Department of Planning and Infrastructure

Broader Western Sydney Employment Area

Utilities Servicing Strategy

October 2013

Executive summary

A high level servicing strategy for the Broader Western Sydney Employment Area (BWSEA) has been developed for each of the following utilities:

- Electrical;
- Telecommunications; and
- Gas

Electrical

Significant new electrical infrastructure will be required to cater for the electrical demands associated with the development of the BWSEA. There are a number of options available to service the BWSEA and the key infrastructure requirements associated with the available servicing strategies are:

- Provision of new Transgrid transmission substations;
- Provision of new Endeavour Energy transmission substations;
- Provision of new Endeavour Energy zone substations; and
- Distribution voltage and low voltage reticulation infrastructure.

Land will need to be dedicated for the substations and easements provided for transmission lines.

Telecommunications

New telecommunications infrastructure will be required to service the BWSEA consisting of the following:

- Provision of new telephone exchanges;
- Provision of high speed data services via the National Broadband Network (NBN). Cable containment infrastructure would be provided by developers and cabling and associated infrastructure by the NBN; and
- Augmentation of existing wireless base stations and provision of new base stations.

Land will need to be dedicated for telephone exchanges and wireless base stations.

Gas

Gas can be provided to the BWSEA via an extension of the existing secondary gas main network that is located on the fringes of the BWSEA. The extension of the secondary gas main network would occur in conjunction with the development of the BWSEA with mains located in new road verges.

It is noted that gas services are not considered a primary energy source and will generally only be provided where financially viable, that is, where a customer base is guaranteed. The provision of gas services by Jemena will depend on the type of development occurring within the BWSEA.

This report is subject to, and must be read in conjunction with, the limitations set out in section 8 and the assumptions and qualifications contained throughout the Report.

Table of contents

1. Introduction 1
   - 1.1 Background 1
   - 1.2 Purpose of this Report 1
   - 1.3 Report Structure 1
   - 1.4 Stakeholder Input 1
   - 1.5 Scope of Work and Report Limitations 1
2. Demand Analysis 4
3. Electrical 4
   - 3.1 Existing Infrastructure 4
   - 3.2 Electrical Servicing Strategy 7
   - 3.3 Electrical Infrastructure Staging 9
   - 3.4 Renewable Energy Opportunities 12
4. Telecommunications 14
   - 4.1 Existing Infrastructure 14
   - 4.2 Telecommunications Servicing Strategy 17
   - 4.3 Telecommunications Infrastructure Staging 17
5. Gas 19
   - 5.1 Existing Infrastructure 19
   - 5.2 Gas Servicing Strategy 22
6. Infrastructure Staging 24
7. Preliminary Environmental Assessment 25
8. Summary of Findings 27
9. Disclaimer 28

Table index

Table 1 2026 Indicative Infrastructure Requirements 24

Table 2 2036 (and beyond) Indicative Infrastructure Requirements 25

Figure index

Figure 1 BWSEA Locality and Extents 3

Figure 2 Existing Trunk Electrical Infrastructure 6

Figure 3 Electrical Servicing Strategy Option 1 10

Figure 4 Electrical Servicing Strategy Option 2 11

Figure 5 Existing Telecommunications Infrastructure 16
Figure 6 Telecommunications Servicing Strategy 18
Figure 7 Existing Gas Infrastructure 21
Figure 8 Gas Servicing Strategy 23

Appendices

Appendix A – Demand Analysis Basis
Appendix B – Environmental Constraints Maps

1. Introduction

1.1 Background

The Department of Planning and Infrastructure (DP&I) are preparing a Structure Plan for an area of land in Sydney known as the Broader Western Sydney Employment Area (BWSEA). The location of the BWSEA, its extents and defined precincts are shown on Figure 1.

GHD have been engaged by the DP&I to prepare a utilities servicing strategy for the BWSEA that will inform the Structure Plan.

1.2 Purpose of this Report

This report summarises the proposed servicing strategy for the BWSEA with regards to the following utilities:

- electrical;
- telecommunications; and
- gas.

1.3 Report Structure

The report is divided into three sections for each utility as follows:

- Section 3: Electrical;
- Section 4: Telecommunications; and
- Section 5: Gas.

1.4 Stakeholder Input

Consultation with the following organisations was conducted while developing the servicing strategy:

- Endeavour Energy;
- Telstra;
- National Broadband Network; and
- Jemena.

Consultation was in the form of written correspondence, meetings and telephone conversations. Preliminary demand assessments were undertaken to inform consultation with the relevant authorities where deemed necessary. In some instances only limited feedback or information has been able to be obtained.

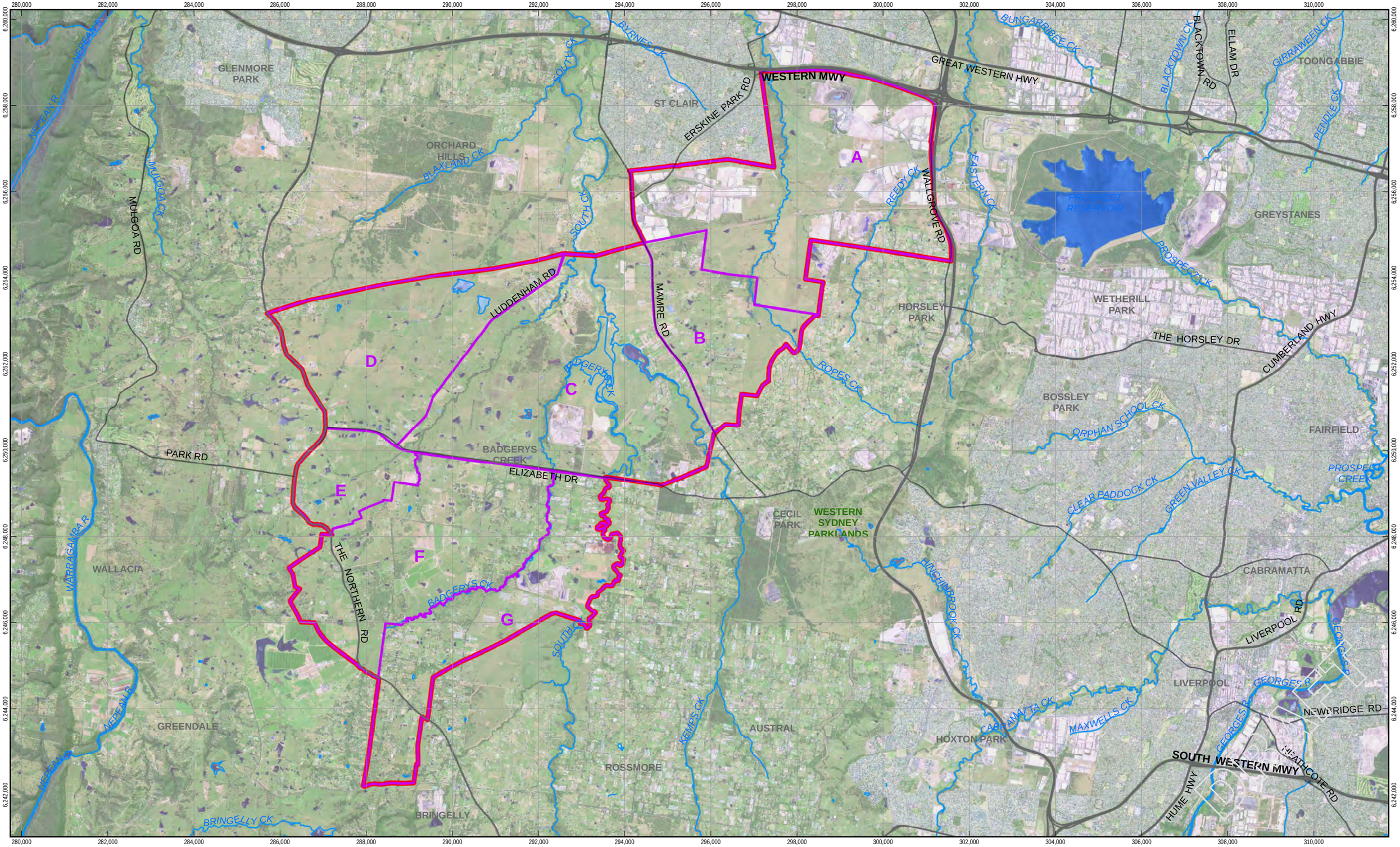
1.5 Scope of Work and Report Limitations

The servicing strategy that has been developed is at a strategic level. The strategy focuses on trunk level infrastructure rather than reticulation level infrastructure. The high level strategy considers the whole BWSEA and does not necessarily focus on precinct level/reticulation issues. The development of the servicing strategy has been based generally on the following:

- consideration of existing utilities infrastructure within and in the vicinity of the BWSEA;
- utilities demand analyses based on development yields and development type provided or confirmed by DP&I;

- consultation with various utilities providers;
- consideration of the proposed land use within the BWSEA and other infrastructure that will be required to service the land such as road networks; and
- GHD experience in relation to utilities servicing strategy development and design for the existing Western Sydney Employment Area (Precinct A).

In some instances only limited feedback or information has been able to be obtained from the relevant utilities authorities. Therefore, some assumptions have had to be applied in developing the servicing strategy as outlined in the report.



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Precinct outlines
- BWSEA Study Area
- Highway
- Main Roads
- Waterways
- Lakes, Ponds and Dams

Department of Planning and Infrastructure
BWSEA Utilities Servicing Strategy

Job Number	21-22526
Revision	B
Date	29 Oct 2013

Broader Western Sydney Employment Area Locality

Figure 1

N:\AU\Sydney\Projects\21\22526\GIS\Maps\21_22526_Z010_SSR_Precinct_Map.mxd

Data Source: LanSAT Image 2013; Department of Planning and Infrastructure Jan 2013 . Created by: qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

2. Demand Analysis

The energy demands of the BWSEA were estimated in order to inform the development of the servicing strategy. Development areas, yields and timeframes were based on information provided by the DP&I consistent with that outlined in the Structure Plan. Loads were estimated based on typical demands for employment generating development similar to that already occurring in Precinct A of the BWSEA. Allowances were made for other general public infrastructure such as wastewater pumping stations, and where necessary, special allowances for particular areas identified in the Structure Plan such as “specialised centres”. A Technical Memorandum summarising the basis of the demand analysis is included in Appendix A.

3. Electrical

3.1 Existing Infrastructure

A review of existing electrical infrastructure in the BWSEA and surrounding area has been completed based on desk top services searches and consultation with Endeavour Energy. The existing electrical infrastructure within the BWSEA can be summarised as follows:

- Existing TransGrid Sydney West transmission substation within Precinct A;
- High voltage overhead transmission lines supplying the TransGrid Sydney West transmission substation and providing interconnections to other TransGrid transmission substations in the greater area;
- Existing Endeavour Energy zone substations located within Precinct A; and
- Existing reticulation level power lines (high and low voltage) servicing existing properties within the BWSEA.

TransGrid’s Kemps Creek transmission substation is located approximately 4.5km to the east of the BWSEA. Endeavour Energy’s West Liverpool transmission substation is located in Prestons, approximately 7km from the BWSEA boundary.Refer Figure 2 for the location of major infrastructure items.

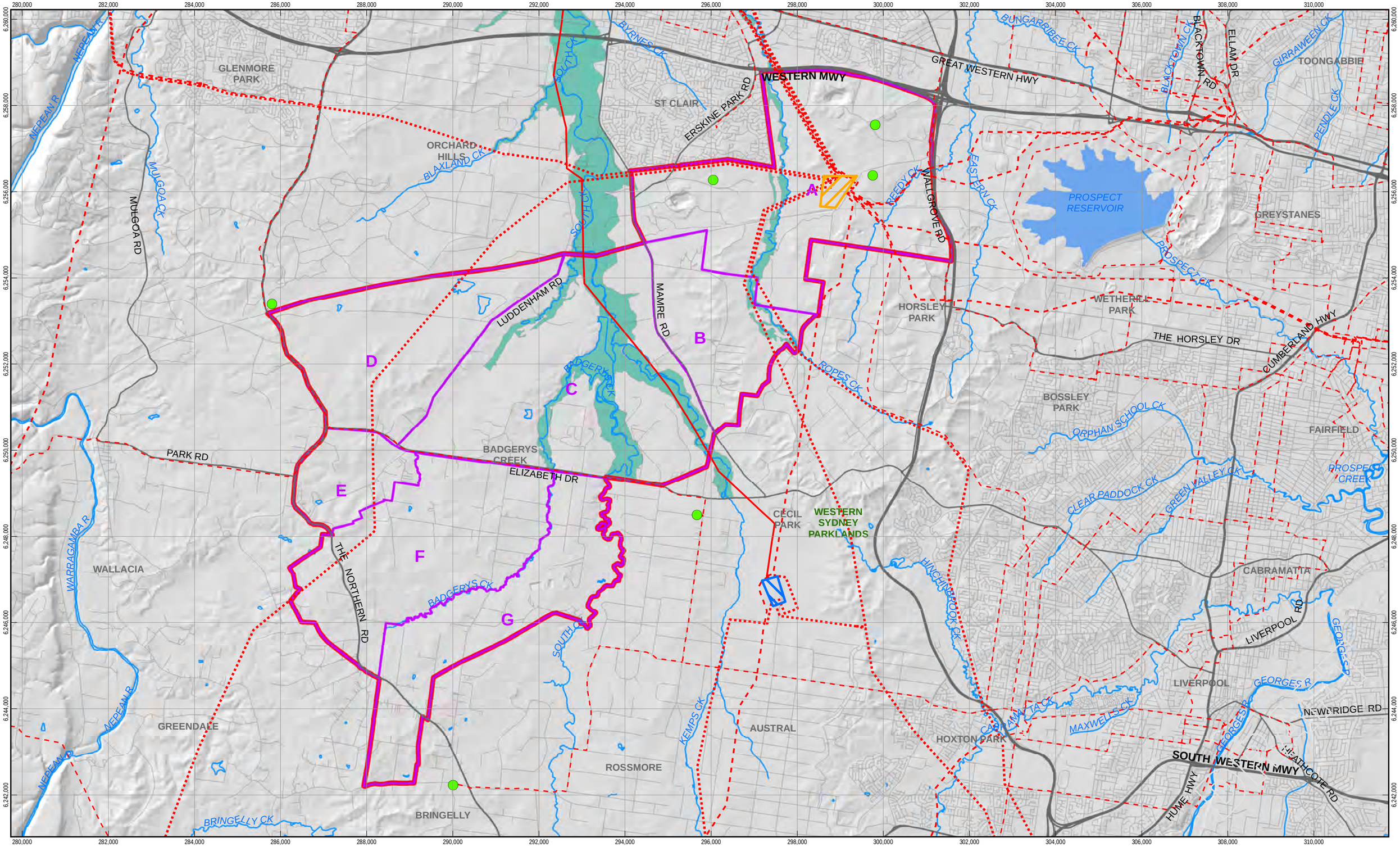
The Transgrid Sydney West transmission substation is located within Precinct A (existing Western Sydney Employment Area) of the BWSEA. The associated high voltage power lines that supply the substation traverse all precincts of the BWSEA except Precinct G. Easements associated with these high voltage overhead power lines vary in width from 30m to 70m depending on voltage. Development within these easements will not be permitted by TransGrid. Relocation of high voltage power lines such as these to suit development layouts is often not economically viable and presents significant technical challenges.

The Transgrid substations supply power to Endeavour Energy’s West Liverpool transmission substation located in Prestons approximately 7 km to the south-east of the BWSEA boundary. This Endeavour Energy transmission substation distributes power to various Endeavour Energy zone substations in south-west Sydney.

Within Precinct A there are three existing Endeavour Energy zone substations. Endeavour Energy have indicated that there is spare capacity available and these could service some further development of Precinct A. Within the remaining precincts of the BWSEA no other zone

substations have been identified and there is only reticulation level infrastructure servicing existing properties.

Endeavour Energy's Horsley Park, Kemps Creek, Bringelly and Luddenham zone substations are located just outside the BWSEA boundary. These zone substations could potentially service some development on the outer fringes of Precincts A, B, C, D or G depending on the type of development and available capacity at the time of development.



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

Existing Substations
- TransGrid Sydney West 330kV Transmission Substation
- TransGrid Kemps Creek Transmission Substation
- Endeavour Energy Zone Substation

Existing Electricity Transmission Line
- 33kV
- 66kV
- 132kV
- 330kV
- 500kV

- BWSEA Study Area
- Precinct outlines
- Highway
- Main Roads
- Roads
- Waterways
- Lakes, Ponds and Dams
- Flood extent

Department of Planning and Infrastructure
BWSEA Utilities Servicing Strategy

Job Number 21-22526
Revision A
Date 11 Sep 2013

Existing Trunk Electrical Infrastructure

Figure 2

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

3.2 Electrical Servicing Strategy

Based on the cumulative diversified forecast demands the existing electrical infrastructure within and surrounding the BWSEA is insufficient to meet the expected demands of the development area. In order to meet these demands Endeavour Energy would need to undertake significant augmentation of their transmission and distribution networks, particularly the establishment of new substations.

Such an augmentation may only be feasible on the basis of development of transmission substations in the BWSEA vicinity by TransGrid, where additional bulk supply points would be required in order to supply the new Endeavour Energy substations.

The final scale and nature of the potential augmentation would be determined through assessment by Endeavour Energy of future supply requirements for the greater area, available capacity at existing substations and related strategic and economic considerations. The network development outcomes would also be consistent with Endeavour Energy's established planning requirements. Endeavour Energy are currently undertaking an assessment and it is expected they will have completed this assessment in November 2013. Consequently, until the assessment has been completed, supply strategy options for BWSEA can only be proposed at a conceptual level and based on Endeavour Energy's planning philosophies and cumulative forecast demand estimates only.

Two proposed servicing options for the BWSEA are presented in Sections 3.2.2 and 3.2.3 and are based on a cumulative diversified forecast demand of 1000 MVA at a load density of 12 MVA/sqkm, and general planning information provided by Endeavour Energy as part of the consultation conducted in developing the servicing strategy.

3.2.1 Key Assumptions

The following key assumptions underpin and are common to both options:

- Some spare capacity is available at TransGrid's Sydney West and Kemps Creek transmission substations to supply the new Endeavour Energy transmission substations in Servicing Option 1 and zone substations in Servicing Option 2. The total effective spare capacity is assumed to be able to collectively supply approximately 20 per cent of the total forecast demand for BWSEA. Endeavour Energy are consulting Transgrid in this regard;
- Some spare capacity is available at Endeavour Energy's North Eastern Creek, Eastern Creek, Horsley park, Kemps Creek, Luddenham and Mamre zone substations to be able to collectively supply approximately 10 per cent of the total forecast demand for BWSEA; and
- Spare capacity is not available at Endeavour Energy's West Liverpool transmission substation and 100 per cent of the total forecast demand for BWSEA must be supplied by new Endeavour Energy transmission substations.

3.2.2 Servicing Option 1

Under this option the following infrastructure would ultimately be required to be provided within the BWSEA:

- An estimated 15 Endeavour Energy zone substations comprising a mix of 33/11 kV and 66/11 kV zone substations rated between 15 and 70 MVA firm capacity;
- An estimated three Endeavour Energy transmission substations comprising a mix of 132/33 kV and 132/66 kV zone substations rated between 120 and 360 MVA firm capacity;

- An estimated two TransGrid 330/132 kV transmission substations;
- High voltage overhead transmission lines; and
- Distribution voltage and low voltage reticulation infrastructure to service individual developments.

The key infrastructure elements associated with this option is shown in Figure 3. The locations of the infrastructure elements shown are indicative only and subject to further refinement.

3.2.3 Servicing Option 2

Under this option the following infrastructure would ultimately be required to be provided within the BWSEA:

- An estimated 10 Endeavour Energy 132/11 kV zone substations comprising mixed ratings of 40 and 90 MVA firm capacity;
- An estimated two TransGrid 330/132 kV transmission substations;
- High voltage overhead transmission lines; and
- Distribution voltage and low voltage reticulation infrastructure to service individual developments.

This option is shown in Figure 4. The locations of the infrastructure elements are indicative only and subject to further refinement.

-

3.2.4 Land Planning Considerations

Land will be required to be set aside for the development of new TransGrid and Endeavour Energy substations. The requirements will vary depending on the individual requirements of each substation. However, estimates of land parcel sizes required for the provision of the new substations can be based on existing substations as follows:

- Each new TransGrid transmission substation land parcel expected to be similar to TransGrid Sydney West transmission substation, being approximately 350,000 sqm;
- Each new Endeavour Energy transmission substation land parcel expected to be similar to Endeavour Energy West Liverpool West transmission substation, being approximately 80,000 sqm; and
- Each new Endeavour Energy zone substation land parcel expected to be similar to Endeavour Energy Kemps Creek substation, being approximately 3,000 sqm.

New TransGrid and Endeavour Energy transmission lines and interconnections within the BWSEA would be located within transmission line easements. The indicative alignments of the required trunk transmission lines is shown on Figure 3 and Figure 4. The easement widths will vary depending on the voltage and will be in the order of 30-70m. Development will not be permitted within the easements for transmission lines. It is noted that that new high voltage transmission lines may be required from the existing TransGrid Kemps Creek transmission substation connecting to new TransGrid transmission substations within the BWSEA. This requirement would impact on existing landowners outside of the BWSEA.

Distribution feeders from existing Endeavour Energy zone substations into the BWSEA would be located within existing road reserves with routes to be determined based on existing road network and existing services therein.

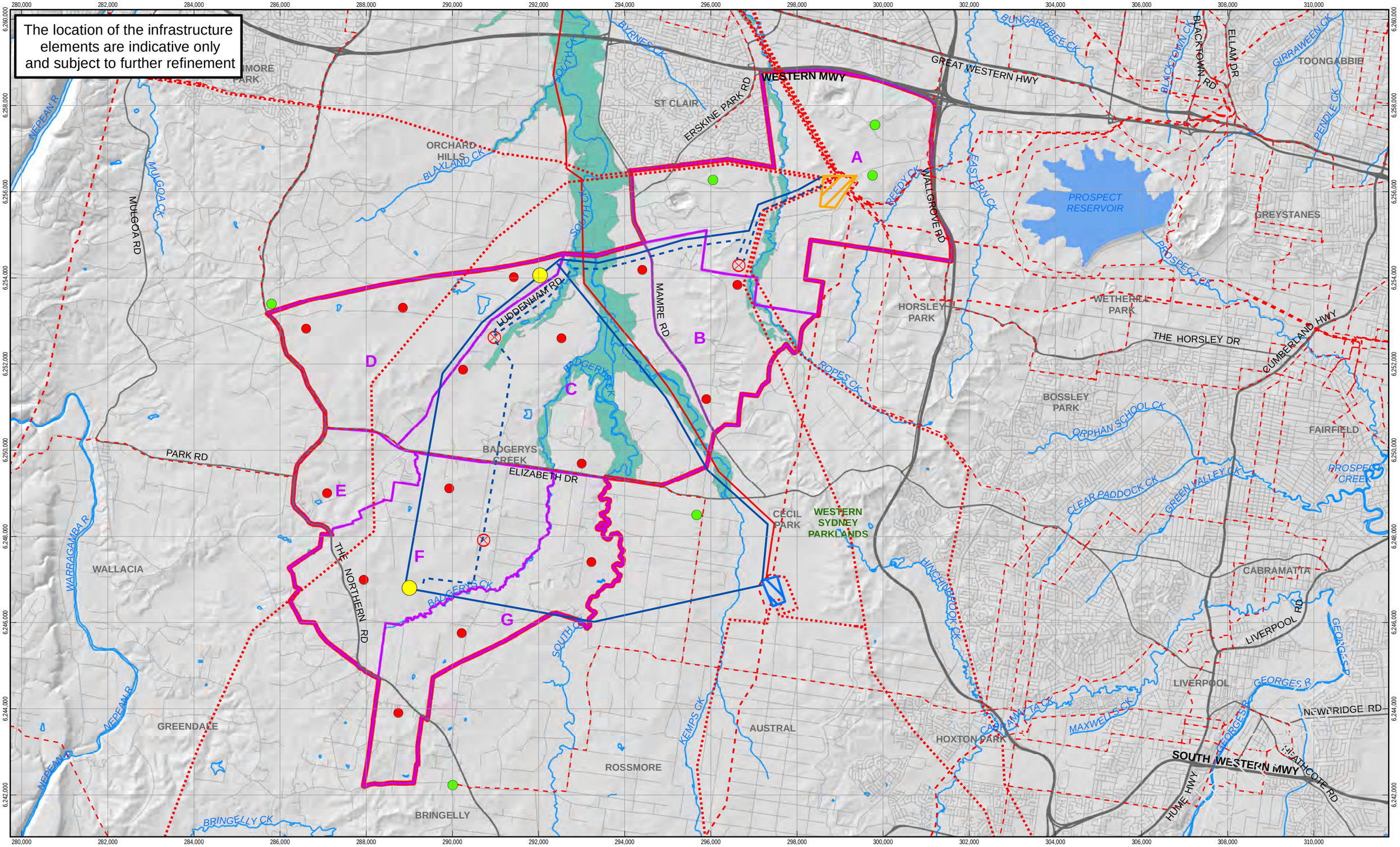
Distribution and reticulation level cabling within the BWSEA would be provided in the standard footway allocation of new roadways.

3.3 Electrical Infrastructure Staging

The development of the remainder of Precinct A is an obvious first stage from an electrical servicing point of view as substantial development has already been completed within this precinct and associated trunk electrical infrastructure is in place. There is some spare capacity in the existing zone substations in this precinct that could service further development.

Beyond this, significant new infrastructure is required to service the remainder of the BWSEA with the construction of substations required. It is noted that the planning, design, construction and commissioning of new substations such as those nominated in this servicing strategy will take several years. Therefore, Endeavour Energy and landowners/developers will need to work closely together to ensure timely delivery of critical electrical infrastructure as development proceeds.

The location of the infrastructure elements are indicative only and subject to further refinement



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

Existing Substations
- TransGrid Sydney West 330kV Transmission Substation
- TransGrid Kemps Creek Transmission Substation
- Endeavour Energy Zone Substation

Existing Electricity Transmission Line
- 33kV
- 66kV
- 132kV
- 330kV
- 500kV

Proposed Infrastructure
- Proposed Transgrid Transmission Substation, (330/132kV)
- Proposed Endeavour Energy Transmission Substation (132/66kV or 132/33kV)
- Proposed Endeavour Energy Zone Substation (66/11kV or 33/11kV)

- TransGrid transmission line
- Endeavour Energy transmission line
- BWSEA Study Area
- A Precinct outlines
- Highway
- Main Roads
- Roads
- Waterways
- Lakes, Ponds and Dams
- Flooding Extent

Department of Planning and Infrastructure
BWSEA Utilities Servicing Strategy

Job Number 21-22526
Revision B
Date 29 Oct 2013

Electrical Servicing Strategy - Option 1

Figure 3

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

The location of the infrastructure elements are indicative only and subject to further refinement

A
B
C
D
E
F
G

PROSPECT RESERVOIR

Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

Existing Substations
- TransGrid Sydney West 330kV Transmission Substation
- TransGrid Kemps Creek Transmission Substation
- Endeavour Energy Zone Substation

Existing Electricity Transmission Line
- 33kV
- 66kV
- 132kV
- 330kV
- 500kV

Proposed Infrastructure
- Proposed Transgrid Transmission Substation, (330/132kV)
- Proposed Endeavour Energy Zone Substation, (33/11kV)
- TransGrid transmission line

- BWSEA Study Area
- Precinct outlines
- Highway
- Main Roads
- Roads
- Waterways
- Lakes, Ponds and Dams
- Flood Extent

Department of Planning and Infrastructure
BWSEA Utilities Servicing Strategy

Job Number 21-22526
Revision B
Date 29 Oct 2013

Electrical Servicing Strategy - Option 2

Figure 4

N:\AU\Sydney\Projects\21\22526\GIS\Maps\21_22526_Z013_ELEC_Electrical_Servicing_Strategy_Opt2.mxd

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011: LanSAT Image 2013; Department of Planning and Infrastructure Jan 2013 . Created by: qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

3.4 Renewable Energy Opportunities

Forward looking developers of industrial and commercial facilities within the broader BWSEA project area could assess a range of renewable energy technologies for implementation with a predominant focus on mature, lower-cost opportunities.

A range of renewable energy and low carbon technology options that would be considered by developers are assessed below, and are broadly listed in descending order of viability.

3.4.1 Viable Opportunities

Solar Power

The development of solar power systems at industrial and commercial sites presents the most viable opportunity for renewable energy implementation within the BWSEA. Two specific forms of solar power could be considered by site developers of industrial and commercial buildings with sizeable, north-facing roof space:

- On-site electricity generation via rooftop solar photovoltaic (PV) systems; and
- On-site hot water generation via rooftop solar arrays.

Solar PV installations are an intermittent source of electricity, as power generation drops off when clouds move in front of the sun. Consequently, solar PV installations would not reduce peak electricity demand during daylight hours at the sites served, unless coupled with energy storage technologies. The application of storage technologies such as flow batteries (chemical storage of energy) or flywheel systems (mechanical storage of energy) would impact overall cost and hence viability of such hybrid solar power projects.

Opportunities for onsite solar power generation would range from small-scale, gas-boosted solar hot water installations serving ablution facilities to large-scale solar PV arrays installed on industrial buildings.

Site developers could cater for large scale solar power systems in the broader BWSEA by designing building layout arrangements with large, north facing roofs, which are structurally rated to support additional solar PV or solar hot water arrays.

Low-Carbon Cogeneration

Reasonable opportunities exist to develop combined cogeneration installations (also known as combined heat and power) at large-scale industrial and commercial premises within the BWSEA.

Cogeneration installations are low-carbon solutions rather than renewable energy opportunities, as these installations rely on natural gas-fired generators to produce electricity and hot water.

Developers could consider cogeneration opportunities at large industrial sites with a significant need for hot water for food or product processing that are also served by natural gas mains. Cogeneration opportunities tend not to be considered for commercial property developments, which have a limited need for hot water for building heating in the winter period only.

Commercial property developers could consider trigeneration opportunities (the generation of electricity, hot water and cooling via absorption chillers) at large commercial developments served by natural gas mains with a significant need for cooling for air conditioning.

The development of cogeneration and trigeneration opportunities would not necessarily reduce reliance on electricity grid supplied power, as risk-averse developers would require grid backup in the event of a failure of the cogeneration systems.

3.4.2 Limited Opportunities

Wind Power

Limited opportunities exist for wind power due to the unknown nature of wind resources within the BWSEA project area. Commercial property developers may consider small-scale roof top wind turbine installations at specific elevated sites where wind resources appear viable.

BioGas

The development of organic waste-processing plants, such as sewage treatment plants or landfill sites within the BWSEA presents a limited opportunity to generate electricity from renewable methane sources produced as a by-product of waste processing.

Although Sydney Water Corporation and private landfill operators typically commit to developing biogas opportunities where commercially viable, such opportunities are limited within the BWSEA due to the small number of waste-processing sites expected to be built.

Hydroelectricity

There are few, if any, opportunities for the implementation of hydroelectric generation within the BWSEA largely due to environmental restrictions, such as topography and legal rights of access to natural water courses in the project area.

Site developers may consider micro-hydro plant at water storage or water treatment facilities, micro-scale “run-of-river” hydroelectricity plant at sites with ornamental lakes.

4. Telecommunications

4.1 Existing Infrastructure

A review of existing telecommunications infrastructure in the BWSEA and surrounding area has been completed based on desk top services searches and consultation with Telstra and the National Broadband Network (NBN). The following sections summarise the existing transmission, cable plant and wireless infrastructure within and surrounding the study area.

4.1.1 Telecommunications Transmission and Switching Infrastructure

Telephone exchanges accommodate telecommunications switching and transmission equipment. The exchanges that currently provide services to the BWSEA precincts are located at:

- Bringelly – Badgerys Creek Road, Bringelly;
- Erskine Park – Aldan Place, St. Clair;
- Kemps Creek – Elizabeth Drive, Kemps Creek;
- Luddenham – The Northern Road, Luddenham; and
- Rooty Hill – Rooty Hill Road.

The exchange equipment is supplemented by Remote Integrated Multiplexers (RIMS) which consolidate local premises telephone cable connections into one fibre cable for connection to an area telephone exchange. A total of twenty five RIMS are located in the BWSEA.

The location of the existing telephone exchanges are shown on Figure 5.

4.1.2 Cable Plant

Cable plant in the BWSEA comprises:

- Optical fibre in the existing developed areas of Precinct A linking premises/RIMS/exchanges; and
- Copper cable servicing the remainder of Precinct A and Precincts B to G.

The fibre cable plant is installed in pit and pipe containment. Some of the copper cable plant is installed in pit and pipe containment, however a significant amount comprises aerial cables attached to the electricity distribution power poles.

The existing cable plant is now owned by the National Broadband Network under a long term leasing agreement with Telstra.

4.1.3 National Broadband Network

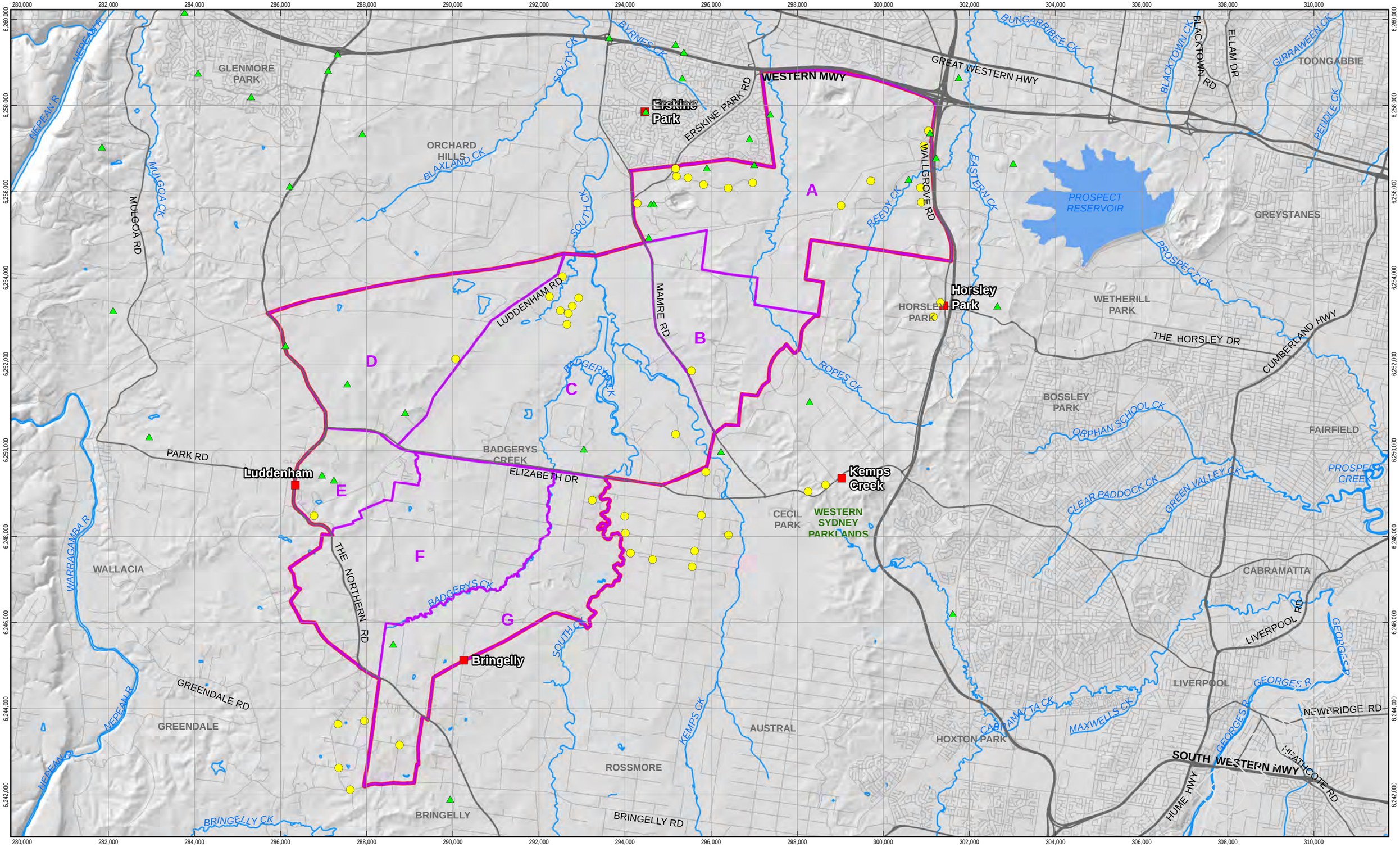
The NBN does not currently have any short to medium term plans to roll out the NBN within the BWSEA. However, the developed areas of Precinct A have optical fibre cable plant that could readily facilitate roll out NBN (conforming to the NBN network architecture) within this area.

4.1.4 Wireless Networks

Wireless networks which currently provide services to the BWSEA precincts include the three generations of mobile telephone technology namely 2G (GSM), 3G and 4G deployed by three major telecommunications carriers Telstra, Optus and Vodafone.

Coverage maps indicate that the BWSEA precincts currently have good coverage levels. The Telstra network signal levels are high enough to enable indoor coverage for approximately 85 % of the area and data rates between 550 kbps and 20 Mbps depending on location.

The existing mobile network base stations in the BWSEA precincts and adjacent areas are shown on Figure 5.



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Mobile Telephone Base Stations
- Remote Intergration Multiplexor
- Telephone Exchanges
- BWSEA Study Area
- Precinct outlines
- Highway
- Main Roads
- Roads
- Waterways
- Lakes, Ponds and Dams

Department of Planning and Infrastructure
BWSEA Utilities Servicing Strategy

Job Number	21-22526
Revision	A
Date	11 Sep 2013

Existing Trunk Telecommunication Infrastructure

Figure 5

N:\AU\Sydney\Projects\21\22526\GIS\Maps\21_22526_Z015_ELEC_Existing_Trunk_Telecommunication.mxd

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011: LanSAT Image 2013; Department of Planning and Infrastructure Jan 2013 . Created by: qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

4.2 Telecommunications Servicing Strategy

4.2.1 National Broadband Network

The existing copper network within the BWSEA is not suitable to service the development of the area. Development within the BWSEA will require high speed data services and the predominately greenfields nature of the area means servicing via the NBN is readily achievable. The NBN rollout could be expanded to include the BWSEA and installed as development proceeds. The NBN Co have a formal process that facilitates network development in collaboration with developers and this process would be adopted for the development of the BWSEA.

Developers are required to provide the cable containment infrastructure and the NBN Co will then arrange for the cabling and network equipment to be installed to provide the broadband services to the respective premises. The developed areas of Precinct A already contain optical fibre plant that could facilitate ready expansion of the NBN to this area initially.

Planning considerations for the future implementation of NBN infrastructure for the BWSEA are not considered significant and will include:

- Reservation of land/space for telephone exchanges for NBN fibre access nodes and roadside cabinets for NBN fibre distribution hubs; and
- Coordination of NBN cable containment routes with underground utility services; and

Although the land requirements for exchanges and roadside cabinets is not significant it would be expected that the following will be required:

- Telephone exchange – one per specialised development centre or precinct; and
- Roadside cabinets – one per 200 premises on any development.

The proposed telecommunications servicing strategy is shown diagrammatically on Figure 6. The locations of the infrastructure elements are indicative only and subject to further refinement.

4.2.2 Wireless

As there is already good coverage of the BWSEA area via existing wireless infrastructure, the servicing strategy for the BWSEA will consist of the following:

- Monitor telecommunication traffic volumes and network capacity as development proceeds; and
- When the telecommunications traffic volumes are reaching the capacity of the existing network, additional capacity will be provided by augmentation of existing base stations and the provision of additional base stations.

Augmentation to existing base stations is relatively easy to provide and does not form any significant constraints to the BWSEA itself in terms of land requirements. Additional base stations can be collocated with other infrastructure at suitable elevated locations such as water reservoir sites or on top of buildings. Land will need to be set aside for this purpose.

4.3 Telecommunications Infrastructure Staging

Staging of telecommunications infrastructure does not represent major constraints to the development of the BWSEA and would be as follows:

- Roll out of NBN throughout the BWSEA as development proceeds; and
- Augment existing wireless network infrastructure based on monitored traffic volumes over time.

The location of the infrastructure elements are indicative only and subject to further refinement

Erskine Park
Horsley Park
Luddenham
Kemps Creek
Bringelly

A
B
C
D
E
F
G

WESTERN MWY
GREAT WESTERN HWY
LUDDENHAM RD
MAMRE RD
ERSKINE PARK RD
WALLGROVE RD
THE HORSLEY DR
CUMBERLAND HWY
PARK RD
ELIZABETH DR
THE NORTHERN RD
GREENDALE RD
BRINGELLY RD
MULGOA RD
BLACKTOWN RD
ELLAM DR
LIVERPOOL RD
NEWBRIDGE RD
HEATHCOTE RD
SOUTH WESTERN MWY
HUME HWY

PROSPECT RESERVOIR
WESTERN SYDNEY PARKLANDS

ORCHARD HILLS
MULGOA
WALLACIA
GREENDALE
BRINGELLY
ROSSMORE
AUSTRAL
CECIL PARK
HORSLEY PARK
WETHERILL PARK
BOSSLEY PARK
GREYSTANES
TOONGABBIE
FAIRFIELD
CABRAMATTA
LIVERPOOL
HOXTON PARK
BADGERYS CREEK

NEPEAN R
WARRAGAMBA R
BYRNES CK
SOUTH CK
BLAXLAND CK
MULGOA CK
REEDY CK
EASTERN CK
BUNGARRIBEE CK
BLACKTOWN CK
GIRRAWEEN CK
PENDLE CK
PROSPECT CK
ROPES CK
ORPHAN SCHOOL CK
CLEAR PADDOCK CK
GREEN VALLEY CK
PROSPECT CREEK
BADGERYS CK
KEMPS CK
CABRAMATTA CK
MAXWELLS CK
GEORGES R
BRINGELLY CK

280,000 282,000 284,000 286,000 288,000 290,000 292,000 294,000 296,000 298,000 300,000 302,000 304,000 306,000 308,000 310,000
6,260,000 6,258,000 6,256,000 6,254,000 6,252,000 6,250,000 6,248,000 6,246,000 6,244,000 6,242,000

Paper Size A3

0 0.5 1 2 3 4
Kilometers

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

N

LEGEND

- Mobile Telephone Base Stations
- Existing Telephone Exchanges
- Proposed Telephone Exchange
- Indicative NBN Cable Routes Located on Proposed Road Corridor
- BWSEA Study Area
- Precinct outlines (A)
- Highway
- Main Roads
- Roads
- Waterways
- Lakes, Ponds and Dams

GHD

NSW GOVERNMENT Planning & Infrastructure

Department of Planning and Infrastructure
BWSEA Utilities Servicing Strategy

Job Number	21-22526
Revision	B
Date	29 Oct 2013

Telecommunications Servicing Strategy

Figure 6

N:\AU\Sydney\Projects\21\22526\GIS\Maps\21_22526_Z008_SSR_Service_Strategy.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

5. Gas

5.1 Existing Infrastructure

A review of existing gas infrastructure in the BWSEA and surrounding area has been completed based on desk top services searches and consultation with Jemena.

Figure 7 shows the existing gas mains in the vicinity of the BWSEA. Gas services exist on the northern fringe, central eastern fringe and near the southern tip of the BWSEA. There are no gas services on the western fringes or traversing through the BWSEA.

The north-west fringe of the BWSEA is approximately 2 km from the Jemena Gas Networks Horsley Park Gas Facility. This facility is the gas supply hub to the Sydney region and receives gas from the Moomba to Sydney and Longford to Sydney gas transmission pipelines. These pipelines are the two gas supply sources to the Sydney region.

The existing gas lines located on the fringes the BWSEA are summarised in the following Sections 5.1.1 to 5.1.4.

5.1.1 Northern Fringe

The following gas infrastructure is located in the northern fringes of the BWSEA:

(a) 150 mm diameter steel secondary gas main located along the M4 Motorway, Erskine Park Road, Lenore Drive and Templar Road in Erskine Park.

(b) 150 mm diameter steel gas main branch off the above main along Archbold Road towards Eastern Creek.

(c) 150 mm diameter steel secondary main located along Burley Road and Old Wallgrove Road in Horsley Park. The last portion of this gas main runs along the south–east boundary of the South of Warragamba Pipeline.

(d) 110 mm diameter polyethylene gas distribution main located along Erskine Park Road, Mamre Road and Bakers Lane, in the northern part of Kemps Creek.

The gas mains described by items (a), (b) and (c) are located on the fringes of Precinct A. These steel gas mains are classified as secondary mains and generally have a pressure rating of 1050 kPa (Gauge) and transport bulk gas to district hubs or major industrial consumers.

The gas mains described by items (a) and (c) above currently service the BlueScope Steel Plant in Erskine Park and the Austral and CSR-PGH Brick Works in Horsley Park respectively. The gas main described by item (b) above services the Eastern Creek quarry. These secondary gas mains could facilitate gas main extensions for bulk gas transport to the remainder of the BWSEA.

The gas main described by item (d) above runs between Precincts B and C. This polyethylene main is classified as a distribution main which normally has a pressure rating of 210 kPa (Gauge) and provides commercial and domestic service where 2.7 kPa (Gauge) or 1.4 kPa (Gauge) metering pressures are sufficient. Distribution mains such as these that are in the vicinity of the BWSEA may have surplus capacity for low load retail and commercial uses such as heating, cooking and hot water, but should not be expected to service any significant industrial loads or network expansion. This main is expected to have limited capacity for new connections within its vicinity, but not for major networks expansion or extension.

5.1.2 Eastern Fringe

A 200 mm diameter steel secondary gas main is located along Elizabeth Drive and turns south along Martin Road and beyond and then west and terminates near Badgerys Creek Road.

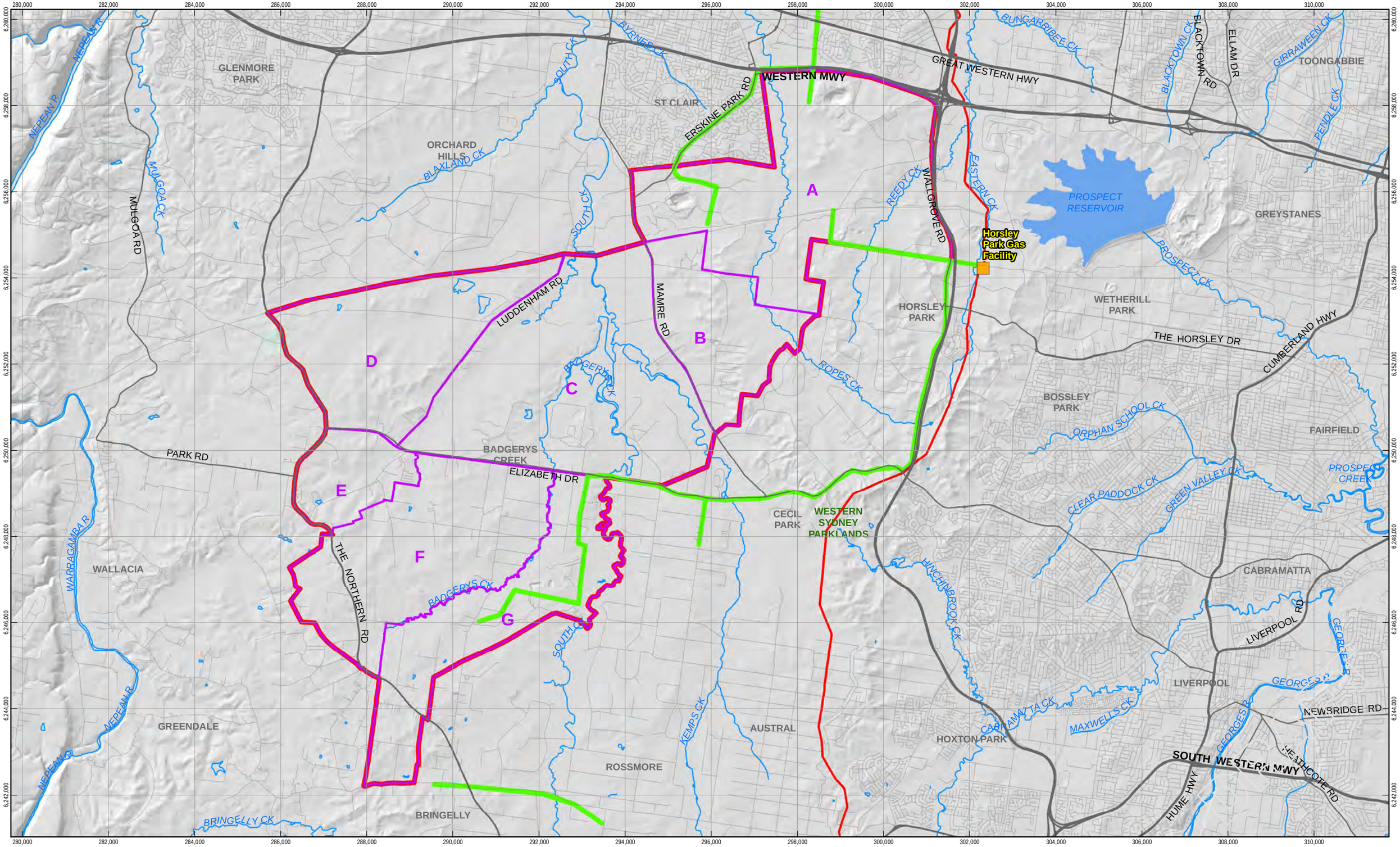
This gas main is located within the northern half of BWSEA Precinct G.

5.1.3 Southern Fringe

A 200 mm diameter gas main is located along Bringelly Road and Greendale Road and terminates about 0.5 km outside the southern tip of the BWSEA Precinct G.

5.1.4 Western Fringe

No gas services are located within the western fringes of the BWSEA.



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Horsley Park Gas Facility
- Existing gas secondary main
- Trunck main (Moomba to Sydney Eastern Gas Pipeline)
- BWSEA Study Area
- A Precinct outlines
- Highway
- Main Roads
- Roads
- Waterways
- Lakes, Ponds and Dams

Department of Planning and Infrastructure
BWSEA Utilities Servicing Strategy

Job Number	21-22526
Revision	A
Date	06 Sep 2013

Existing Gas Infrastructure

Figure 7

N:\AU\Sydney\Projects\21\22526\GIS\Maps\21_22526_Z006_SSR_Gas_Mains_Infrastructure.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

5.2 Gas Servicing Strategy

The existing gas network within the BWSEA is insufficient to service the development area and new gas infrastructure will be required. The relatively large area of the BWSEA in proportion to the potential gas loads presents some difficulty in determining a commercially sound gas servicing strategy.

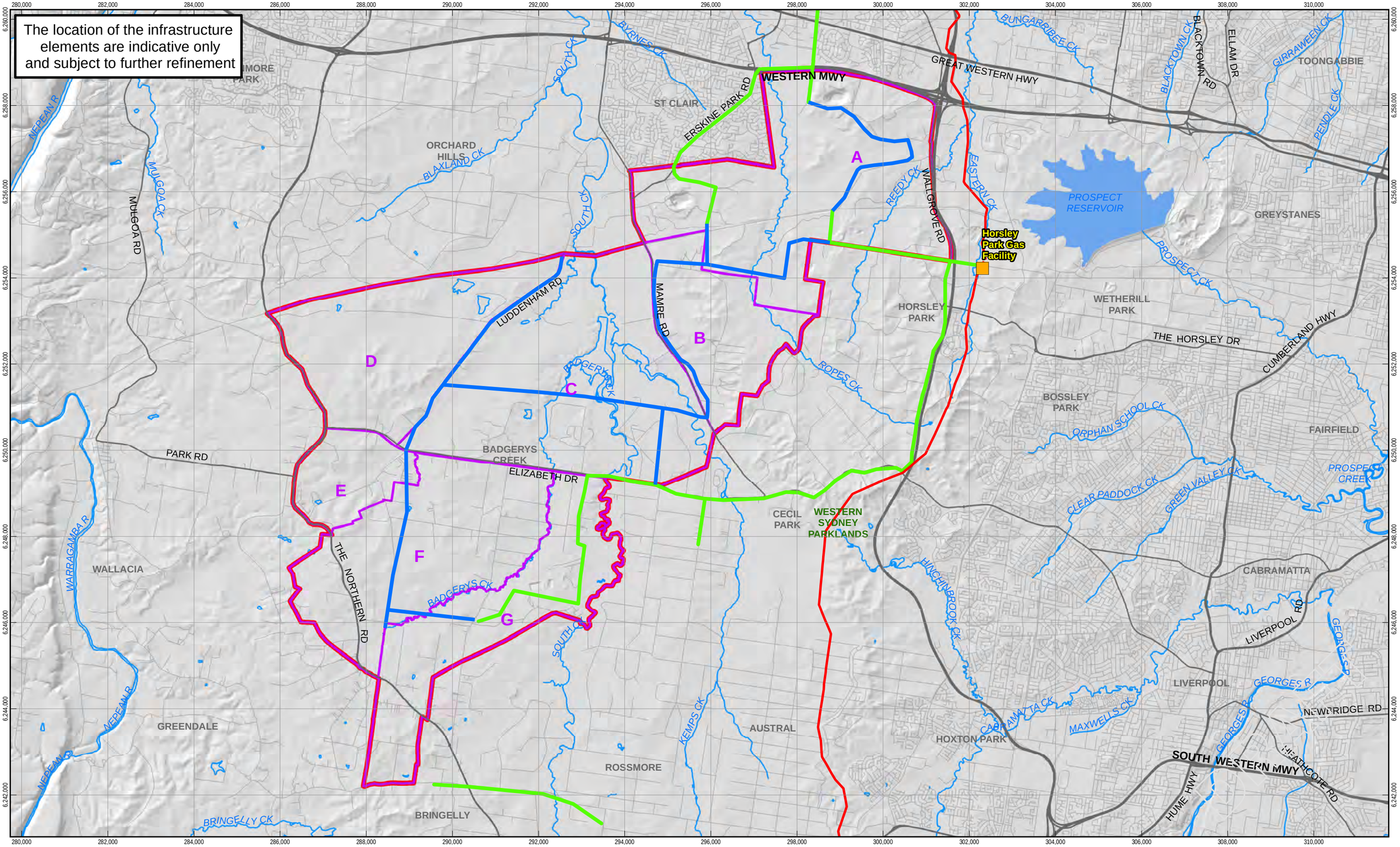
The potential land use and gas loads may not offer sufficient incentive for private industry or network operators to invest in the installation of a comprehensive gas network to service the entire BWSEA. However, the presence of gas network services within the BWSEA could influence the future potential of the area and may attract industrial activity which depend on gas services for economic operations. These may include light industries such as bakeries, kilns, food processing, metal works and others beyond the planned warehouse, office and retail centres.

The final strategy for the gas service needs to consider the commercial risks and potential benefits for the area being developed with or without a gas network service. Jemena would normally only consider gas network expansion into the BWSEA precincts based on a specific request from a proponent and where the servicing of the proponent presents a commercial return for Jemena.

The Jemena Gas Networks Facility for the Sydney Region Gas Supply is located in Horsley Park (approximately 2 km west from Wallgrove Road along Chandos Road). Therefore, if necessary, any practical load can be made available within the BWSEA. This would be achieved by utilising the existing secondary gas mains as described above, which receive gas from the hub, and installation of new secondary gas extensions for broad coverage of the BWSEA. If required, additional capacity augmentation can be provided by installation of a primary main from the Horsley Park Gas Supply Hub to a new primary central receiving facility location within the BWSEA.

An indicative secondary gas main network expansion layout is shown on Figure 8 demonstrating how the BWSEA could be serviced if required. The locations of the infrastructure elements are indicative only and subject to further refinement. The secondary gas main sizes will be in the order of DN 200 mm and will be designed to transfer bulk gas volumes flowing at pressure in the range 1050 kPag (near the source) to 550 kPag (minimum at most disadvantaged point). The bulk gas will be distributed to approximately 10 district regulators located strategically around the BWSEA to provide a distribution point outlet within 3 or 4 km from any customer location. The district regulator controls the pressure to 210 kPag for a broader distribution in polyethylene gas mains for typical commercial and industrial use. Heavy industry customers which require high supply pressures will be connected directly to nearest secondary gas main.

The location of the infrastructure elements are indicative only and subject to further refinement



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Horsley Park Gas Facility
- Trunck main (Moomba to Sydney Eastern Gas Pipeline)
- Existing gas secondary main
- Indicative Secondary Gas Main Route
- BWSEA Study Area
- A — Precinct outlines
- Highway
- Main Roads
- Roads
- Waterways
- Lakes, Ponds and Dams

Department of Planning and Infrastructure
BWSEA Utilities Servicing Strategy

Job Number	21-22526
Revision	B
Date	29 Oct 2013

Gas Servicing Strategy

Figure 8

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

6. Infrastructure Staging

Utility infrastructure staging requirements are summarised in Tables 1 and 2. The infrastructure locations and staging are indicative only and subject to further refinement based on actual land development rates over time.

Telecommunications and gas infrastructure required to service the BWSEA can be readily provided in a progressive manner as development proceeds. Secondary and reticulation level gas mains can be extended as development proceeds via new roadways. Similarly, telecommunications cabling is extended as development proceeds, and new exchanges provided as necessary.

Electrical servicing will require a more detailed planning approach with regards to infrastructure staging. Developers will need to work closely with Endeavour Energy as development proceeds so that Endeavour Energy have the ability to plan for the provision of new transmission/zone substations. The substations will be required to service the electrical reticulation network expansion throughout the BWSEA. These infrastructure items have long lead times from planning to commissioning, and substation capacities represent thresholds to development proceeding any further.

Table 1 2026 Indicative Infrastructure Requirements

Project Location	Description
Precinct A/B	Endeavour Energy transmission substation (Servicing Option 1)
Precincts B & C	Endeavour Energy zone substations for each precinct (Servicing Options 1 and 2)
Precincts A, B & C	NBN roll out
Precincts A, B & C	Telephone exchange for each precinct
Precinct B & C	Secondary gas main extension into each precinct

Table 2 2036 (and beyond) Indicative Infrastructure Requirements

Precinct C/D	Transgrid transmission substation (Servicing Options 1 and 2)
Precincts D-G	Endeavour Energy transmission/zone substations
Precincts D-G	NBN roll out
Precincts D-G	Telephone exchange for each precinct
Precincts D-G	Secondary gas main extension into each precinct

7. Preliminary Environmental Assessment

GHD reviewed the environmental constraints and opportunities in the study area that have the potential to influence the location and staging of the utilities and services infrastructure. This was undertaken to assist in identifying any major issues that may significantly constrain infrastructure development, or have the potential to influence the siting, staging and design of utility related infrastructure during future stages of design and development.

The constraints mapping task involved establishing a project specific GIS database which stores all of the spatial data used for the project in a standard Australian coordinate system, to allow information about constraints to be efficiently represented and analysed. The GIS database included both information provided by DP&I and publicly available data obtained by GHD. The database included the following layers:

- existing features
- terrestrial ecology
- soils
- flooding
- salinity
- geology
- land use
- heritage

Potential environmental constraints in the study area were mapped in the form of a series of constraints maps and are included in Appendix B.

The environmental issues which are considered most likely to constrain the development of utilities and services infrastructure are the presence of remnant native vegetation (endangered or critically endangered communities), major watercourses, and areas within the floodplain. However, the BWSEA is likely to be divided into a number of precincts to facilitate the staged

release of land for development. As a result, the environmental and social context in which the utilities and services infrastructure will be developed will differ from that which is currently present.

The landscape in the BWSEA will change significantly as rezoning and development progresses. Land ownership is likely to change from relatively large land holdings, with low density homes and agricultural buildings, to many smaller land holdings. Land use would change from predominantly rural residential, agriculture, and some industrial areas, to varying densities of commercial and industrial land use. In addition to utility and services infrastructure, infrastructure such as roads, water and wastewater will be substantially expanded as part of the BWSEA.

Depending on the changes to the environment that have already occurred when construction and operation of the utilities and services infrastructure occurs, the potential impacts may not necessarily occur. For example, some areas of vegetation may have already been cleared by other development related activities, such as constructing or widening roads.

The identification and mapping of constraints would be refined as the planning and development of the study area progresses. The precinct planning process would provide an opportunity to further refine information in relation to the presence and significance of existing constraints, particularly those relating to ecology and Aboriginal heritage.

High voltage electricity infrastructure would generate electric and magnetic fields (EMF). The issue of EMF and human health effects has been extensively reviewed over the past 30 years by Australian and international inquiries and expert panels have been established to try to determine whether or not human exposure to EMF is related to adverse health effects. To date, adverse health effects due to EMF have not been established. While EMFs involve both electric and magnetic components, electric fields are relatively constant over time, are readily shielded and, in the health context, are generally no longer associated with the same level of interest as magnetic fields.

Electricity supply authorities generally address EMF issues by adopting the principle of prudent avoidance which involves doing whatever can be done without undue inconvenience and at modest expense to avert the possible risk. The practice of prudent avoidance has been adopted by the (Australian) Energy Networks Association (ENA) and most Australian power utilities. Future planning would need to consider the potential for human health impacts associated with EMF and this adopting the principle of prudent avoidance would involve designing facilities to reduce the intensity of the fields generated, and locate them to minimise the fields that people, especially children, encounter over prolonged periods.

As the design and development of infrastructure progresses, detailed site-specific environmental impact assessments would be undertaken based on actual infrastructure proposals, in accordance with the assessment and approval requirements of the NSW *Environmental Planning and Assessment Act 1979*. As the planning for infrastructure in the study area progresses, consideration would need to be given to the likely approval process under State and Commonwealth legislation, such as the *Environmental Planning and Assessment Act 1979* and the EPBC Act. This would involve identifying potential environmental constraints that have the potential to influence the approvals process due to the likely nature of impacts. Future options development processes would need to consider alternative routes and construction methods that avoid environmental impacts where practicable.

8. Summary of Findings

The demands on utilities for an area the size of the BWSEA is significant. Therefore, significant network expansion will be required for all three utilities (electrical, telecommunications and gas). There are however opportunities unique to the BWSEA that will enable the area to be adequately serviced such as:

- The proximity of Transgrid transmission substations and Endeavour Energy zone substations;
- Proximity of the Jemena Gas Networks Hub;
- Current mobile network coverage;
- The BWSEA is essentially a greenfields site and utilities networks expansion can occur in conjunction with new roadway construction; and
- Ability to set aside land required for new utilities servicing infrastructure such as transmission and zone substations.

In summary, the BWSEA can be serviced as follows:

Electrical

- Provision of new electrical transmission substations and associated overhead transmission lines;
- Provision of new electrical zone substations and associated overhead/below ground electrical feeders; and
- Associated electrical reticulation network expansion.

Telecommunications

- Provision of new telephone exchanges;
- Provision of optic fibre cabling and associated NBN infrastructure; and
- Provision of wireless base stations.

Gas

- Extension to the existing secondary gas network into the BWSEA; and
- Associated gas reticulation network expansion.

The staging of infrastructure will depend on the rates of development over time. Telecommunications and gas infrastructure required to service the BWSEA can be readily provided in a progressive manner as development proceeds. Electrical servicing will require a more detailed planning approach with regards to infrastructure staging due to the lead times associated with the provision of new transmission and zone substations.

9. Disclaimer

This report: has been prepared by GHD for Department of Planning and Infrastructure and *may only be used and relied on by Department of Planning and Infrastructure for the purpose agreed between GHD and the Department of Planning and Infrastructure as set out in Section 1 of this report.*

GHD otherwise disclaims responsibility to any person other than Department of Planning and Infrastructure arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report.

GHD has prepared this report on the basis of information provided by Department of Planning and Infrastructure and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Appendices

Appendix A – Demand Analysis Basis

Technical Memorandum

Technical Memorandum

19 June 2013

To	Brent McLean		
Copy to			
From	Chris McDougall	Tel	2 8898 8858
Subject	Utility Demand Estimate Basis	Job no.	21/22526

1 Introduction

We refer to recent email and telephone correspondence regarding the BWSEA development yield and utility demand estimate basis. This Technical Memorandum summarises recent correspondence and outlines the basis for both the development areas that have been adopted and the utility demands estimates. Development yields and demand estimates have considered the following:

- Information within the Draft Structure Plan provided to GHD and some of the studies that have informed the Draft Structure Plan;
- Additional information provided to GHD for use in other studies currently being undertaken (traffic and transport, water); and
- The high level nature of the study and our experience in dealing with utility authorities and the information that they would deem relevant.

2 Development Yield and Development Rates

Table 1 summarises the developable area for each precinct and the rates of development over time. Developable area is defined as the known land area available for development. It is not necessarily the final net development area as final requirements for other infrastructure such as roads or open space is unknown. Using these known development areas for the purposes of estimating utility demands is therefore considered conservative. The areas correlate with those outlined in Section 5 of the Draft Structure Plan. Development rates over time are based on information provided to GHD and are the same as those being utilised for the traffic and transport planning of the Structure Plan.

3 Utility Demands

Where demand estimates are required to inform the servicing strategy development or discussions with authorities, they will be estimated based on the development and timing breakdown in Table 2.

Items to note with regards to Table 2:

- The breakdown of “light” industry and “heavy” industry has been determined by considering an existing precinct within the original Western Sydney Employment Area (Eastern Creek Business Park) and defining the existing developments in terms of light or heavy utility demands. It was found that approximately 8% of the total net development area of the business park had heavier utility

GHD Level 6, 20 Smith Street Parramatta NSW 2150 PO Box 788 Parramatta NSW 2124 Australia
T 61 2 8898 8800 F 61 2 8898 8810 E ptamail@ghd.com W www.ghd.com

demands than standard light industrial development. The same percentage of land across the entire BWSEA has been assumed to be “heavy” industry when determining utility demands.

- Where relevant or significant to a particular utility, other allowances have been made and are identified in Table 2 as follows:
  - Infra = allowances for infrastructure such as streetlighting or power demands of a sewage treatment plant for example;
  - In Precinct B an allowance has been made for the potential development of a “specialised centre” prior to 2046. Two potential specialised centres are nominated in the Draft Structure Plan. We note that the Urbis report (“BWSEA Economic Issues and Drivers Study, April 2013”) identifies a “commercial” demand of 230ha in the BSWEA. We have therefore adopted a “commercial” development type with an area of 115 ha to account for one potential specialised centre that may be developed prior to 2046.

4 Clarifications

Should any of the information used as the basis for determining development areas or utility demands be revised than we should be informed in order to assess their significance to any servicing strategy development.

Table 1: BWSEA Development Area and Development Rates Over Time

Precinct	Year				Total Land Area Available (Ha)
	2026	2036	2046	Beyond 2046	
	Cumulative Developable Land (Ha)	Cumulative Developable Land (Ha)	Cumulative Developable Land (Ha)	Cumulative Developable Land (Ha)	
A	1,750	1,750	1,750	1,750	1,750
B	164	328	493	493	493
C	362	724	1,087	1,732	1,732
D	75	150	225	823	823
E	25	50	75	407	407
F	-	-	-	-	1,674
G	66	166	200	1,200	1,200
Total excl. Precinct A (WSEA)	692	1,418	2,080	4,655	6,329
TOTAL incl. Precinct A (WSEA)	2,442	3,168	3,830	6,405	8,079

Table 2: BWSEA Development Area and Development Rates Over Time

Precinct	Year															Total Developable Land Available (Ha)
	2026			2036				2046				Beyond 2046				
	Cumulative Developable Land Available - Light Industrial (Ha)	Cumulative Developable Land Available - Heavy Industrial (Ha)	Other allowances	Cumulative Developable Land Available - Light Industrial (Ha)	Cumulative Developable Land Available - Heavy Industrial (Ha)	Cumulative Developable Land - Commercial (Ha)	Other allowances	Cumulative Developable Land Available - Light Industrial (Ha)	Cumulative Developable Land Available - Heavy Industrial (Ha)	Cumulative Developable Land - Commercial (Ha)	Other allowances	Cumulative Developable Land Available - Light Industrial (Ha)	Cumulative Developable Land Available - Heavy Industrial (Ha)	Cumulative Developable Land - Commercial (Ha)	
A	1,610	140	Infra	1,610	140		Infra	1,610	140		Infra	1,610	140		1,750
B	151	13	Infra	196	17	115	Infra	348	30	115	Infra	348	30	115	493
C	333	29	Infra	666	58		RO	1,000	87		Infra	1,593	139		1,732
D	69	6	Infra	138	12		Infra	207	18		Infra	757	66		823
E	23	2	Infra	46	4		Infra	69	6		Infra	374	33		407
F	-	-	Infra	-	-		Infra	-	-		Infra	-	-		1,674
G	61	5	Infra	153	13		Infra	184	16		Infra	1,104	96		1,200
Total (excl WSEA)	637	55	-	1,199	104	115	-	1,808	157	115		4,177	363	115	6,329
TOTAL (incl. WSEA)	2,247	195	-	2,809	244	115	-	3,418	297	115		5,787	503	115	8,079
TOTAL (all dev. types)			2,442				3,168				3,830			6,405	

GHD Level 6, 20 Smith Street Parramatta NSW 2150 PO Box 788 Parramatta NSW 2124 Australia
T 61 2 8898 8800 F 61 2 8898 8810 E ptamail@ghd.com W www.ghd.com

Table 2 Notes

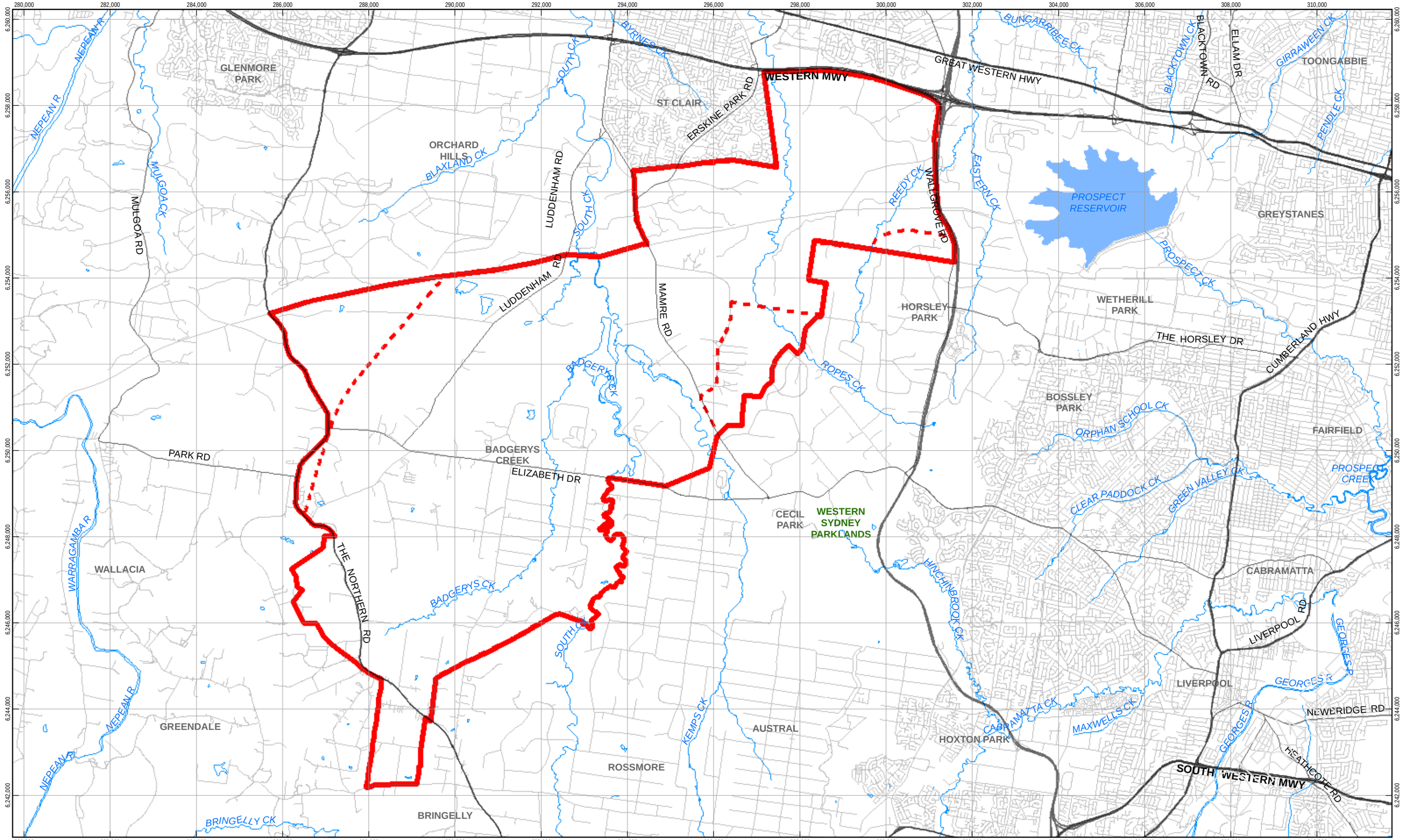
1. Adopted 8% heavy industry/"higher energy" for such development as a cold storage facilities based on analysis of Eastern Creek Business Park Stage 1-3 facility types
2. RO = Reverse Osmosis wastewater treatment plant
3. Infra = make nominal allowance for infrastructure loadings such as streetlighting, sewage pumping stations etc
4. 115ha of commercial development allowed for in Precinct B to account for one "specialised centre" that has the potential to be developed by 2036. 115ha derived from half of 230ha of commercial development demand nominated in Urbis Economic Issues and Drivers Study, april 2013.

Regards

Chris McDougall
Civil Engineer

GHD Level 6, 20 Smith Street Parramatta NSW 2150 PO Box 788 Parramatta NSW 2124 Australia
T 61 2 8898 8800 **F** 61 2 8898 8810 **E** ptamail@ghd.com **W** www.ghd.com

Appendix B – Environmental Constraints Maps



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Highway
- Main Roads
- Roads
- Proposed boundary adjustment
- Broader WSEA Study Area
- Waterways
- Lakes, Ponds and Dams

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number 21-22276
Revision A
Date 09 Sep 2013

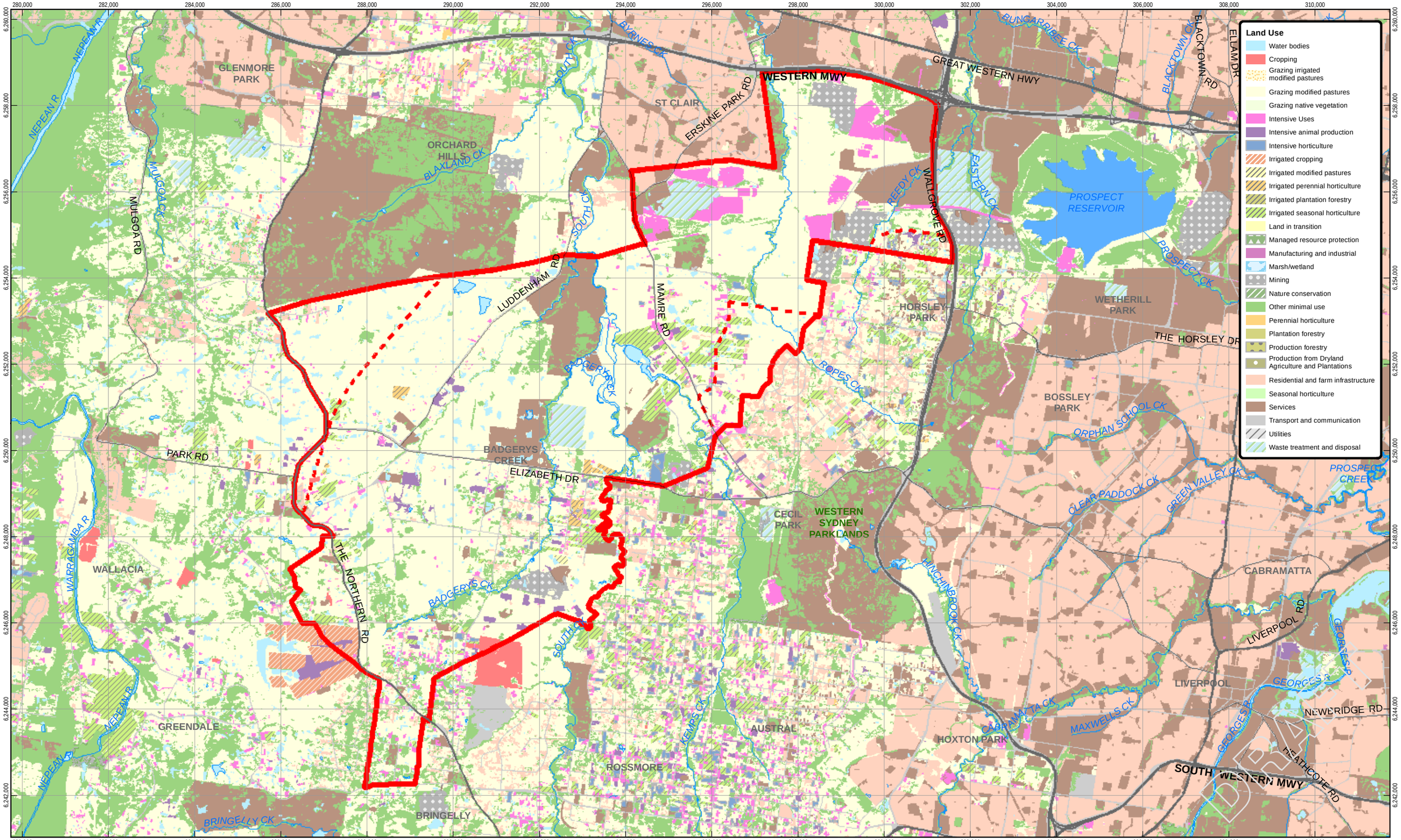
Base Map

Map 1

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z001_Basemap.mxd

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011: LanSAT Image 2013; Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Proposed boundary adjustment
- Broader WSEA Study Area
- Waterways
- Lakes, Ponds and Dams
- Highway
- Main Roads

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number	21-22276
Revision	A
Date	09 Sep 2013

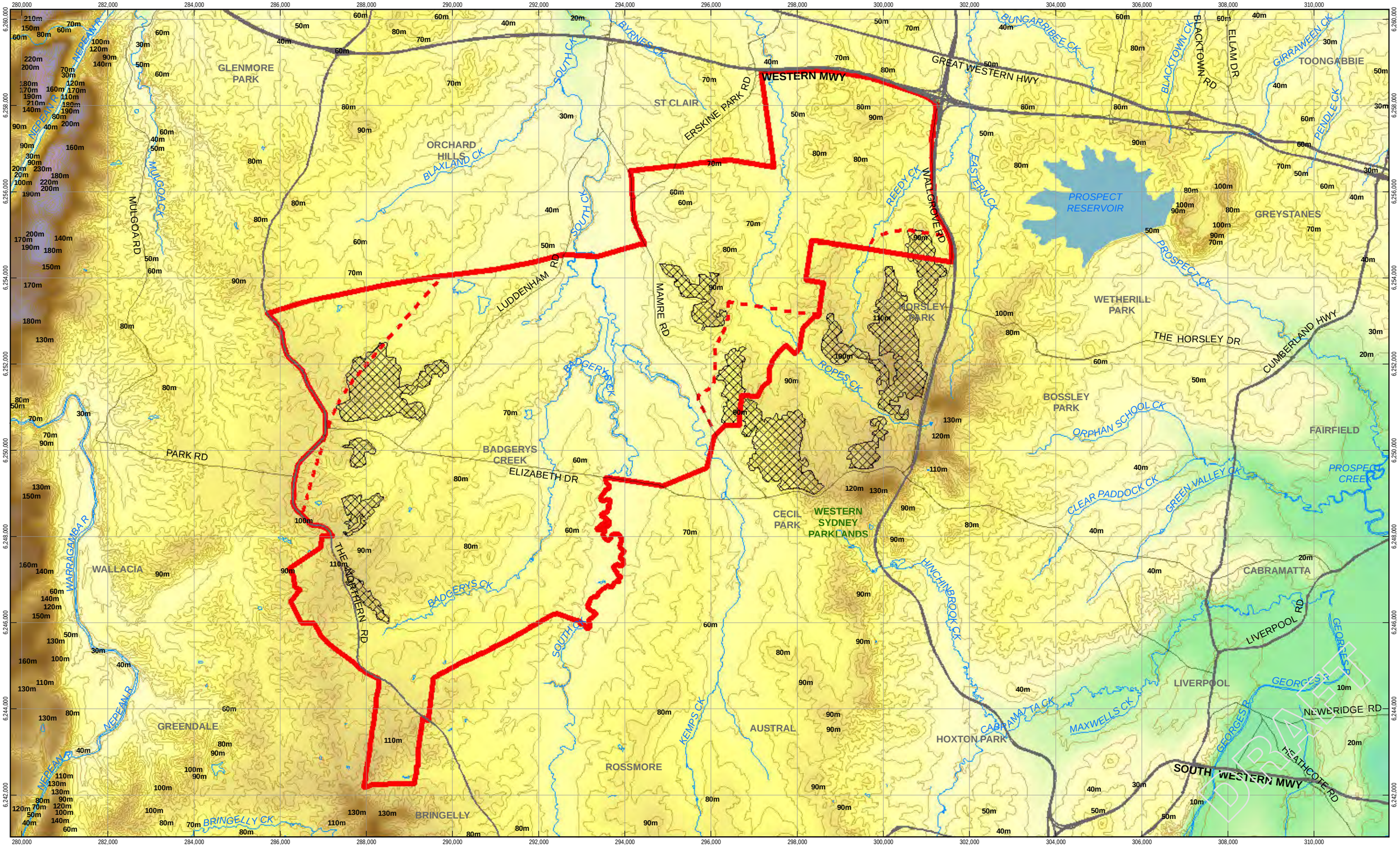
Existing Land Use

Map 2

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z007_LandUse.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Highway
- Main Roads
- Proposed boundary adjustment
- Broader WSEA Study Area
- Waterways
- Lakes, Ponds and Dams
- Areas where slope is greater then 10%
- 5m Contour
- High : 399.137
- Low : -10.1429

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number	21-22276
Revision	A
Date	09 Sep 2013

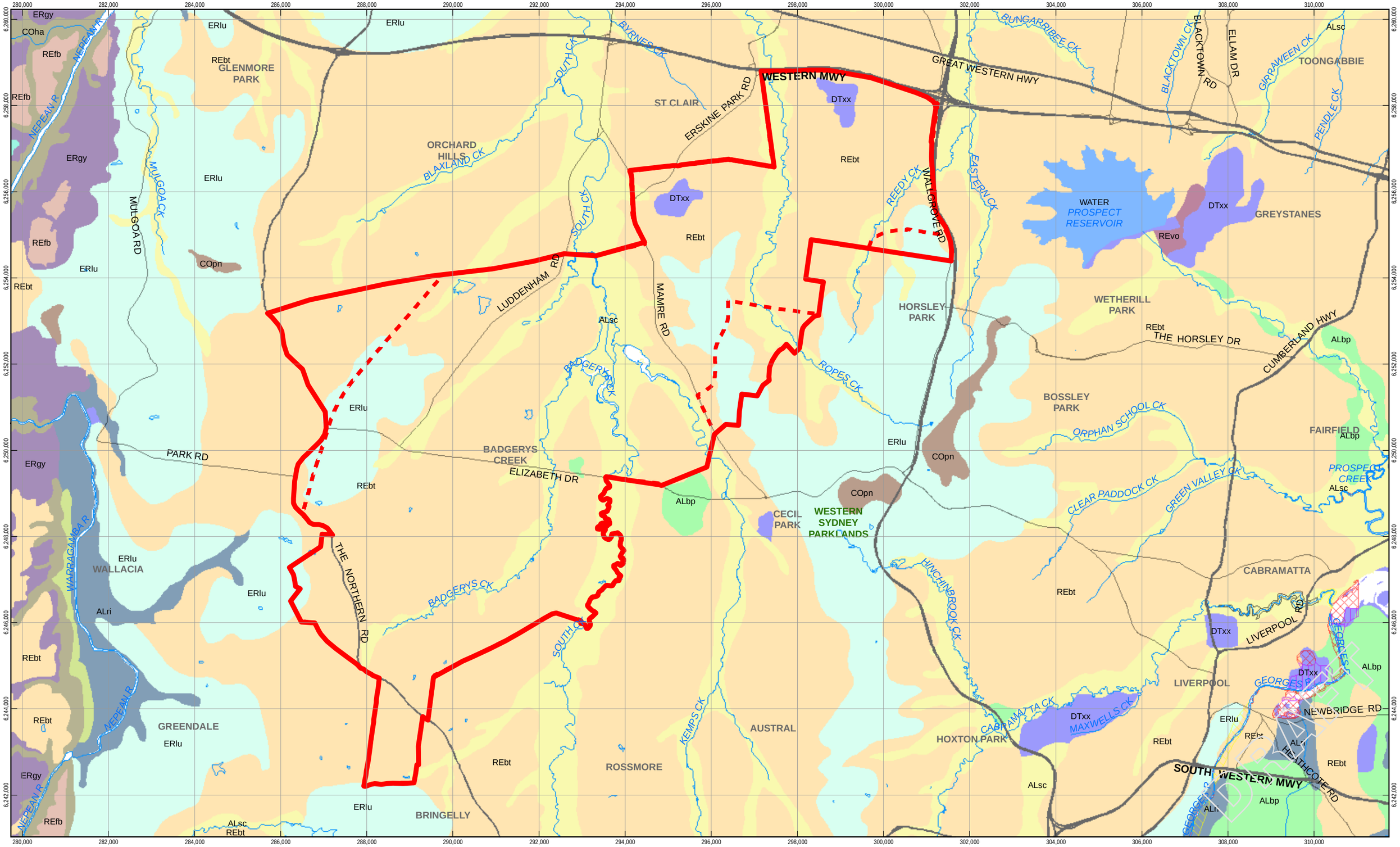
Topography

Map 3

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z005_Topography.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- bp, BERKSHIRE PARK, ALLUVIAL
- bt, BLACKTOWN, RESIDUAL
- fb, FAULCONBRIDGE, RESIDUAL
- gy, GYMEA, EROSIONAL
- ha, HAWKESBURY, COLLUVIAL
- hw, HAZELWOOD, COLLUVIAL
- lh, LUCAS HEIGHTS, RESIDUAL
- lu, LUDDENHAM, EROSIONAL
- pn, PICTON, COLLUVIAL
- ri, RICHMOND, ALLUVIAL
- sc, SOUTH CREEK, ALLUVIAL
- vo, VOLCANIC, RESIDUAL
- xx, DISTURBED TERRAIN, DISTURBED TERRAIN

Acid Sulphate Soil

- High probability of occurrence
- Low probability of occurrence
- Disturbed Terrain
- No known occurrence

- Highway
- Main Roads
- Waterways
- Lakes, Ponds and Dams
- Proposed boundary adjustment
- Broader WSEA Study Area

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number 21-22276
Revision A
Date 09 Sep 2013

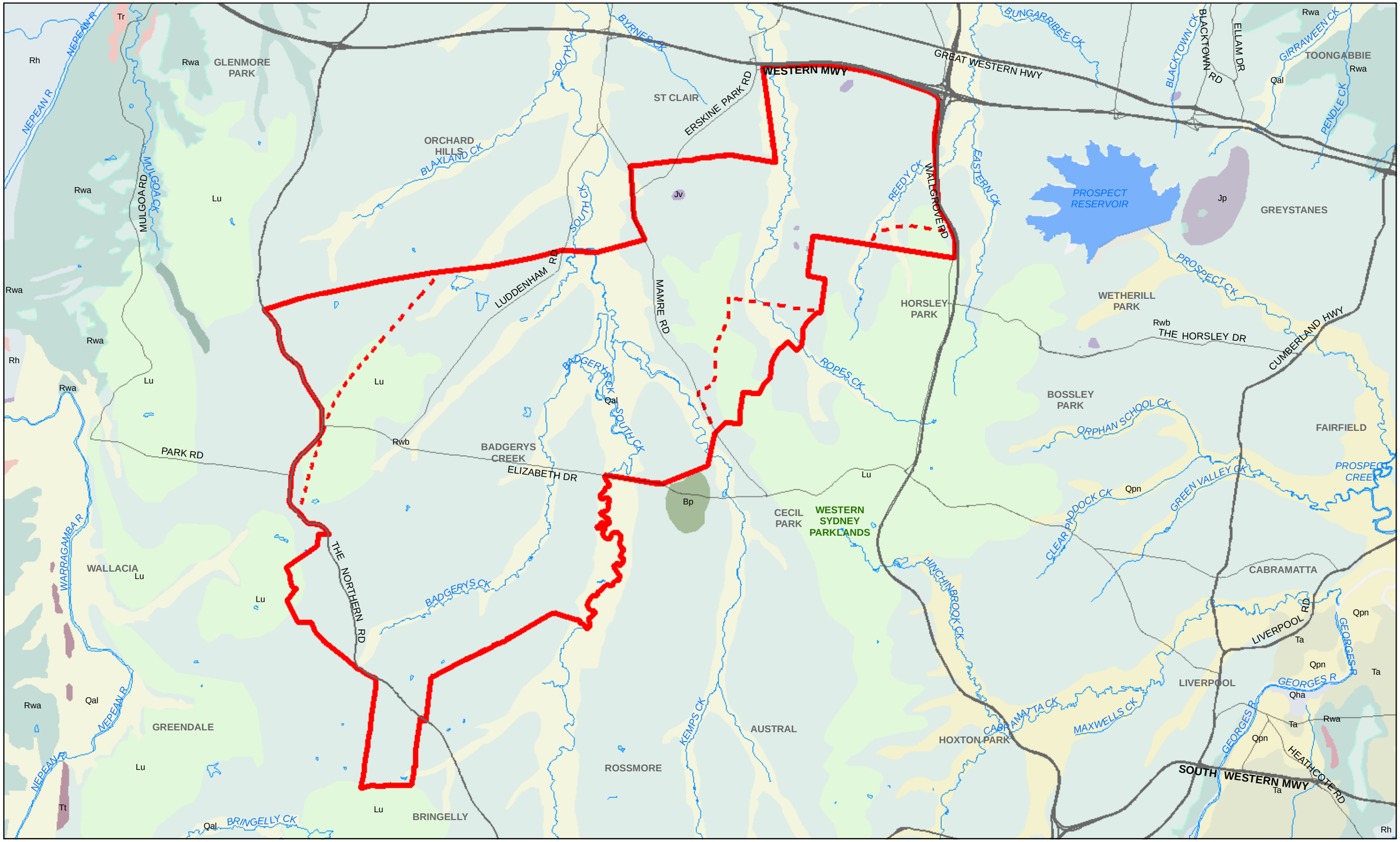
Soils Types

Map 4

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z001_Soils.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

Geology

Bp, Jp, Jv, Lu, Qal, Qha, Qpc, Qpn, Rh, Rwa, Rwb, Rwm, Ta, Tc, Tr, Tt, mf/Rwb

Highway
Main Roads
Waterways
Lakes, Ponds and Dams
Proposed boundary adjustment
Broader WSEA study area

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number	21-22276
Revision	A
Date	09 Sep 2013

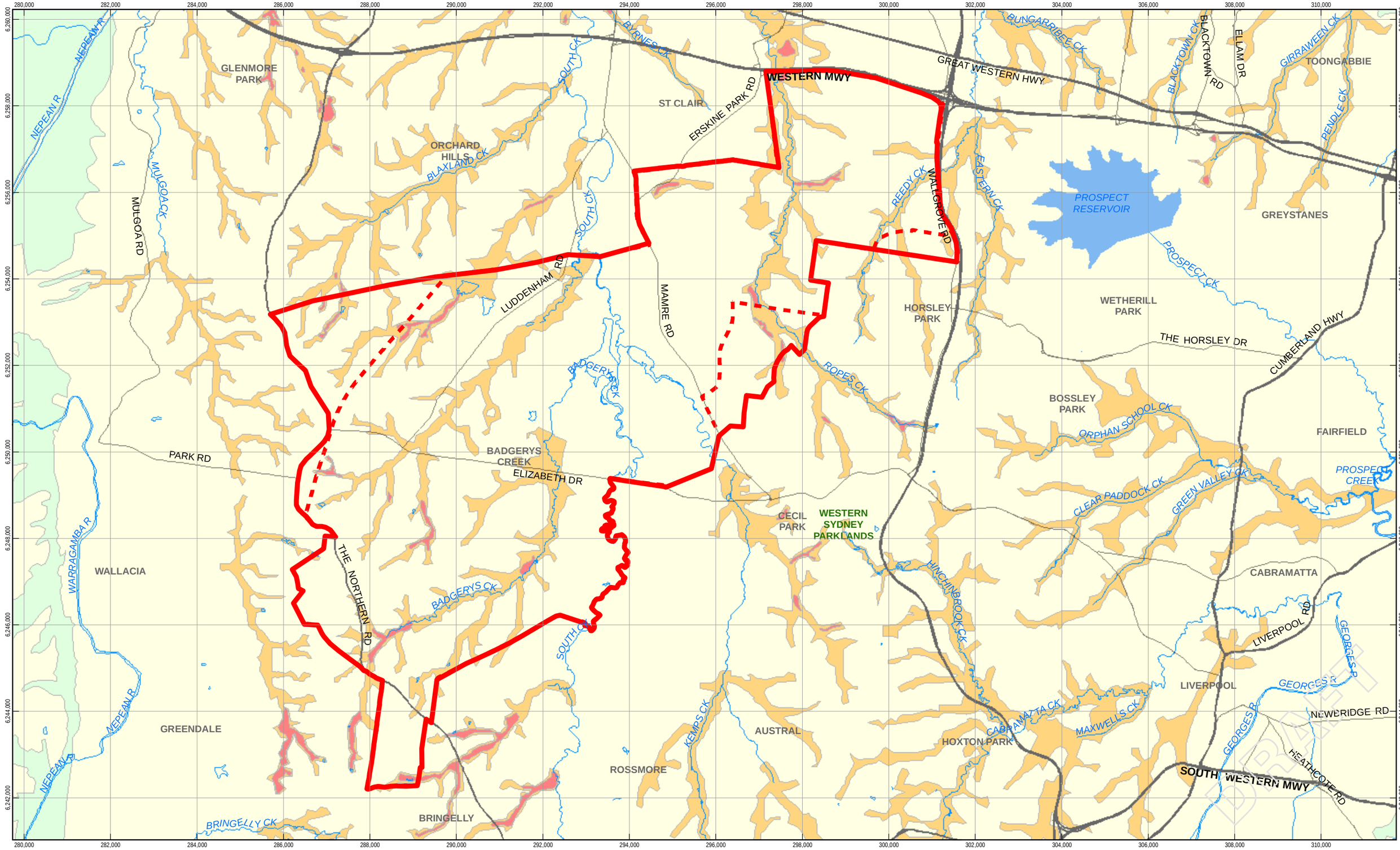
Geology

Map 5

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z004_Geology.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

Soil Salinity Hazards

- Areas of Known Salinity
- Areas of Extensive Salinity Hazard
- Areas of Localised Hazard
- Areas of no Known Hazard

- Highway
- Main Roads
- Waterways
- Lakes, Ponds and Dams

- Broader WSEA Study Area
- Proposed boundary adjustment

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number	21-22276
Revision	A
Date	09 Sep 2013

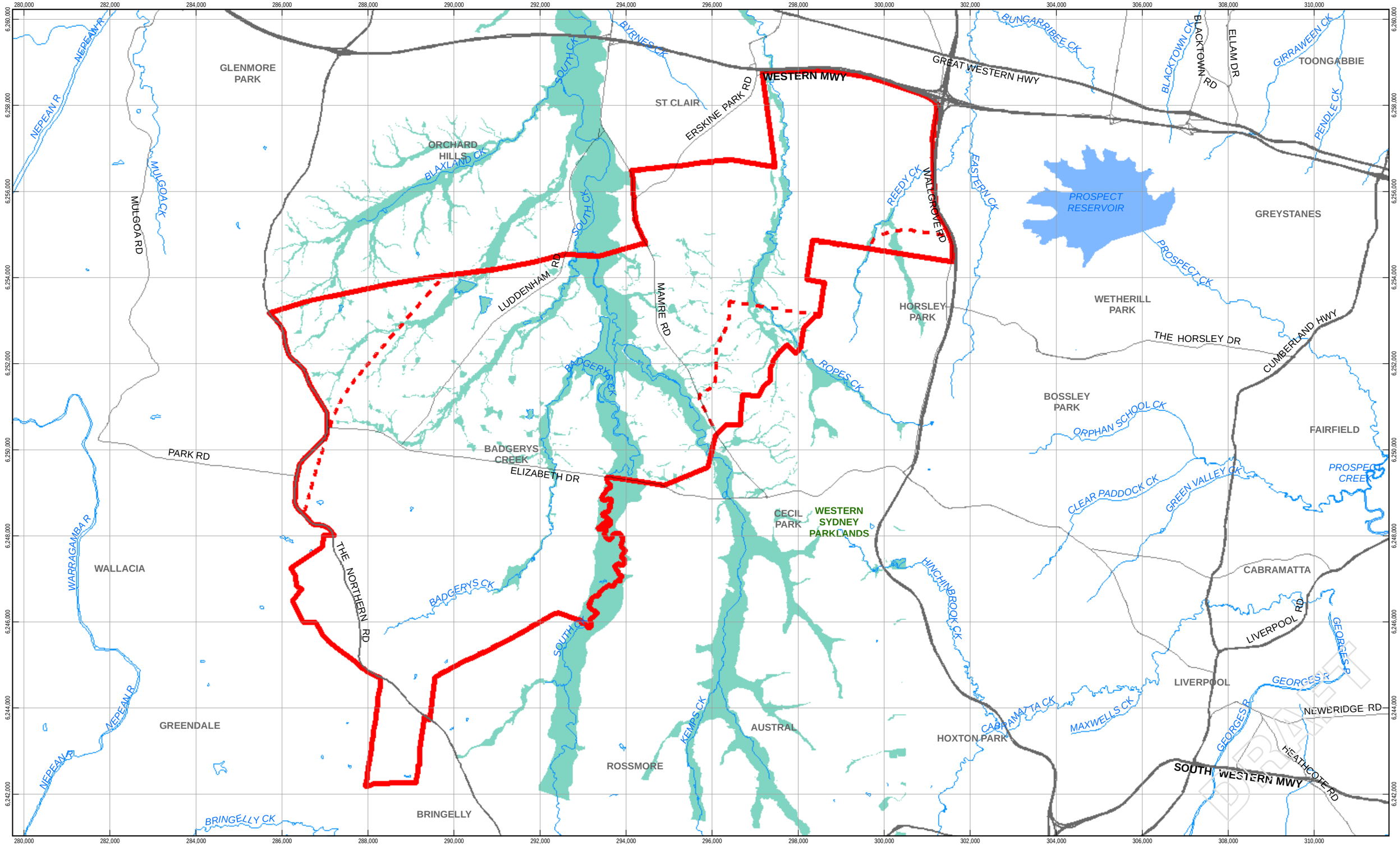
Soil Salinity

Map 6

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z008_Soils_Salinity.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Highway
- Main Roads
- Proposed boundary adjustment
- Broader WSEA study area
- Waterways
- 1 percent flooding region
- Lakes, Ponds and Dams

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number	21-22276
Revision	A
Date	09 Sep 2013

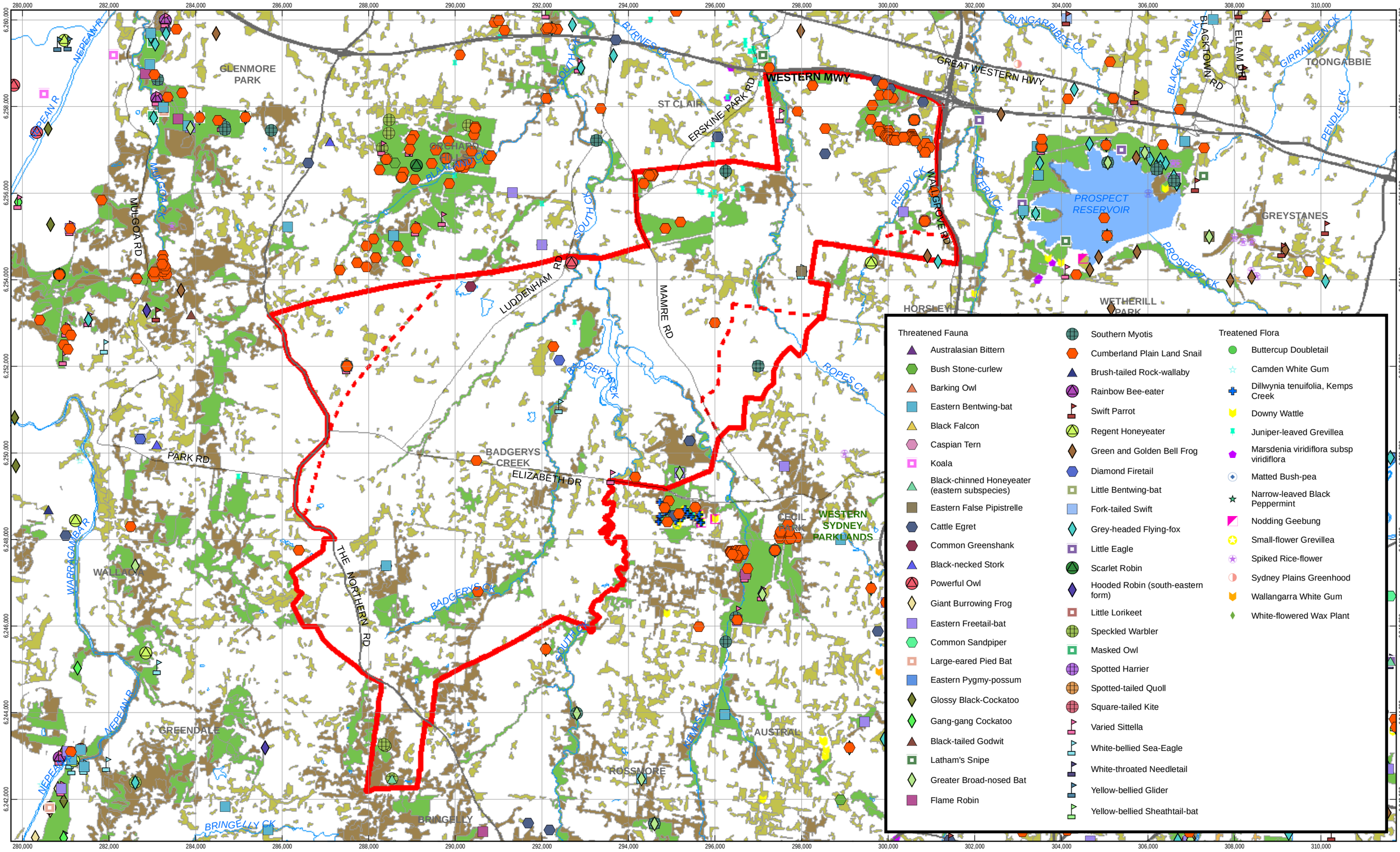
Flooding

Map 7

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z003_Flooding.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Threatened Fauna

- Australasian Bittern
- Bush Stone-curlew
- Barking Owl
- Eastern Bentwing-bat
- Black Falcon
- Caspian Tern
- Koala
- Black-chinned Honeyeater (eastern subspecies)
- Eastern False Pipistrelle
- Cattle Egret
- Common Greenshank
- Black-necked Stork
- Powerful Owl
- Giant Burrowing Frog
- Eastern Freetail-bat
- Common Sandpiper
- Large-eared Pied Bat
- Eastern Pygmy-possum
- Glossy Black-Cockatoo
- Gang-gang Cockatoo
- Black-tailed Godwit
- Latham's Snipe
- Greater Broad-nosed Bat
- Flame Robin
- Southern Myotis
- Cumberland Plain Land Snail
- Brush-tailed Rock-wallaby
- Rainbow Bee-eater
- Swift Parrot
- Regent Honeyeater
- Green and Golden Bell Frog
- Diamond Firetail
- Little Bentwing-bat
- Fork-tailed Swift
- Grey-headed Flying-fox
- Little Eagle
- Scarlet Robin
- Hooded Robin (south-eastern form)
- Little Lorikeet
- Speckled Warbler
- Masked Owl
- Spotted Harrier
- Spotted-tailed Quoll
- Square-tailed Kite
- Varied Sittella
- White-bellied Sea-Eagle
- White-throated Needletail
- Yellow-bellied Glider
- Yellow-bellied Sheathtail-bat

Treatened Flora

- Buttercup Doubletail
- Camden White Gum
- Dillwynia tenuifolia, Kemps Creek
- Downy Wattle
- Juniper-leaved Grevillea
- Marsdenia viridiflora subsp viridiflora
- Matted Bush-pea
- Narrow-leaved Black Peppermint
- Nodding Geebung
- Small-flower Grevillea
- Spiked Rice-flower
- Sydney Plains Greenhood
- Wallangarra White Gum
- White-flowered Wax Plant

Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

Significant Vegetation

- Core Habitat
- Other Remnant Vegetation
- Support to Core Habitat
- Urban Remnant Trees (Critically Endangered Community)

- Highway
- Main Roads
- Waterways
- Lakes, Ponds and Dams

- Broader WSEA Study Area
- Proposed WESA Study Area

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number	21-22276
Revision	A
Date	09 Sep 2013

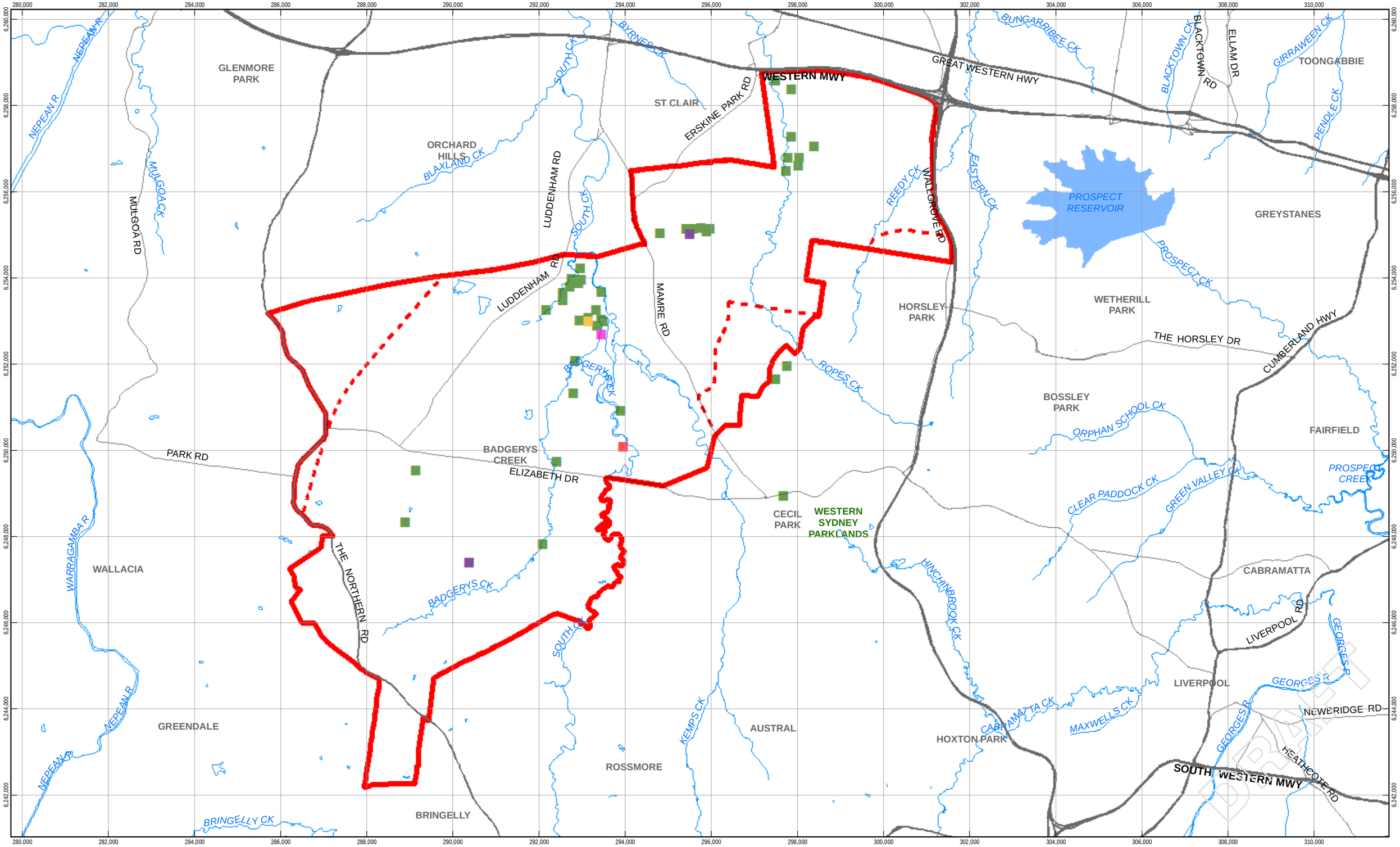
Ecology and Threatened Flora

Map 8

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z002_Ecology_And_Threatened_Flora.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Axe Grinding Groove
- Isolated Find
- Open Camp Site
- Open Camp Site, Scarred Tree
- Scarred Tree
- Highway
- Main Roads
- Proposed boundary adjustment
- Broader WSEA study area
- Waterways
- Lakes, Ponds and Dams

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number 21-22276
Revision A
Date 09 Sep 2013

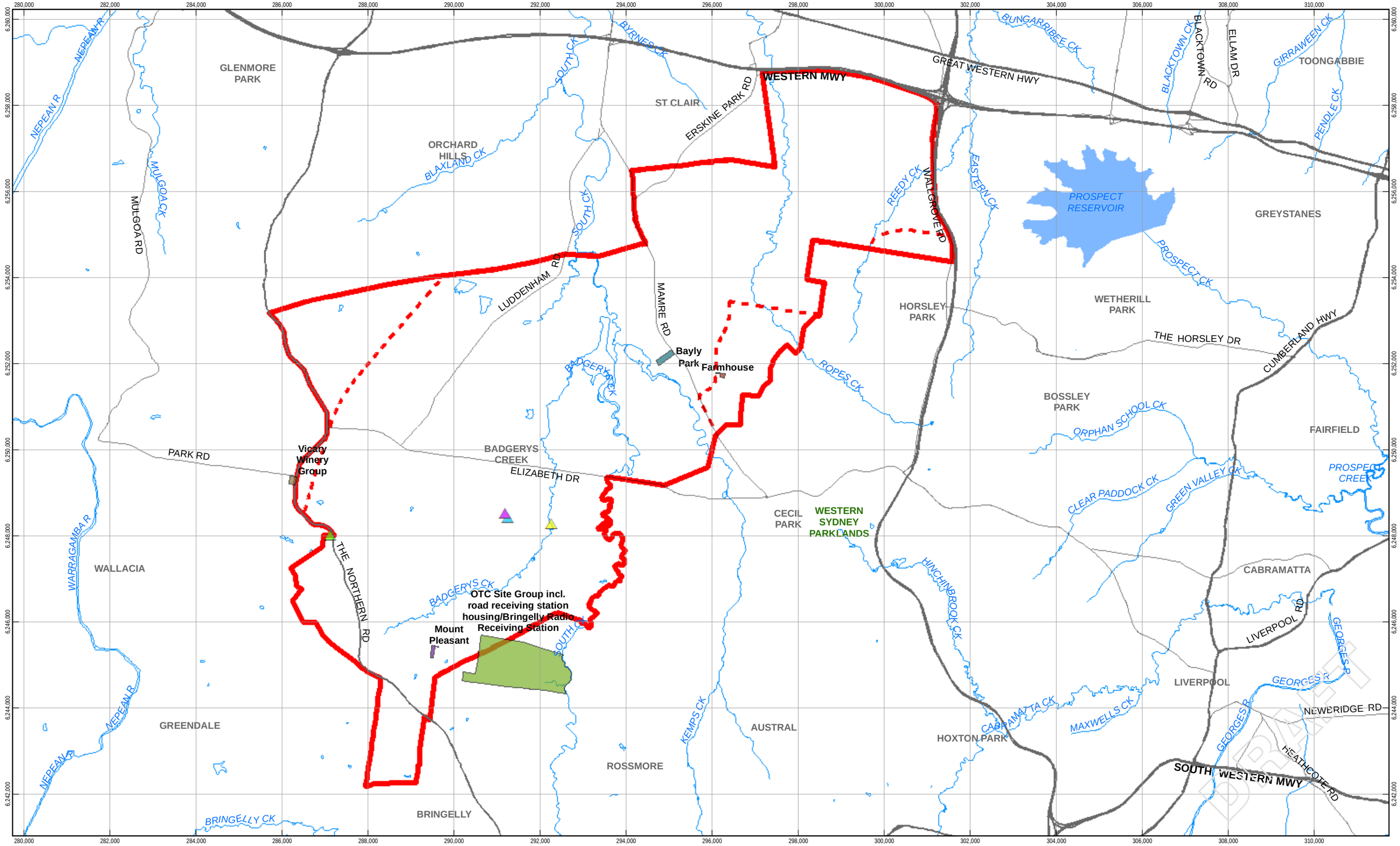
Aboriginal Heritage

Map 9

G:\21\22276\GIS\GHD\Maps\MXD\21_22276_Z004_Aboriginal_Heritage.mxd

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au



Paper Size A3

0 0.5 1 2 3 4

Kilometers

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

N

LEGEND

- Badgerys Creek Public School
- Lawson's Inn Site
- Road Bridge
- St Johns Anglican Church Group and Cemetry (approx)
- Bayly Park
- Farmhouse
- Mount Pleasant
- OTC Site Group incl. road receiving station housing/Bringelly Radio Receiving Station
- Vicary Winery Group
- Highway
- Main Roads
- Waterways
- Lakes, Ponds and Dams
- Broader WSEA Study Area
- Proposed boundary adjustment

Department of Planning and Infrastructure
Broader Western Sydney Employment Area

Job Number	21-22276
Revision	A
Date	09 Sep 2013

Non Indigenous Heritage

Map 10

Data Source: Department of Planning and Infrastructure Jan 2013 . Created by: sdwoodger

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

GHD

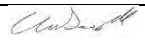
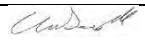
133 Castlereagh St Sydney NSW 2000

-

T: +61 2 9239 7100 F: +61 2 9239 7199 E: sydmail@ghd.com.au

n:\au\sydney\projects\21\22526\WP\193380.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0 Draft	F. Palermo G. Mascord R. Romanous	C. McDougall		S. Konstas		13/09/13
1	F. Palermo G. Mascord R. Romanous	C. McDougall		S. Konstas		29/10/13

www.ghd.com