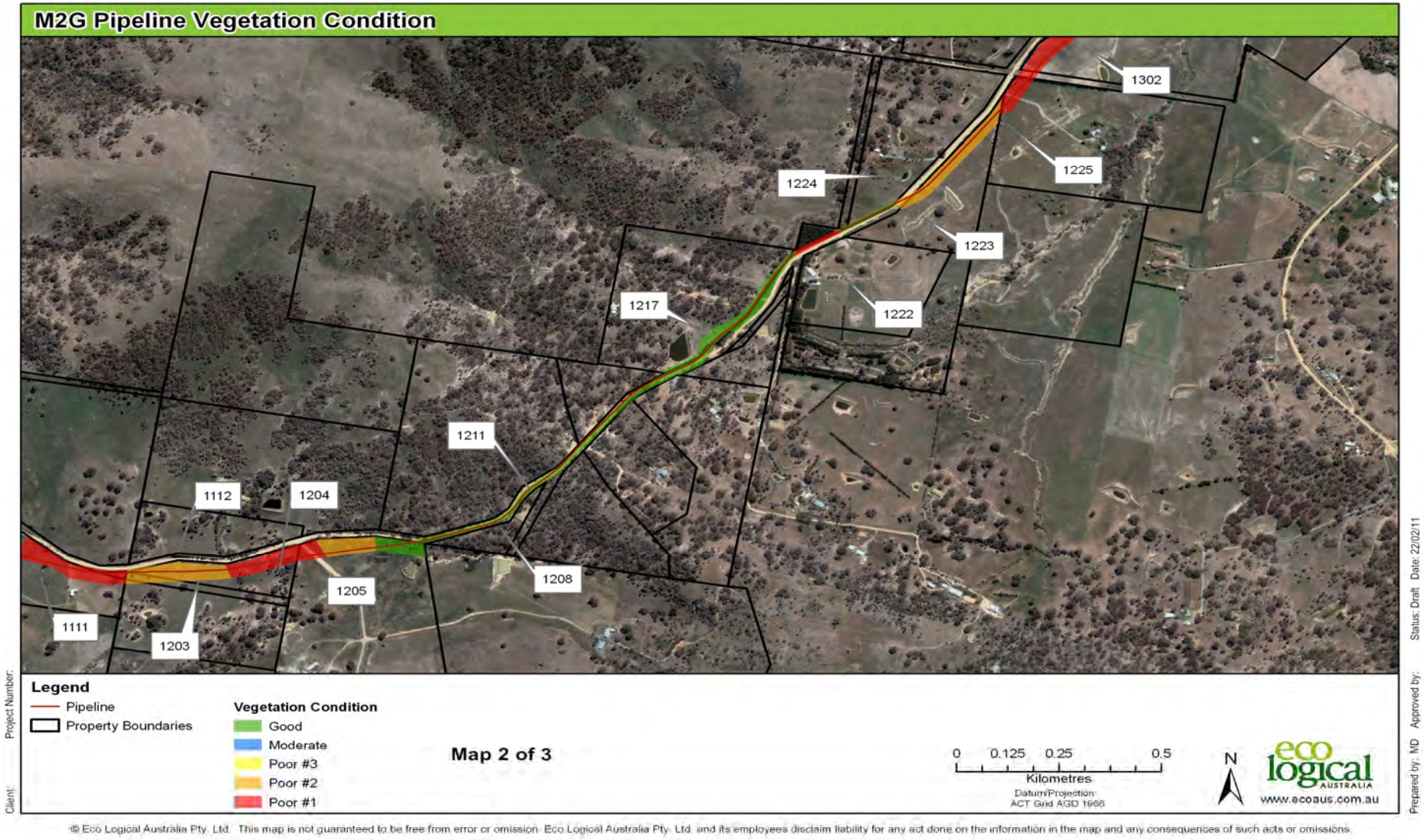


Figure 5: Central Section (NSW)

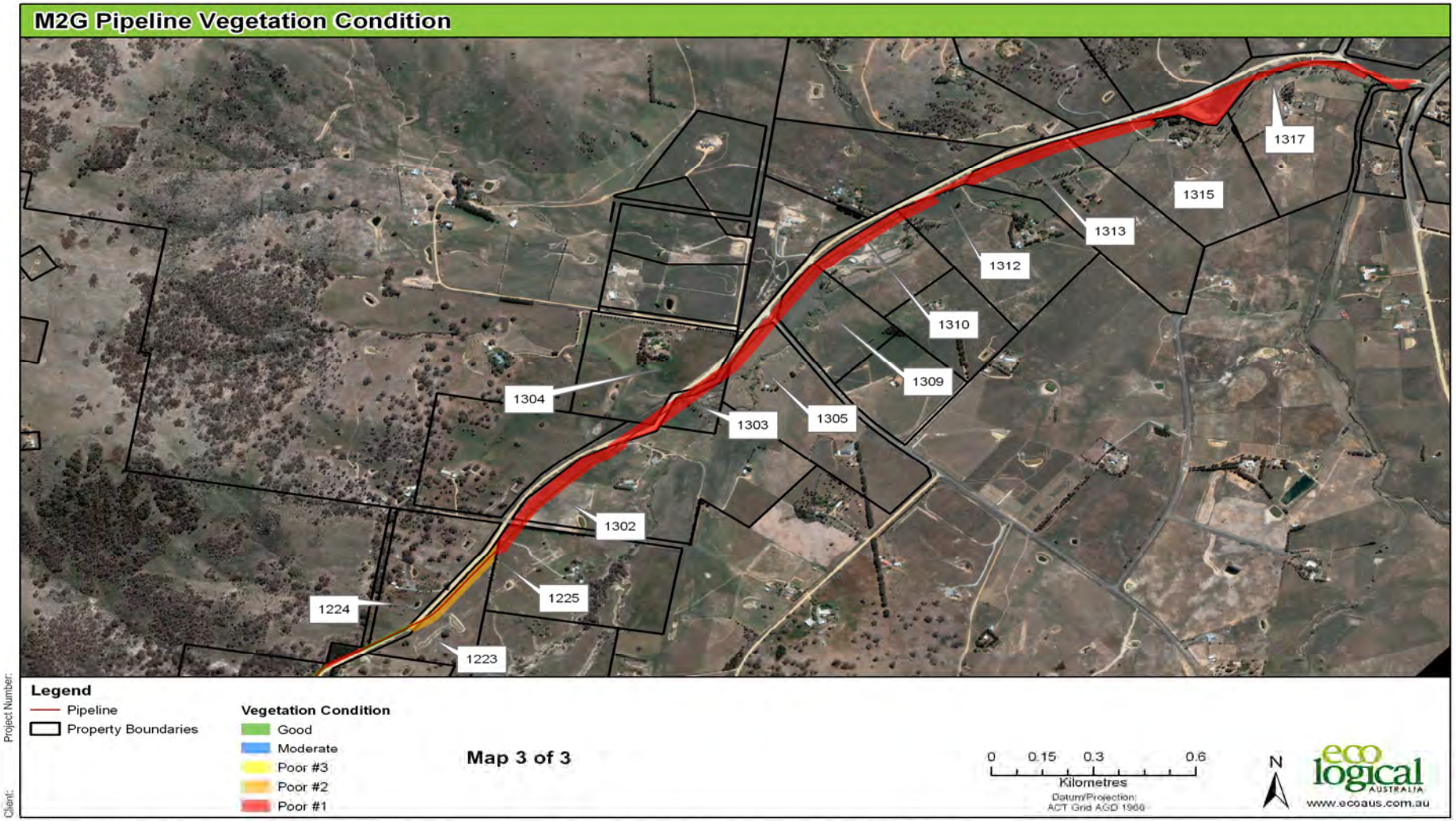


Figure6: Eastern Section (NSW)

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