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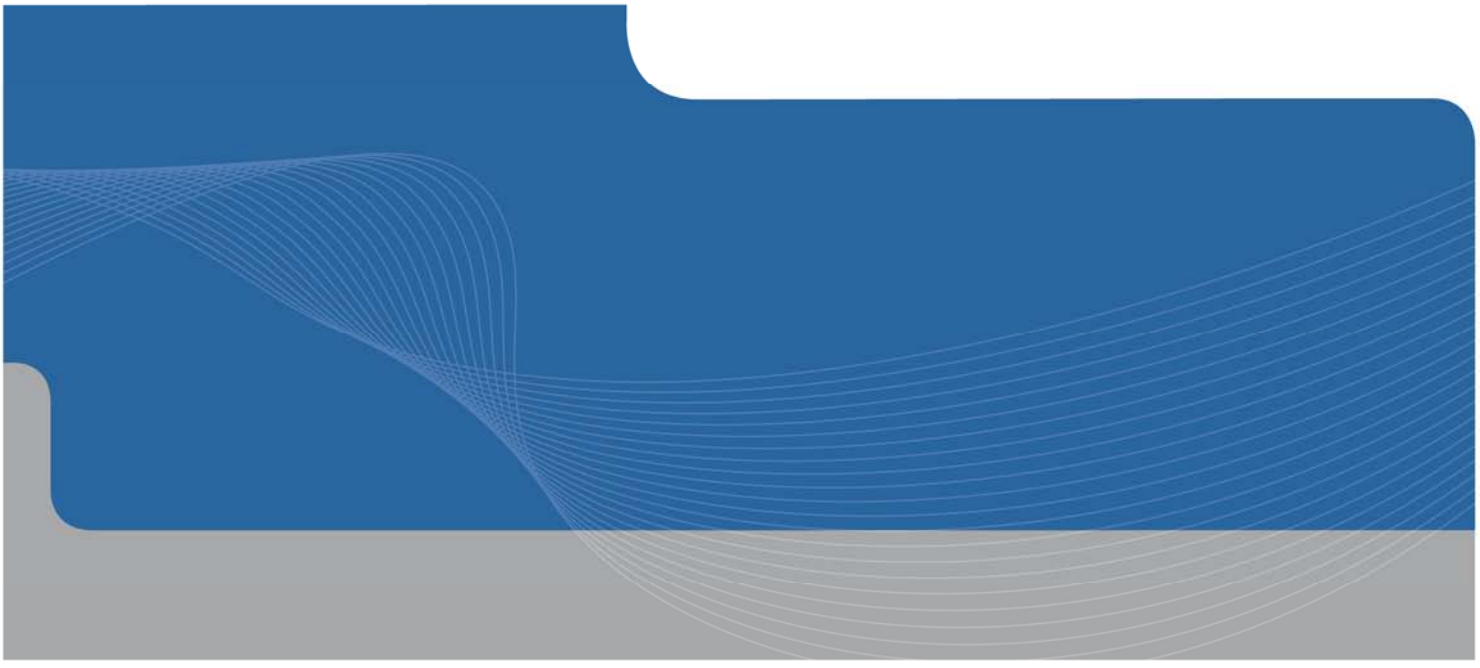
Goulburn Mulwaree Council

Report for Highland Source Project

Ecological Impact Assessment

April 2010



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

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Executive Summary

This report documents the findings of an Ecological Impact Assessment undertaken by GHD Pty Ltd (GHD) on behalf of Goulburn Mulwaree Council to assess the terrestrial and aquatic ecological impacts associated with the Highlands Source Project (hereafter referred to as 'the Project'). It has been prepared as a technical document to support the Environmental Assessment for the Project.

The Project comprises approximately 83 km of trunk water main and ancillary infrastructure, extending from Wingecarribee Reservoir within the Wingecarribee Local Government Area (LGA), to the Goulburn Water Treatment Plant within the Goulburn Mulwaree LGA. The preferred pipeline route corridor would be located mostly adjacent to existing infrastructure easements that have previously been cleared and either remain cleared or have regenerating vegetation present. From Wingecarribee Reservoir, the pipeline route corridor largely runs adjacent to existing power line easements until it crosses the Hume Highway. After crossing the Hume Highway, the pipeline route would be located adjacent to and outside of an existing gas pipeline easement (the Moomba to Sydney Gas Pipeline), which it follows almost the entire way to Goulburn.

The objective of this report is to provide an ecological assessment of the Proposal pursuant to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the requirements (relating to ecology) of the Director-General of the NSW Department of Planning (the DGRs) dated 14 December 2009. This report provides an assessment of the significance of impacts on threatened biota listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and on 'Matters of National Environmental Significance' pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). As a result of this assessment, particular areas where mitigation may be required have been identified and management measures proposed so as to minimise the impacts of the Proposal.

In order to determine those threatened species, populations and endangered ecological communities (EECs) that may be present within the study area, a combination of literature review and habitat assessment was undertaken. Following this, a series of three targeted field surveys was undertaken between November 2009 and January 2010. The surveys were conducted within a specified survey corridor at selected locations along the pipeline route, where habitats and vegetation were considered likely to contain higher levels of biodiversity and potentially threatened species. A range of standard diurnal and nocturnal survey techniques were employed with consideration of the DGRs and DEC (2004) biodiversity survey guidelines as considered appropriate given the nature and context of the site and access and seasonal limitations. The results of the field surveys assisted in assessing the potential impacts of the Project on threatened biota.

Desktop research identified 30 threatened fauna species previously recorded or predicted to occur in the locality that are likely to occur in the survey corridor. Field surveys confirmed the presence of six species of threatened fauna, including: the

gang-gang cockatoo, glossy black cockatoo, brown treecreeper, eastern falsistrellus, large-footed myotis and eastern bentwing bat, which are all listed as vulnerable under the TSC Act (none are listed under the EPBC Act). A further two bird species under preliminary determinations for listing as threatened species were recorded: the scarlet robin and varied sitella. Two threatened plants (Camden Woollybutt and Hoary Sunray) and two EECs (Southern Highlands Shale Woodlands and Robertson Basalt Tall Open-forest) were recorded within the survey corridor. Additional threatened flora and fauna species have the potential to occur, based on the availability of suitable habitat and have been considered in the impact assessment.

Construction of the pipeline would require clearing a 10m-wide corridor within cleared grazing land and other non-native vegetation, with this reduced to a 6m-wide footprint within native vegetation. On this basis, construction of the Project would require permanent removal of approximately 19 ha of native vegetation and 42 ha of non-native vegetation, with temporary disturbance to 83 ha of non-native vegetation. Construction activities would also remove specific features and habitats of potential value to native fauna (including threatened species), including hollow-bearing trees, rocky substrates and termite mounds. Disturbance to aquatic and riparian habitats is also possible at watercourse crossings, depending on the construction technique employed.

The native vegetation to be permanently removed during construction includes over 4 ha of Southern Highlands Shale Woodlands EEC, as well as individuals and habitat for the threatened Camden Woollybutt *Eucalyptus macarthurii*. Vegetation to be cleared in the construction corridor is also likely to contribute to available habitat for the threatened fauna species identified within the survey corridor and other species considered likely to occur. Impacts on fauna would include reduced shelter or roosting sites, foraging habitat and food abundance. Clearing will have additional negative effects on the quality of habitats in the broader locality through edge effects and incremental fragmentation of habitat.

The avoidance and/or minimisation of impacts on the environment and contribution to the maintenance or improvement of biodiversity values are core principles for the Project. The potential impacts on biodiversity values associated with construction and operation of the Project have been addressed adopting the hierarchy of avoid, mitigate, offset. A key measure in the avoidance of biodiversity loss has been the alignment of the pipeline alongside existing cleared easements; impacts will be further substantially mitigated through the narrowing of the construction corridor to a maximum of 6 m width where sensitive environments occur, which includes native vegetation, creek crossings and wetlands. Additional mitigation and environmental management measures to minimise impacts on flora and fauna impacted by the proposed pipeline route have been developed, adopting a precautionary approach given the constraints on the scope of investigations undertaken as part of this study.

A ‘Biodiversity Management Strategy’ for the further assessment and management of biodiversity values associated with the Project has been discussed and agreed with DECCW as part of the Adequacy Review of the EA. The key actions to be undertaken by the proponent to further reduce and offset potential impacts on biodiversity are:

- Additional targeted surveys to more accurately describe and quantify the biodiversity values of the survey corridor and the offset sites.
- Refinement of the pipeline corridor through the detailed design phase to avoid threatened biota and their habitats, as far as possible;
- Preparation of a Flora and Fauna Management Plan (FFMP) that will contain site-specific/species-specific mitigation measures and environmental management protocols to be implemented before, during and post-construction to further avoid or reduce impacts on threatened biodiversity. The FFMP will be prepared in consultation with DECCW and finalised before construction.
- Preparation of an Offset Plan, developed in consultation with DECCW, which will describe the biodiversity values of the proposed offset sites, and detail how unavoidable impacts on threatened biota will be compensated for in the offset sites. The Offset Plan would aim to ensure that the Project contributes to the maintenance and improvement of biodiversity.

The Biodiversity Management Strategy will be included in the Draft Statement of Commitments and if Project Approval is granted under Part 3A of the EP&A Act, would form part of the Conditions of Consent.

Assessments of Significance for impacts on threatened biota (species and EECs listed under the TSC Act) potentially affected by construction of the Project have been undertaken in accordance with the draft threatened species assessment guidelines for Part 3A projects (DEC and DPI, 2005). The assessments conclude that there is unlikely to be a significant impact on threatened biota or their habitats.

Matters of National Environmental Significance that could be affected by the Project are limited to a number of threatened and migratory species listed under the EPBC Act. One threatened plant, Hoary Sunray and seven migratory species were recorded during the surveys. In addition, a number of other threatened flora and fauna species listed under the EPBC Act are known or predicted to utilise habitat in the locality. The Project would remove potential habitat for these species. However, on the basis of the assessments undertaken in this report, it is concluded that the proposed development is unlikely to impose a significant impact on any Matters of National Environmental Significance and hence is unlikely to constitute a controlled action as defined under the EPBC Act.

1. Introduction

This Ecological Assessment has been undertaken by GHD Pty Ltd (GHD) on behalf of Goulburn Mulwaree Council (GMC) to assess the terrestrial and aquatic ecological impacts associated with the Highlands Source Project (hereafter referred to as 'the Project'). It has been prepared as a technical document to support the Environmental Assessment (EA) for the Project.

The objective of the Ecological Impact Assessment is to provide an ecological assessment of the impact of the Proposal pursuant to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the requirements of the Director-General of the NSW Department of Planning (the DGRs) dated 14 December 2009, relating to Ecological impacts. The working paper also provides an assessment of the significance of impacts on 'Matters of National Environmental Significance' pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). As a result of this assessment, particular areas where mitigation may be required have been identified and management measures proposed so as to minimise the impacts of the Proposal

1.1 Overview

Goulburn has faced severe drought and water restrictions since 2002. By mid 2007 Goulburn had less then 12 months' water supply available. GMC, in conjunction with a State Government Task Force, identified an Emergency Pipeline from Wingecarribee Reservoir as the best means of overcoming the emergency and drought proofing Goulburn for the future (GMC & DoC, 2007). Subsequent rains in June 2007 removed the emergency aspect of the Project; however the need for improved water security remains.

Since 2007, a range of options for securing Goulburn's water supply have been investigated. GMC has prepared a draft Integrated Water Cycle Management (IWCM) Strategy that will outline actions for improving long term water sustainability. The IWCM Strategy is expected to be finalised towards the end of 2009, and it is anticipated that the Highlands Source Project will be an integral part of this Strategy. Additionally, GMC has undertaken a Goulburn Water Supply Strategy Review, in which the Highlands Source Project was identified as the best solution for improving the city's water security.

1.2 Scope of Assessment

1.2.1 Objectives and Purpose of this Report

The objectives of this Ecological Impact Assessment are to:

- Address the Director General's Requirements (DGRs) for the EA;

- Identify and describe attributes of the existing environment of the study area, including type and condition of vegetation communities and habitats;
- Identify the occurrence or likelihood of occurrence of threatened species, populations ecological communities and their habitats listed under the TSC Act, FM Act and EPBC Act within the study area;
- Assess the significance of potential impacts of construction and operation of the Project on the above in accordance with Part 3A of the EPA Act threatened species assessment requirements; and
- Identify measures to avoid, minimise, mitigate and offset impacts on biodiversity values of the study area.

The DGRs identify ecology as a key issue for the EA. Table 1 outlines the DGRs relating to flora and fauna and where they have been addressed in this report.

Table 1 Director-General's Requirements – Ecology

Director-General's Requirements	Department	Where Addressed in this Report
Description of proposal, subject site and survey corridor;	DECCW,GMSC	Section 3, Section 4
Provision of relevant plans, maps and land tenure;		Figures 1 – 9
Determine which threatened species, populations or ecological communities may be utilising, or present within the project area;		Section 6, Section 7, Appendix D
Identify habitats within the project area;		Section 7
Undertake a comprehensive fauna and flora assessment consistent with Guidelines for Threatened Species Assessment (DEC and DPI 2005). The assessment should target all threatened species that may potentially occur within the project area;		Sections 5 – 8
Apply Biometric methodology to collect data on the project area and offset site;		Biometric tool not used (as agreed with DECCW)
Documentation of survey effort and technique;		Section 5, Figure 2

Undertake specific survey requirements outlined in Attachment 2 of DG's Environmental Assessment Requirements;	Section 5, Section 6
Assess and quantify likely environmental impacts on threatened species, populations and ecological communities, including the extent to which the development footprint will impact on areas of native vegetation;	Section 8, Appendix G, Appendix H
Identify species likely to be impacted by project;	Section 6, Appendix D
Discuss local and regional abundance of threatened species likely to be impacted by project;	Appendix D
Describe and quantify habitat values within the project area;	Section 7
Discuss conservation status with reference to threatening processes;	Section 7, Section 8
Assessment of ameliorative measures and management actions that will be undertaken to avoid, control, mitigate or compensate for potential impacts of the proposal on endangered ecological communities, threatened species, and their habitats;	Section 9
Assessment of action that will be undertaken to avoid, mitigate or compensate for potential impacts of the proposal on vegetation communities including provision of an offset strategy that will result in a maintained or improved outcome for biodiversity.	Section 9
Provide information on qualifications and experience;	Section 1
Provide evidence of appropriate licences and approvals relating to flora and fauna surveys.	Section 1

Assess the impact of clearing native vegetation, including but not limited to clearing of high conservation value vegetation types, degrading a major Regional Biodiversity Corridor, and destroying key habitat for threatened species.	HNCMA	Section 8, Appendix G, Appendix H
Provide details on riparian vegetation that may be impacted by the project;	DECCW (NSW Office of Water)	Section 7, Section 8
Assess the potential impact of the proposal on existing riparian vegetation and the rehabilitation of riparian vegetation (including potential to disturb riparian vegetation during routine maintenance and repair);		Section 8
Provide detailed plans on any wetlands on/or adjacent the proposed pipeline route;		Section 7, Section 8
Provide details on the presence and distribution of Groundwater Dependent Ecosystems (GDEs) in the vicinity of the site and outline any impacts of GDEs that may result from the project.		Section 7, Section 8
Discuss mitigation measures that will be undertaken to protect and enhance the waterways and riparian zone impacted by the project.		Section 9

1.2.2 Scope of Work

An initial desktop review and Preliminary Environmental Assessment (PEA) identifying potential ecological constraints for the proposed pipeline was undertaken in October 2009 (GHD 2009). This document incorporated the draft PEA that was produced in August 2009 by Eco Logical Australia Pty Ltd. This report assessed potential flora and fauna constraints within the pipeline corridor.

This subsequent Ecological Assessment has been prepared as a technical document to support the EA, and addresses the DGRs, which state that the EA must include a 'flora and fauna impact assessment in accordance with the NSW Department of Environment and Climate Change (DECC) *Guidelines for Threatened Species Assessment* (DEC, 2005). This report assesses the ecological impacts of the proposed construction and operation of the water pipeline corridor, with due consideration of

relevant Commonwealth and State legislation (see Section 2), as well as relevant guidelines, including:

- *Guidelines for Threatened Species Assessment* (DEC, 2005), with regard to the nature and content of this report; and
- *DEC Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC 2004). The field surveys completed for this assessment, as described in Section 5, have been designed and implemented to comply with the minimum requirements recommended in these guidelines.

The DEC (2005) guidelines identify important factors and/or heads of consideration that must be considered by proponents and consultants when assessing potential impacts on threatened species, populations, or ecological communities, or their habitats for development applications assessed under Part 3A. The guiding principles outlined in the guidelines and addressed in the current assessment are as follows:

- 'Maintain or improve' biodiversity values (i.e. there is no net impact on threatened species or native vegetation);
- Conserve biological diversity and promote ecologically sustainable development;
- Protect areas of high conservation value (including areas of critical habitat);
- Prevent the extinction of threatened species;
- Protect the long-term viability of local populations of a species, population or ecological community; and
- Protect aspects of the environment that are matters of national environmental significance.

The assessment is based on the entire length of the proposed pipeline assuming an extension of 10 m to the original 20 m corridor of impact ('the survey corridor'). This assessment is designed to provide information and analysis to demonstrate that feasible alternatives have been considered, that the Project has been designed to be consistent with the principles outlined above, and where there are impacts, that adequate mitigation measures and biodiversity offsets are implemented.

1.2.3 Limitations

Flora and fauna surveys undertaken as part of this investigation were not designed to detect all species, either resident or transitory to the survey corridor. Instead they aimed to provide an overall understanding of the ecological values of the survey corridor with particular emphasis on threatened species, ecological communities and their habitats to allow an assessment of the impacts of the Project. Whilst targeted surveys for particular species and fauna groups were undertaken, emphasis was placed on habitat assessment and resource identification to assess the likely occurrence, on site, of threatened species known to occur in the wider locality and region.

Flora and fauna field surveys conducted during one season and/or for a short period would not be expected to detect the total species present or those which may occur within the area surveyed as some species may occur in the locality or region on a seasonal basis, use habitats or areas periodically (as part of a wider home range) or become active at different times of the year. Some plant species are also very cryptic and not easily identified when not in flower. Whilst the field surveys conducted provide an indicative baseline of the species present to increase the number of flora and fauna species detected would require follow-up surveys in other seasons to record a broader range of species. This investigation sampled the different habitat types present within the survey corridor, on three occasions between November 2009 and January 2010, using recognised survey techniques to target fauna groups and threatened species and was timed to coincide with known high activity periods of specific fauna groups (e.g. early morning bird surveys and dusk/nocturnal surveys for nocturnal species).

Factors that limited the scope of field surveys undertaken as part of this investigation included:

- Restricted access to some properties along the pipeline route;
- Restricted timeframe to conduct surveys;
- Seasonal and vagrant species; and
- Unfavourable weather conditions (e.g. high fire danger, windy and wet weather) impeding survey efforts whilst mobilised for field surveys.

For the above reasons, the impact assessment and conclusions of this report rely on information obtained from a variety of sources in addition to the field survey data. Where it is considered that the likelihood of observing a particular threatened species was diminished due to the extent of survey effort or seasonal or climatic factors, then this has been indicated. An assessment of the likelihood of occurrence of threatened species has been provided, on the basis of known distributional ranges, previous records in the locality, and habitat and resource availability in the survey corridor. Impact assessments have been prepared for those threatened species recorded in the survey corridor during the field surveys as well as those species not detected but considered likely to occur or to be impacted by the Project.

Given the level of survey completed and the conservative approach to the assessment undertaken, it is considered that the flora and fauna species of relevance to the survey corridor have been identified and that the ecological value, conservation significance and likely impacts on threatened species and their habitats have been appropriately assessed.

Nevertheless, it is recommended that some further targeted field surveys be undertaken (post approval and pre-construction) to confirm the presence of particular threatened species and resources of relevance in the construction corridor not already surveyed and/or of particular habitat value to ensure appropriate impact mitigation measures and environmental management measures are implemented to minimise the potential for adverse impacts on these species.

A Flora and Fauna Management Plan (FFMP) will be prepared and will detail the requirements for further survey and particular environmental management protocols and measures to be implemented to avoid and/or minimise impacts on threatened species and endangered ecological communities listed under the TSC and EPBC Acts.

1.2.4 Qualifications of Contributors and Licences

The contributors to this ecological assessment, their qualifications and role are documented below.

Field surveys were conducted under Scientific Licence S11428 issued by DECCW and as required under Clause 22 of the *National Parks and Wildlife Regulations 2002* and Section 132C of the *National Parks and Wildlife Act 1974*. Survey procedures used are approved by GHD Animal Care and Ethics Committee accredited by Industry and Investment NSW (Ref No. AW 2006/095).

Table 2 Qualifications and Experience of Contributors

Person	Position	Qualifications	Experience (Yrs)	Role
Jayne Tipping	Principal Ecologist	BSc (Ecology), MEnvLaw	16+	Technical review
Jeremy Pepper	Principal EIA	BSC (Hons) Cert II Bush Regen and Cert III Horticulture	13+	Reporting
Mihkel Proos	Ecologist	BAppSc (Parks rec and Heritage)	5	Field Team Leader and reporting.
Skye Rivett	Ecologist	BSc (Applied SocEcol)	8	Flora and fauna field surveys and reporting
Ben Harrington	Ecologist	BSc MSc Physical Geography	6	Fauna field surveys and technical advice
Anders Bofeldt	Casual Field Ecologist	Cert III Horticulture	10	Flora field surveys
John Davies	Senior Botanist/ Ecologist	BSC (Hons)	25	Flora field surveys
Rowena Hamer	Graduate Ecologist	BSc (Environmental Management)	1	Reporting

2. Planning and Statutory Requirements

2.1 Environmental Planning & Assessment Act 1979

The EP&A Act forms the legal and policy platform for development assessment and approval in NSW and aims to, *inter alia*, 'encourage the proper management, development and conservation of natural and artificial resources'. The Project is class of development to which *State Environmental Planning Policy (Major Development) 2005* applies and as such is to be assessed under the provisions of Part 3A of the EP&A Act, with the Minster for Planning as the Consent Authority for the Project Application.

The DGRs for the EA have been requested and received in accordance with the process under Part 3A. This report addresses the requirements that relate specifically to ecology and biodiversity.

2.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides legal status for biota of conservation significance in NSW. The Act aims to, *inter alia,* 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2;
- The listing of 'Key Threatening Processes' (under Schedule 3);
- The preparation and implementation of Recovery Plans and Threat Abatement Plans; and
- Requirements for the preparation of Species Impact Statements (SISs).

The TSC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the survey corridor and hence could occur subject to the habitats present;
- Targeted field surveys for threatened species listed under the Act;
- Development of suitable impact mitigation and environmental management measures for threatened species, where required; and
- Assessment of potential impacts on threatened species.

2.3 Fisheries Management Act

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations.

The FM Act lists threatened species of freshwater fish, aquatic invertebrate and macroinvertebrate species, endangered populations and aquatic ecological

communities and key threatening processes. Potential impacts on species, populations and communities subject to the FM Act are assessed in Appendix D. Section 5A assessments of significance have been prepared for 'affected aquatic entities'. These assessments have concluded that the Project incorporates measures to avoid or mitigate impacts and is likely to avoid significant impacts on affected aquatic entities.

The Project would involve activities that meet the definition of 'dredging' or 'reclamation' under Clause 198A of the *Fisheries Management Act 1994*. Under Section 201(1) of the FM Act, a person must not carry out dredging or reclamation work except under the authority of a permit issued by the Minister. The Project does not require a permit under Section 201(1) of the FM Act because it is subject to approval under Part 3A of the EP&A Act and Section 75U(1) of the EP&A Act applies.

Under Clause 199 of the FM Act, the Proponent is required to notify the Minister for Fisheries before it carries out or authorises the carrying out of dredging or reclamation work. The notice must be given in writing and the Proponent must consider any matters raised by the Minister within 28 days after the notice is given.

As the Project involves construction of regulators that function as weirs, the Proponent is required to notify the Minister for Fisheries in accordance with Section 218(5) of the FM Act. If the Minister requests, the Proponent must include a suitable fishway or bypass. Consultation has been undertaken with the Fish Passage Task Force (FPTF) which includes a representative from the NSW Department of Industry and Investment – Fisheries regarding the need for structures to provide for fish passage.

2.4 Native Vegetation Act 2003

The NSW Government released the regulations for the *Native Vegetation Act 2003* (NV Act) on 14 November 2005, which came into effect on 1 December 2005. The NV Act regulates the clearing of native vegetation on all land in NSW except for land listed in Schedule 1 of the Act. Excluded land under Schedule 1 of the Act includes National Parks and other conservation areas, State forests and reserves, and urban areas. Specifically, urban areas, which are excluded, include areas zoned residential (but not rural residential), village, township, industrial or business.

According to s.75U(e) of the EP&A Act, an authorisation under Section 12 of the NV Act to clear native vegetation is not required for a project approved under Part 3A. Hence, the NV Act does not apply to the current Project.

2.5 Noxious Weeds Act 1993

Under the *Noxious Weeds Act 1993* (NW Act), Goulburn-Mulwaree Council is responsible for the control of noxious weeds in the LGA. The NW Act provides for the declaration of noxious weeds by the Minister of Agriculture. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land. As such, noxious weeds within the survey corridor have been recorded as part of this assessment.

2.6 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, would have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Environment and Water Resources.

In January 2007 the Commonwealth and NSW governments signed a Bilateral Agreement which accredits the assessment regimes under Part 3A, Part 4 and Part 5 of the EP&A Act for assessment purposes under the EPBC Act. The Bilateral Agreement applies only to proposals that the Commonwealth Environment Minister has determined are controlled actions under the EPBC Act, with the exception of nuclear actions.

The EPBC Act identifies matters of national environmental significance as:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The Administrative Guidelines for the EPBC Act (DEH 2006) set out criteria intended to assist in determining whether an action is controlled and hence requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a 'significant impact' on a matter of national environmental significance (NES). Would the Proponent deem the Project likely to have a significant impact on a matter of NES, a referral to the Commonwealth Minister for the Environment would be undertaken to obtain a determination as to whether the Project is a 'controlled action' requiring Commonwealth approval.

The EPBC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species or ecological communities that have been previously recorded within the locality of the survey corridor and hence could occur, subject to the habitats present;
- Targeted field surveys for threatened species listed under the Act;
- Development of suitable impact mitigation and environmental management measures for threatened species, where required; and
- Assessment of potential impacts on threatened species.

3. Project Description

3.1 Overview

3.1.1 The Project

The Project is to construct and operate the water supply scheme that would transfer water from the Wingecarribee reservoir to the Goulburn WTP. The scheme comprises approximately 83 km of DN 300 mm to DN 375 mm diameter pipeline, a pump station at the Wingecarribee Reservoir, power and controls, a balance tank, and a telemetry system.

If approved it is proposed to have the transfer scheme operational by June 2011. The Project's timeframe is set by the conditions governing the provision of government funding under the Australian Government Water Smart Australia Program.

Key construction activities include:

- Trench excavations and placement of the pipeline;
- Constructing railway, road and river crossings;
- Constructing a pump station and controls at the Wingecarribee Reservoir site; and
- Constructing a balance tank at an appropriate location along the pipeline (subject to design requirement).

Key operational activities would include:

- Regular maintenance of the pumping station;
- Regular maintenance of the air valves and scour valves; and
- Less frequent maintenance of the pipeline (e.g. pigging to remove blockages, or repairing bursts as required).

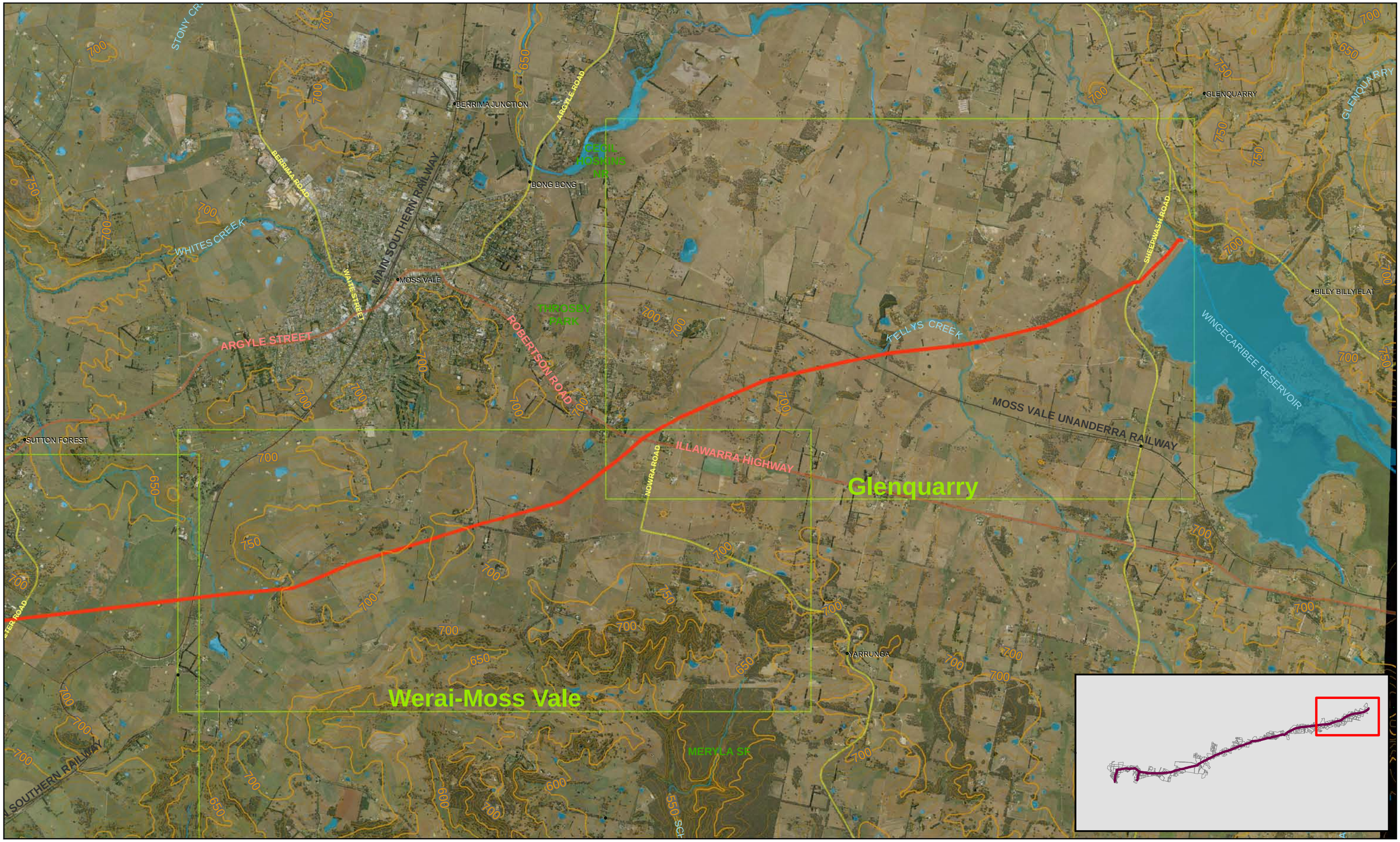
3.2 Pipeline

3.2.1 Pipeline route

The proposed pipeline route was determined based on a number of physical factors such as topography, landscape, land use and environmental considerations. The majority of the proposed pipeline route is located adjacent to existing subsurface infrastructure easements (gas, electricity and optical fibre).

There are two water transfer schemes under consideration; raw and treated water options. Each proposed scheme has a different pipeline route at the Goulburn end of the pipeline. However the majority of the pipeline route is common to both schemes.

The proposed pipeline route is shown in Figure 1.



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area
- 50m Contour (Labelled)
- Potential Offset Sites
- 10m Contour
- Potential Offset Sites

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Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	14 JAN 2010

Locality Map
Sector: Werai - Glenquarry

Figure 1(a)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood

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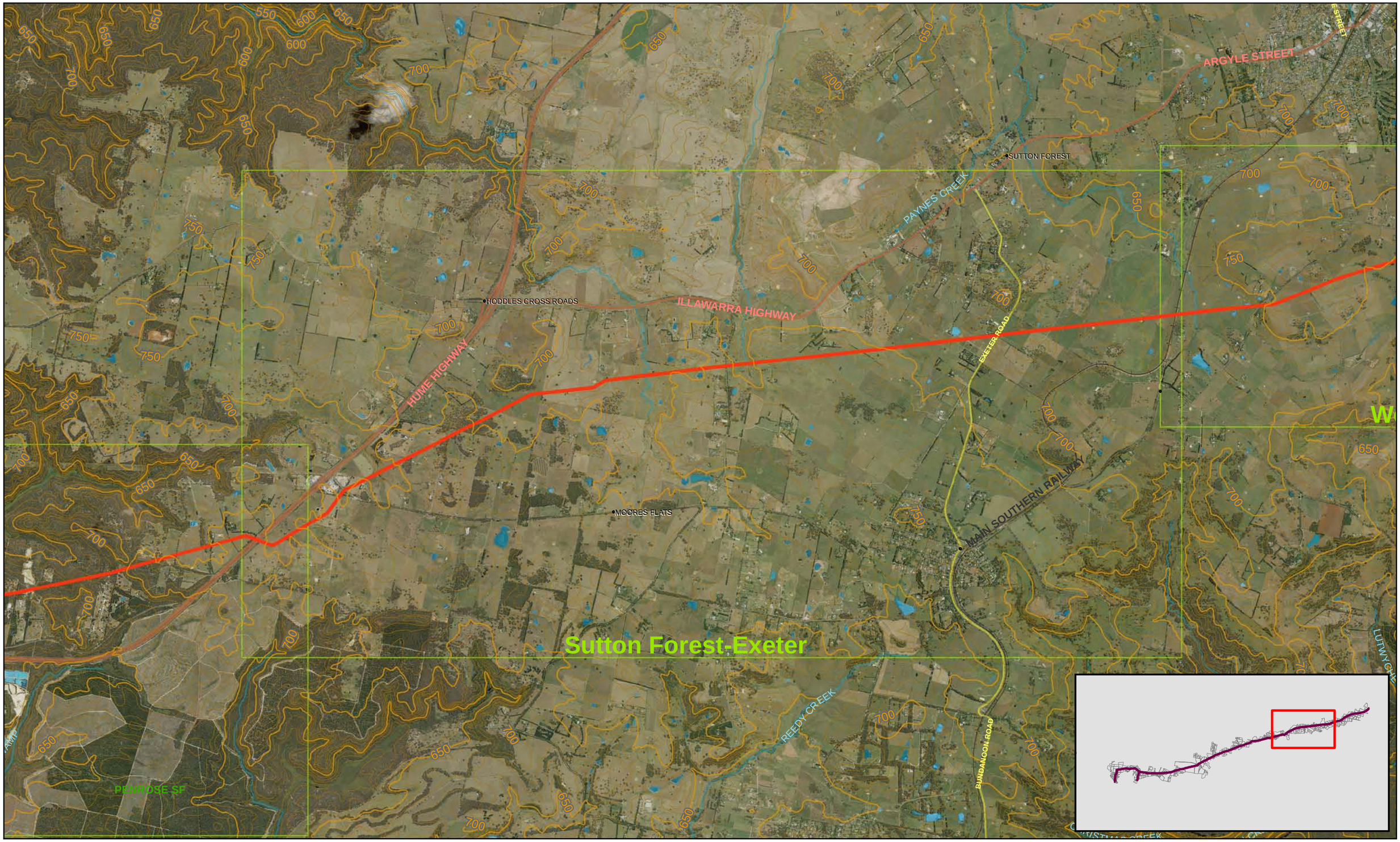

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0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
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Legend

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- Potential Offset Sites

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Locality Map
Sector: Sutton Forest-Exeter

Figure 1(b)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood

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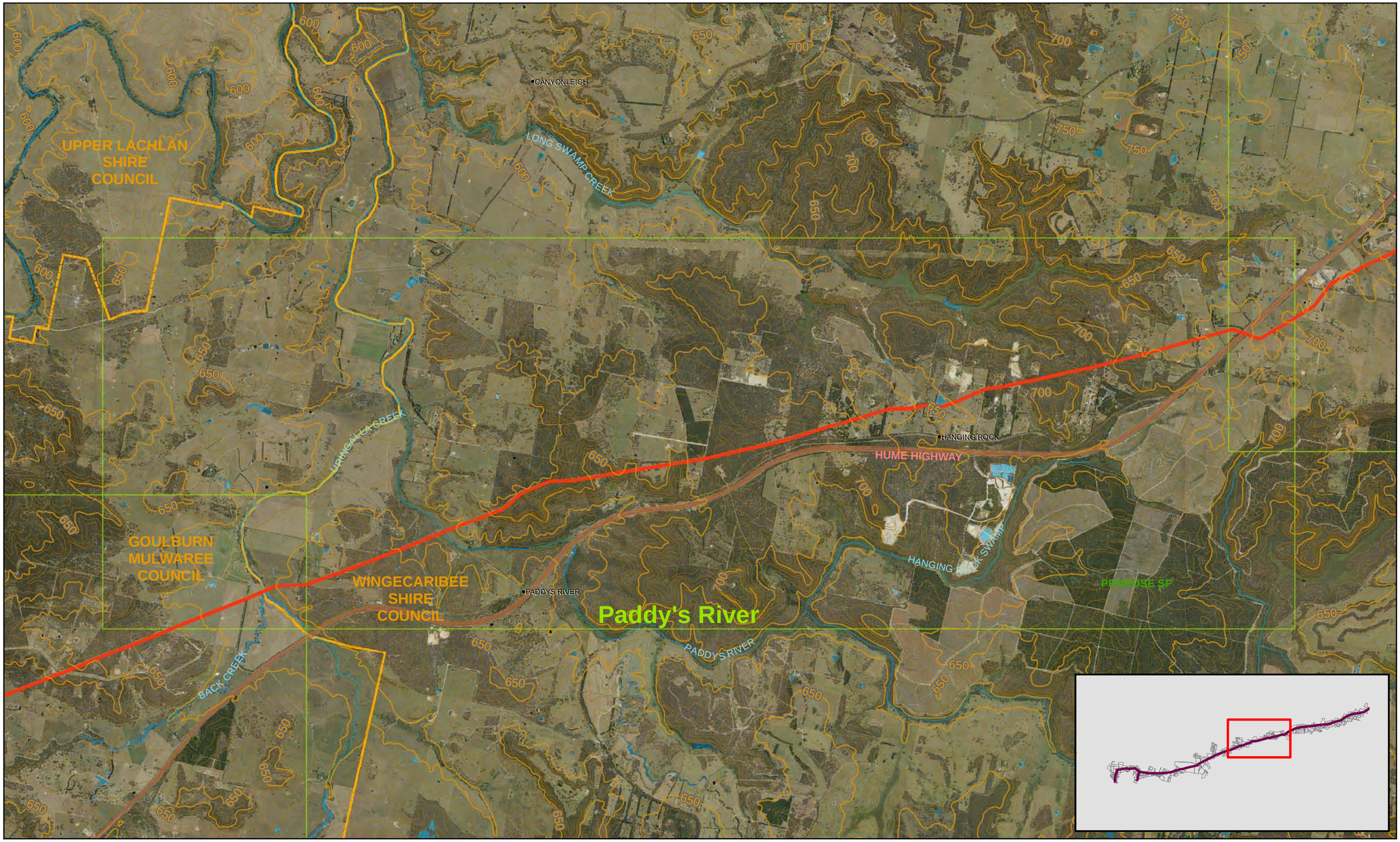

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area
- 50m Contour (Labelled)
- Potential Offset Sites
- 10m Contour
- Potential Offset Sites

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Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	14 JAN 2010

Locality Map
Sector: Paddys River

Figure 1(c)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood

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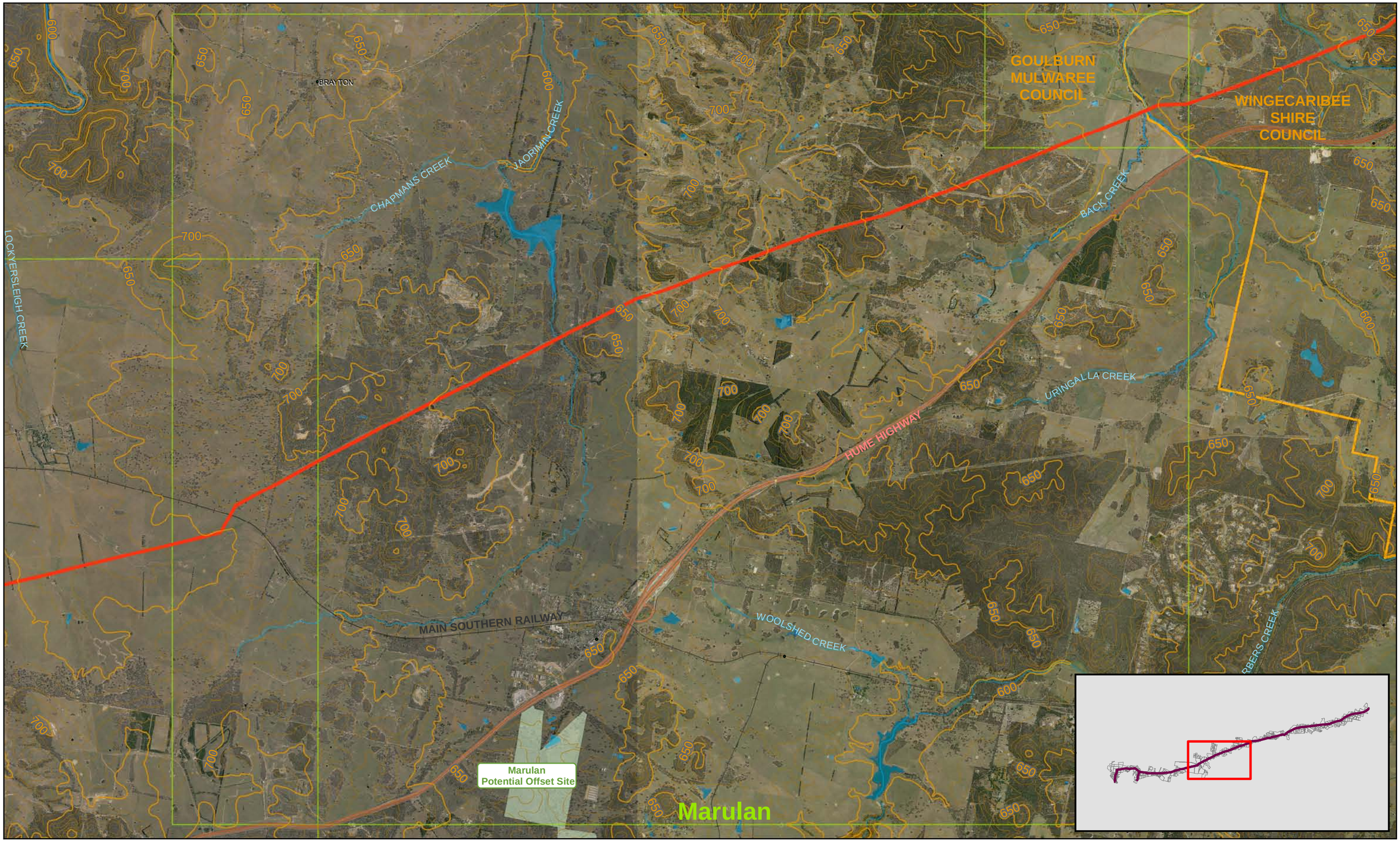

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N

Legend

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Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	14 JAN 2010

Locality Map
Sector: Marulan

Figure 1(d)

G:\23\13312\GIS\ArcView\Wkspace\EAFigures\Ecology\23_13312_Location.mxd

Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Proposed Pipeline Alignment
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  - (Treated Water)
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- Railway
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- Rivers, Creeks
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- 10m Contour
- Potential Offset Sites

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Job Number	23-13312-15
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Locality Map
Sector: Towrang

Figure 1(e)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood

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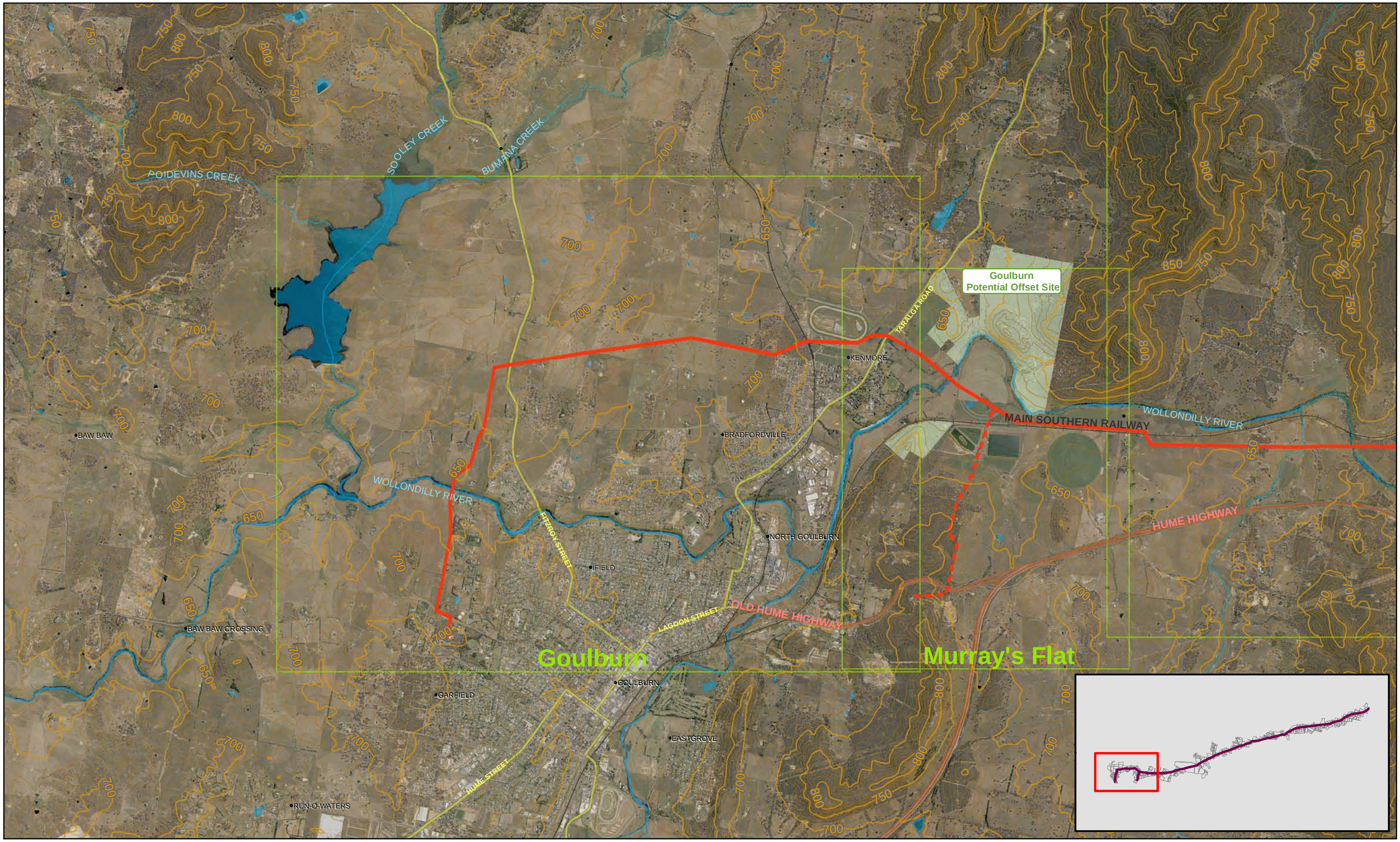

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

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Highlands Source Project

Job Number	23-13312-15
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Locality Map
Sector: Goulburn-Murrays Flat

Figure 1(f)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood

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3.3 Pipeline Construction

Pipeline Site Compounds and Stockpile Areas

Site compounds, storage, stockpile and lay down areas would be required at various locations along the pipeline. The proposed locations of the facilities have generally been selected to occupy existing cleared areas or areas that would be cleared for the excavation of the pipeline trench.

Construction Corridor

Preparation of the construction easement would include clearing of trees and vegetation where present and removal of topsoil and other obstacles such as rocks with a bull dozer. The proposed construction easement width would provide sufficient space to construct the trench while providing enough space for excavated material to be placed beside the trench, a trench safety area, pipes to be strung out beside the trench prior to installation and the movement of vehicles such as trucks, cranes and excavators beside the trench.

In cleared or degraded areas (such as existing paddocks) the construction corridor would be up to 20m wide. In areas where native vegetation occurs within the pipeline easement, the cleared construction corridor would be narrowed to 6m.

Following construction, an easement of approximately 10 m in width would be maintained as a cleared landscape to allow access for ongoing maintenance activities.

Crossings

The pipeline would cross major roads (*e.g.* the Hume and Illawarra Highways), local roads, railways (including the Moss Vale Unanderra Railway) various water bodies (including the Wollondilly River) and a number of services. All crossings would be constructed in accordance with appropriate agency (Road and Traffic Authority (RTA), Australian Rail Track Corporation (ARTC) or NSW Office of Water (NOW)) requirements. Waterway crossings are discussed in detail in Section 8.2.7.

3.4 Operation of the Project

3.4.1 Maintenance Activities

During the operation phase of the Project, GMC staff will periodically traverse the route to undertake routine maintenance and ensure the pipeline is functioning adequately. The maintenance crews will remain in the cleared pipeline easement at all times and cause minimal disturbance to the natural environment.

Key operational activities would include:

- Regular maintenance of the pumping station;
- Regular visual inspection of the air valves and scour valves; and
- Less frequent maintenance of the pipeline, including scouring the pipeline to remove sludge building up. If raw water is selected to be transferred to Goulburn,

then it is likely that the water would need to be pumped from the pipe, removed by tanker and handled or discarded in an appropriate manner. If treated water is selected to be transferred, then water may be discharged to an adjacent waterway, farm dam, or pumped and removed by tanker.

3.4.2 Scour Water Management

Scouring of sections of the pipeline are routine maintenance operations that would occur approximately once or twice a year to 'exercise' the valves. On most potable and raw water pipelines, the water is released directly to the environment following sample testing. In the event that the water quality is unsuitable for release then tankering will need to be arranged. The volumes released can be quite small for each valve exercise and are manageable with tankering to a nearby farm dam where it can be treated depending on the specific water quality issue.

3.5 Rehabilitation

The rehabilitation principles would guide the preparation of land access agreements and property plans developed for the construction of the pipeline and the maintenance of the easement. All disturbed ground would be rehabilitated in general accordance with the following principals:

- Rehabilitation objectives would be agreed with the landholder prior to construction. The agreed rehabilitation objectives would likely be included in the statutory agreements negotiated with the landholder to access and construct the pipeline;
- The basis of the rehabilitation objectives would be to establish stabilised ground of a nature similar to the pre-construction condition, over approximately 70% of the disturbed area;
- Rehabilitation of the disturbed areas would be undertaken progressively, immediately after a section of pipeline trench has been backfilled or a crossing has been constructed;
- Erosion and sediment controls would remain in place until the rehabilitation objectives are achieved. GMC would remove all controls once the rehabilitation objectives are achieved; and
- Rehabilitated areas would be periodically inspected, reinstated (if required) and maintained by GMC on an on-going basis until the rehabilitation objectives are achieved.

4. Site and Survey Corridor Description

4.1 Investigation Area

The Project comprises approximately 83 km of trunk water main and ancillary infrastructure, extending from Wingecarribee Reservoir within the Wingecarribee Local Government Area (LGA), to the Goulburn Water Treatment Plant within the Goulburn Mulwaree LGA.

The Wingecarribee LGA is located in the Southern Highlands and centred approximately 150 km south of Sydney. The majority of the LGA is elevated > 640 m (above sea level). The Goulburn Mulwaree LGA is situated to the south west of the Wingecarribee LGA. The pipeline corridor follows an upward sloping gradient to Goulburn, *ca.* 702 m (above sea level).

The preferred pipeline route corridor would be located mostly adjacent to existing infrastructure easements that have previously been cleared and either remain cleared or have regenerating vegetation present. From Wingecarribee Reservoir, the pipeline route corridor largely runs adjacent to existing power line easements until it crosses the Hume Highway. After crossing the Hume Highway, the pipeline route would be located adjacent to and outside of an existing gas pipeline easement (the Moomba to Sydney Gas Pipeline), which it follows almost the entire way to Goulburn. The investigation area will be limited to a corridor approximately 100 m wide (local width may vary depending on local design constraints).

The investigation area was divided into six sections for the purposes of describing the flora and fauna of the investigation area and the potential impacts of the Project. These are:

1. Goulburn-Murray's Flat;
2. Towrang;
3. Marulan;
4. Paddy's River;
5. Sutton Forest-Exeter;
6. Werai-Moss Vale-Glenquarry.

The locality, survey effort, vegetation communities, fauna habitats and threatened species have been mapped and described according to these sectors.

4.2 Bioregion

The proposed pipeline route corridor would fall within the Sydney Basin and South Eastern Highlands bioregions, running through the Moss Vale (SB11), Burragorang (SB9) and Bungonia (SEH7) Biographical Subregions (DECCW 2008). The broad characteristics of these subregions are summarised in Table 3.

Table 3 Characteristics of relevant Biogeographical Subregions

Subregion	Geology	Characteristic landforms	Typical soils	Vegetation
Moss Vale (SB11)	Triassic Wianamatta Group shales, Tertiary basalts and trachyte intrusions, large Quaternary peat swamp.	Shale and basalt plateau with rolling hills and shallow valleys. Very large peat swamp at Wingecarribee.	Structured red and red-brown clay loams and loams, and loamy alluvium with high fertility. Areas of sandstone at the margins thin, waterlogged sandy soils. Organic peat in swamps. Stony slope debris on larger intrusions.	Tall forest of narrow-leaved peppermint, Sydney peppermint, monkey gum, black ash, messmate, coastal white box, and brown barrel on shale and basalts. Extensive sedgelands and hanging swamps on sandstone. Wingecarribee raised sphagnum bog. Sydney peppermint, narrow-leaved peppermint, and gully ash on trachyte domes.
Burragorang (SB9)	Permian and Triassic sandstones and shales on the western edge of the Basin. Limited basalt caps.	Rolling hills on a sandstone plateau with deep gorges and sandstone cliffs in Burragorang valley.	Rocky outcrops, texture contrast soils and uniform sands on sandstone. Bouldery debris with sandy clay matrix below cliffs. Rich loams in alluvium.	Heath, shrubland and woodland with black ash, hard-leaved scribbly gum, Sydney peppermint and red bloodwood on sandstone similar to other parts of the Basin. Deane's gum, turpentine, blue-leaved stringybark immediately below escarpment passing to grey gum, narrow-leaved ironbark and thin-leaved stringybark on bouldery slopes. River oak along main streams below the plateaus.
Bungonia (SEH7)	Primarily fine-grained Palaeozoic sedimentary and meta-sedimentary rocks, with minor areas of acid volcanics and limestone. Areas of Tertiary river terrestrial sediments and low sandsheets in the south with very limited basalt.	Distinct plateau with very steep, deep margins on the Great Escarpment dropping into the Shoalhaven River. Strong linear ridges on resistant sandstones and volcanics, wide valleys with some cold air drainage and inverted tree lines.	Mostly yellow texture contrast soils some with harsh clay subsoils. Shallow structured organic loams on limestone and basalt, deep siliceous sands and clayey sands on Tertiary sediments.	Mottled gum, broad-leaved peppermint, white gum, red stringybark and black ash forests and woodlands. Snow gum with and snow grass in cold pockets. Black she-oak common as understorey and in regeneration areas. Limited distribution of argyle apple.

Source: (DECC 2008)

4.3 Geology, Soils and Topography

The pipeline area is underlain by rocks of a Palaeozoic age and an overlying sequence of sediments and volcanics forming the Cookbundoon Syncline. The region is covered by landscapes such as tablelands and associated grassy woodlands, alluvial flats, dissected plateaus, escarpment country and porphyrys. The natural ecosystems within the region have been extensively modified since European settlement and the extent of the component vegetation communities within the proposed development area has been dramatically reduced.

Based on Soil Landscape publications for the Hawkesbury-Nepean Catchment, 34 soil landscapes can be identified along the pipeline route. These may be grouped broadly into erosional, alluvial, transferral, colluvial and residual soil landscapes.

The pipeline follows an upward sloping gradient from an altitude of approximately 675 metres at Moss Vale to 702 metres above sea level at Goulburn. The proposed pipeline route would traverse a series of hill slopes, flood plains, river valleys and low hills and cross creeks, rivers and other infrastructure.

For further details refer to the EA.

4.4 Climate

The pipeline runs through the Sydney Basin and South Eastern Highlands bioregions, which have temperate climates with warm summers and no dry season. The nearest Australian Bureau of Meteorology (BOM) open meteorological stations are located at Goulburn (Goulburn TAFE) and Moss Vale (Hoskins St.), at opposite ends of the proposed pipeline. Temperatures are similar at both stations. At Goulburn the mean daily maximum temperature is 27.7 degrees Celsius in January and 11.4 in July; mean daily minimum temperature is 13.5 degrees Celsius in January and 1.5 in July. At Moss Vale the mean daily maximum temperature is 25.8 degrees Celsius in January and 11.8 in July; mean daily minimum temperature is 12.4 degrees Celsius in January and 1.3 in July.

Mean annual rainfall drops from 965.3 to 635.7mm between Moss Vale and Goulburn, with rainfall distributed evenly over the year in both areas. Annual rainfall within the Goulburn Mulwaree LGA is variable with the wettest year on record being 1949 (1183 mm) and the driest year being 1896 (346 mm). Long periods of drought have been historically experienced, most recently with Goulburn facing severe drought from 2002 to 2007.

4.5 Catchment

The pipeline corridor runs north of, and roughly parallel to, the catchment boundary separating the Hawkesbury Nepean catchment from the Southern Rivers catchment, placing it entirely within the Sydney Catchment Authority's drinking water catchments that drain into Warragamba Dam.

The site falls within the area managed by the Hawkesbury Nepean Catchment Management Authority (CMA). The area through which the proposed pipeline would traverse generally drains north, with the eastern section of the pipeline route draining naturally into the Wingecarribee River, and the western section of the pipeline route draining into the Wollondilly River. These two rivers have their confluence within the Wollondilly Nature Reserve. The Pipeline route will bisect approximately 19 major waterways, including the Wollondilly and Paddys Rivers and a number of creeks.

4.6 Landuse

Overall, the proposed alignment travels through agricultural land which is generally used for grazing, with some other agricultural uses scattered along the alignment. The proposed pipeline would travel through much of this agricultural land via or adjacent to existing infrastructure easements which travel through the area. These easements are currently either used for gas pipelines or overhead electricity lines.

Refer to the EA document for details on land use.

5. Methodology

5.1 Literature Review and Assessment

A desktop literature review was undertaken to identify the representative spectrum of flora and fauna, threatened species, populations and ecological communities listed under the NSW TSC Act and the Commonwealth EPBC Act that could be expected to occur within the survey corridor, based on previous records, known distributional ranges and habitats present. The following databases and documents were reviewed prior to conducting the field investigations:

- NSW NPWS Wildlife Atlas database (November 2009, 10 km radius search for TSC Act listed flora and fauna, centred on the survey corridor. The NSW Bungonia, Burragorang, Monaro and Moss Vale CMA sub-regions were searched for Endangered Ecological Communities);
- EPBC online Protected Matters Database (November 2008, 10 km radius);
- NSW Fisheries Management Act 1994 online database;
- GHD (2009). *Preliminary Environmental Assessment for the Highlands Source Project*; and
- EcoLogical Australia (2009) *Wingecarribee to Goulburn Pipeline- Preliminary Environmental Assessment*.

Various flora and fauna assessments undertaken for development proposals in the general vicinity of the pipeline alignment were also reviewed for records of threatened species and endangered ecological communities (see Section 10 - Reference list).

5.2 Field Surveys

5.2.1 Overview

Field surveys were undertaken at selected locations along the length of the survey corridor over three discrete periods:

- 16 to 20 November 2009 (Survey 1);
- 7 to 11 December 2009 (Survey 2); and
- 11-15 January 2010 (Survey 3).

A summary of the survey effort applied to the study area over the course of the three survey periods is presented in Table 4. Survey locations are shown on Figure 2. Survey methodology and effort is described in the following sections.

Table 4 Summary of Survey Effort

Task	Technique	Person Hours / Number
FLORA		
Flora Inventory	Quadrats	61 Quadrats
Targeted Searches for Threatened Flora	Random Meander	All areas accessed containing suitable habitat for targeted species within proposed construction footprint and adjacent areas of vegetation
FAUNA		
Bird Survey	Diurnal Bird Counts	30 minutes x 26 sites
Reptiles and Amphibians	Active Searches	4 sites for total of 3 hours
Bats	Anabat	15 nights (approximately 150 hours)
Forest Owls and threatened arboreal fauna	Call Play Back	7 locations.
Arboreal and other nocturnal fauna	Spotlighting	13 locations, covering approximately 6 km. Time expended 13 hours
Nocturnal mammals	Camera Traps	4 camera locations

The locations of survey sites and the staging of surveys within the survey periods were determined to a large extent by constraints to property access. Survey 1 in November 2009 focussed on ground-truthing existing vegetation mapping and habitat assessment in representative habitats along the proposed alignment where access to land was granted. Some targeted surveys for fauna groups were also undertaken, including for birds and microbats. During Survey 1, 'priority survey areas', including terrestrial and aquatic habitats that warranted targeted surveys based on the quality and quantity of vegetation communities and fauna habitats present, were identified. Targeted impact assessments were undertaken at these priority survey areas for threatened flora, fauna and endangered ecological communities during December and January 2009 (Surveys 2 and 3, respectively).

Despite access constraints, the majority of the pipeline alignment was inspected during the survey periods. Sections of the alignment where access was not granted were inspected as far as possible from adjoining properties or roads and assessed using aerial photograph interpretation and extrapolation of information gathered on adjoining sites. Given this approach, and the targeted surveys undertaken within all habitat types and identified survey priority areas, it is considered that a representative and appropriate level of survey of the pipeline has been undertaken.

5.2.2 Weather

Weather during the November surveys comprised predominately warm, dry weather (BOM, 2009) with small amounts of rain toward the Moss Vale end of the pipeline. The November surveys were undertaken in very high temperatures, with intermittent storms and wet weather throughout the week. During the January surveys temperatures were hot with scattered showers throughout the week. Table 5 and Table 6 summarise the daily temperature ranges, rainfall and wind speed during each of the survey periods (BOM 2010).

Table 5 Rain, Wind Speed and Temperature Data for Mossvale during Survey Period

Date	Temp (Celsius)_		Rain mm	Wind speed km/h
	Min	max		
Nov-07	14.2	32.4	0	61
Nov-08	13.2	-	0	-
Nov-09	-	-	-	-
Nov-10	-	27.7	-	63
Nov-11	11	22.7	3.2	69
Average/ Total	**12.8**	**27.6**	**3.2**	**38.6**
Nov-11	15.6	27	0	44
Nov-12	18	36.1	0	43
Nov-13	16.7	25.6	0	57
Nov-14	13.3	17	22	31
Nov-15	13.8	22.3	0.6	30
Average/ Total	**15.48**	**25.6**	**22.6**	**41**
Nov-16	14.2	34.1	0.2	56
Nov-17	11.9	20.7	0.4	43
Nov-18	11.9	26.7	0.4	43
Nov-19	13	36.7	0	46
Nov-20	16.2	37.9	0	61
Average/ Total	**13.44**	**31.22**	**1**	**49.8**

- Data not available on Bureau of Meteorology website.

Table 6 Rain, Wind speed and Temperature Data for Goulburn during Survey Period

Date	Temp (Celsius)		Rain mm	Wind speed km/h
	Min	max		
Nov-16	15.3	34.2	0	70
Nov-17	12.9	24.7	0	39
Nov-18	12.7	30.8	0	39
Nov-19	8.7	38.3	0	52
Nov-20	13.5	39.9	0	81
Average/ Total	**12.62**	**33.58**	**0**	**56.2**
Dec-07	8.5	31.1	0	63
Dec-08	14.8	34.7	0	70
Dec-09	11.7	25.8	3.6	43
Dec-10	9.1	29.7	0	74
Dec-11	10	22.1	0.2	65
Average/ Total	**10.82**	**28.68**	**3.8**	**63**
Jan-11	16.3	36.2	0	54
Jan-12	15.6	37.7	0	56
Jan-13	15.9	31.9	0	46
Jan-14	12.7	20.6	1.4	33
Jan-15	13.7	24.3	0	39
Average/Total	**14.84**	**30.14**	**1.4**	**45.6**

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Metres

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Legend

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- Local Government Area

Survey Type

- Anabat
- Bird Survey
- Call Playback
- Camera
- Herpetological Search
- Nocturnal Survey
- Spotlighting
- Survey Quadrat

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Ecology Survey Locations
Sector: Werai - Glenquarry

Figure 2(a)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly

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Ecology Survey Locations
Sector: Sutton Forest-Exeter

Figure 2(b)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly

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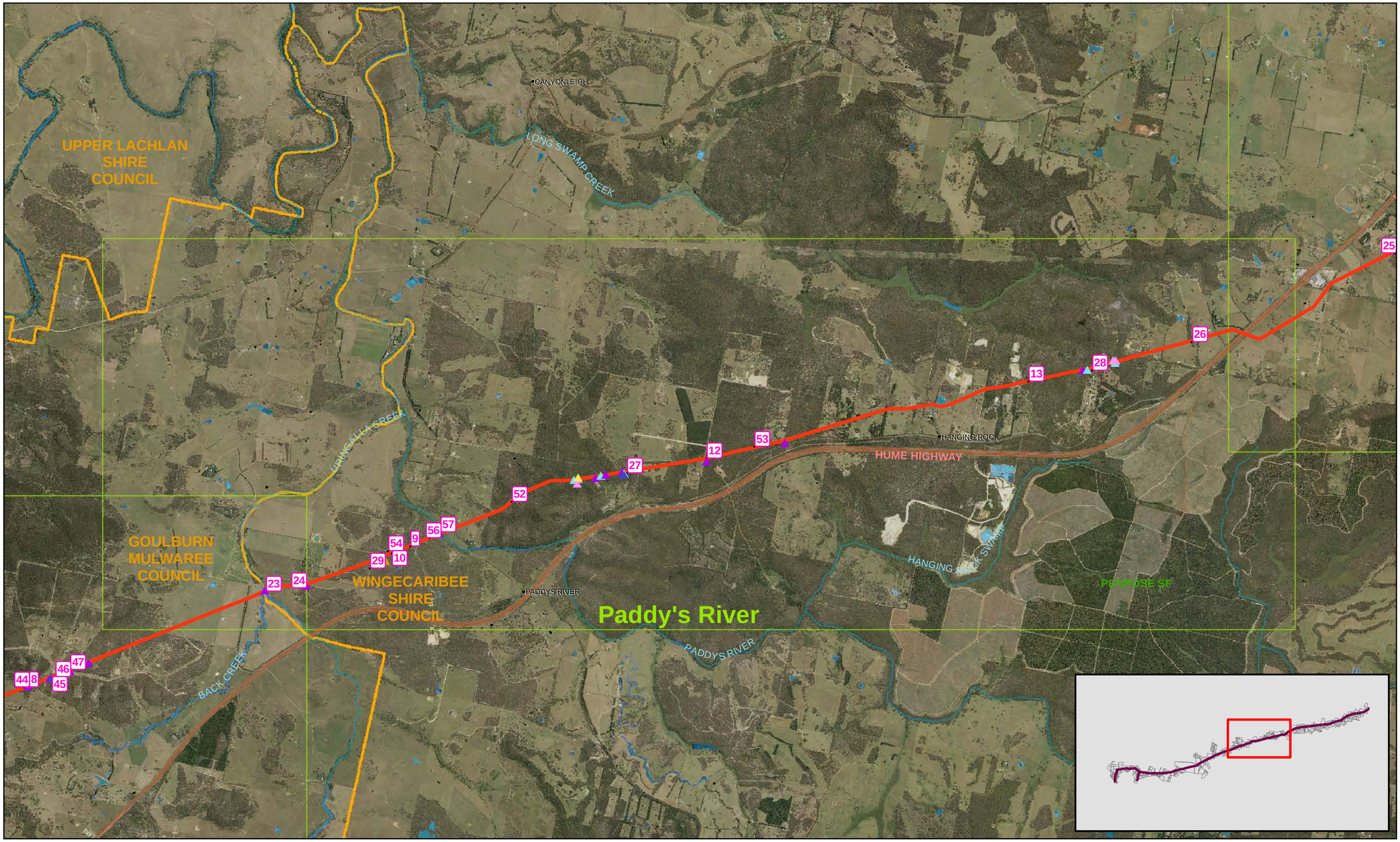

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Ecology Survey Locations
Sector: Paddys River

Figure 2(c)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly

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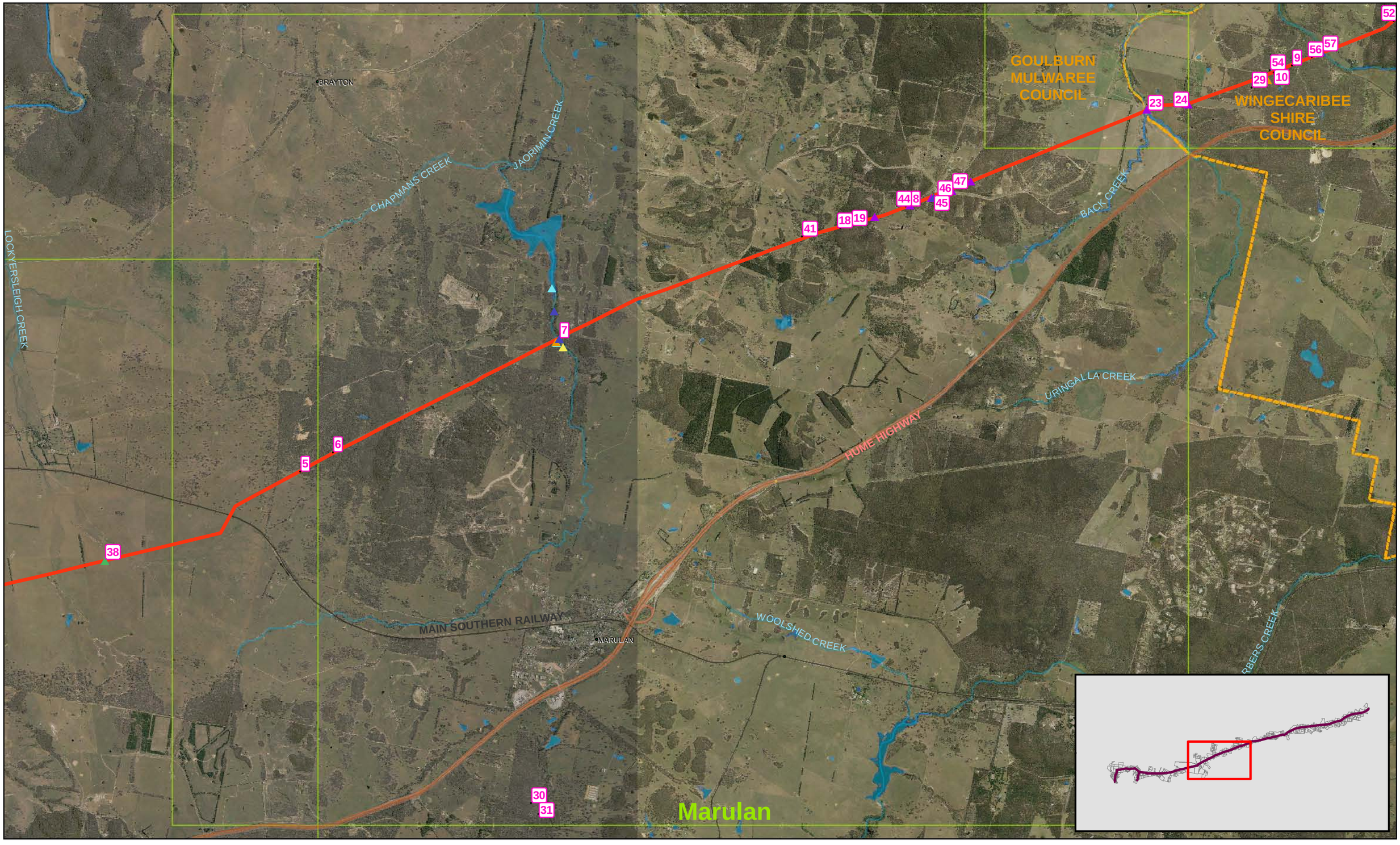

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0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Proposed Pipeline Alignment (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Survey Type

- Anabat
- Bird Survey
- Call Playback
- Camera
- Herpetological Search
- Nocturnal Survey
- Spotlighting
- 8 Survey Quadrat

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Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	05 FEB 2010

Ecology Survey Locations
Sector: Marulan

Figure 2(d)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly

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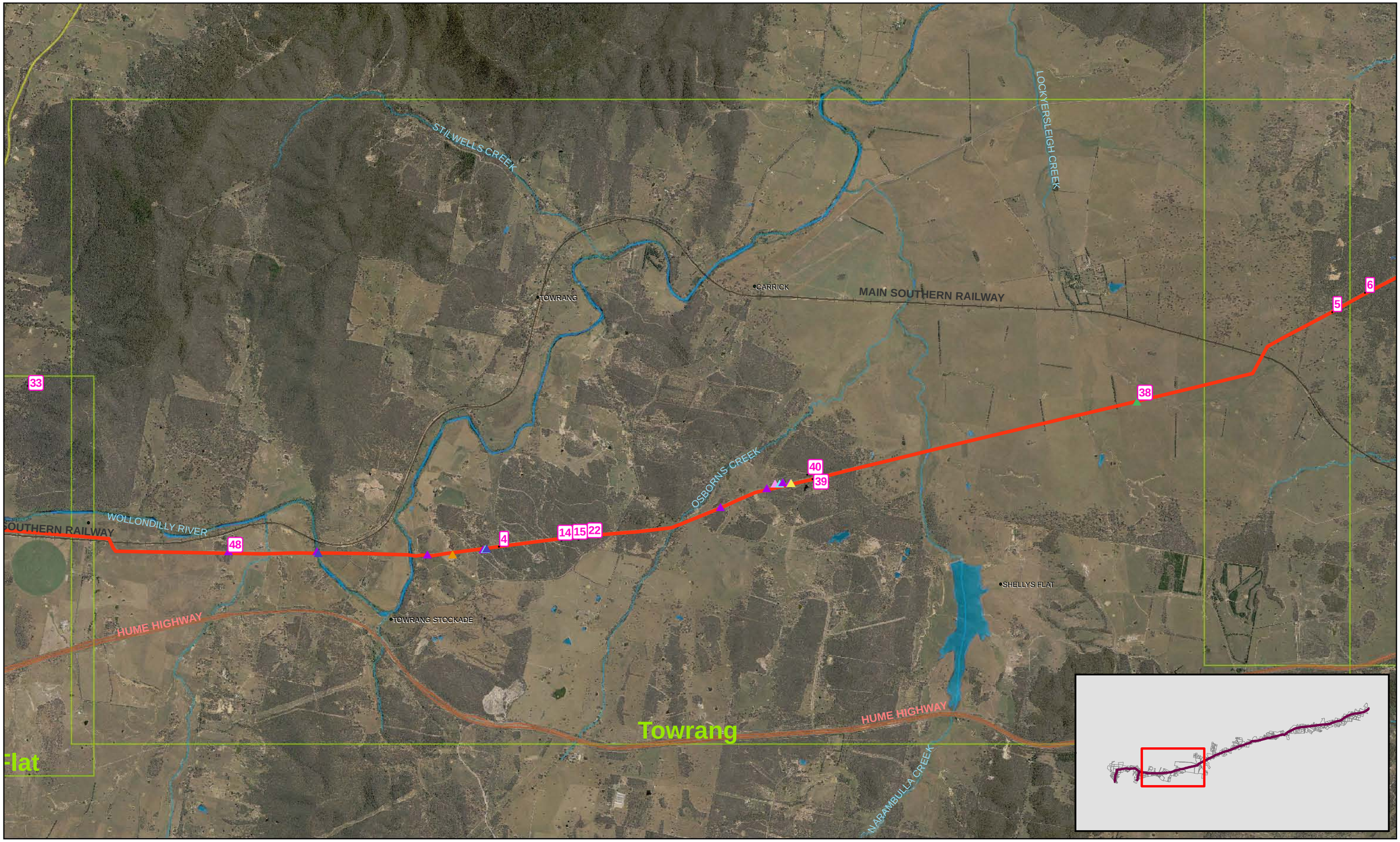

1:45,000 (at A3)

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Survey Type

- Anabat
- Bird Survey
- Call Playback
- Camera
- Herpetological Search
- Nocturnal Survey
- Spotlighting
- Survey Quadrat

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Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	05 FEB 2010

Ecology Survey Locations
Sector: Towrang

Figure 2(e)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly

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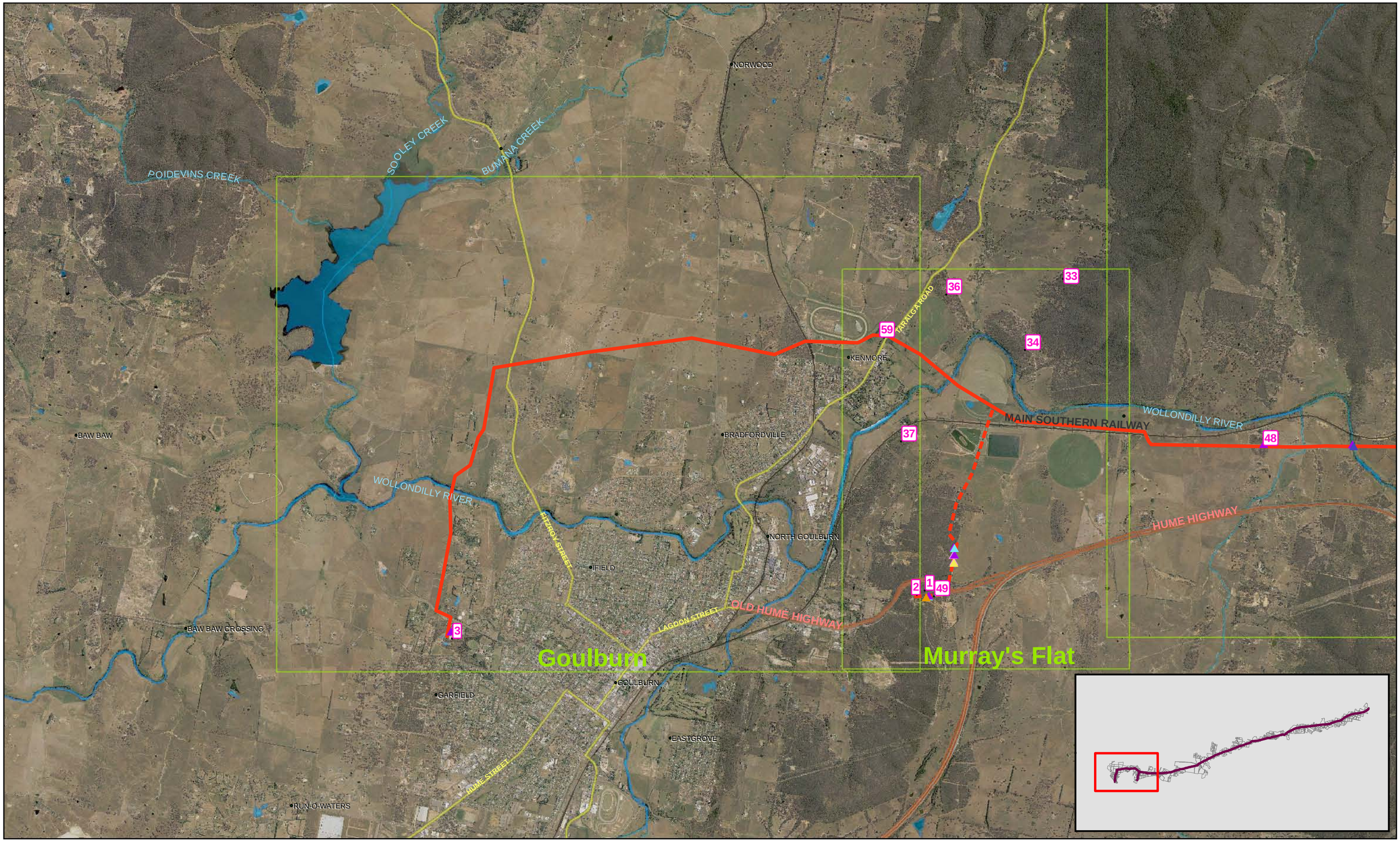

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Legend

- Proposed Pipeline Alignment
  - (Raw Water)
  - (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

Survey Type

- Anabat
- Bird Survey
- Call Playback
- Camera
- Herpetological Search
- Nocturnal Survey
- Spotlighting
- Survey Quadrat

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Goulburn Mulwaree Council

Goulburn Mulwaree Council
Highlands Source Project

Job Number	23-13312-15
Revision	0
Date	05 FEB 2010

Ecology Survey Locations
Sector: Goulburn-Murrays Flat

Figure 2(f)

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Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly

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