ASSESSMENT | PLANNING | MANAGEMENT

Ecological Assessment

Potts Hill Reservoirs Site Part 3A Concept Plan
(Project No. 029-046)

Report prepared for
Landcom

May 2008

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1. Introduction

This *Ecological Assessment Report* has been prepared to support the Concept Plan for the Potts Hill Reservoirs site. Landcom and Sydney Water Corporation (SWC) are seeking a rezoning of the site to enable redevelopment of the surplus land for a combination of residential, public open space, and employment uses. Rezoning and development approval are sought under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) and *State Environmental Planning Policy (Major Projects) 2005*.

This document, and accompanying technical appendices, provide required supporting information with respect to the biodiversity of the site as specified by the Minister of Planning and relevant agencies in the Director General's requirements for the proposed Concept Plan application.

This report describes the natural environment of the proposed development site and considers the potential impacts of the project on threatened flora and fauna and their habitats. Information is provided on the ecological values of the site, current and proposed uses and proposed ecological outcomes under the Concept Plan. The potential for future impacts is assessed, proposed impact mitigation and offset strategies to ameliorate or counterbalance these impacts are considered, and an assessment of the proposal against the 'maintain or improve' principle, as required under Part 3A of the EP&A Act, is provided.

This document broadly follows a structure and indicative content set out in the Draft Guidelines for Threatened Species Assessment under Part 3A prepared by Department of Environment and Climate Change, and Department of Primary Industries (DECC & DPI, 2005).

1.1 Study Site Location

The study site is located in the northern part of the Bankstown Local Government Area (LGA). It is adjoined by the residential suburbs of Birrong (to the west), Yagoona (south), Chullora (east), and Regents Park (north) (see Figure 1). The centre of the site is approximately at latitude 150.92, and longitude -33.80.

The site is currently zoned Special Uses 5 under *Bankstown Local Environmental Plan (LEP) 2001,* and 5(a) Special Uses under *Auburn Local Environmental Plan 2000*. It has a history of use for water supply to the Sydney metropolitan area since the late 1800s. It is owned and managed by Sydney Water Corporation (SWC). Further details of the site are provided in section 2 of this report.

1.2 Description of Project

Sydney Water has identified that there is land surplus to its requirements at the Potts Hill site. The proposed land uses for both the identified surplus and retained lands are described in section 3 of this report.

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1.3 Background

1.3.1 Surplus land investigations

SWC and Landcom have undertaken a review of land holdings at the Potts Hill Reservoirs site. Approximately 40 hectares of the total 116 hectare site have been identified as surplus to SWC's needs. SWC and Landcom entered into a project delivery agreement (PDA) to investigate the development potential of these surplus lands. The remainder of the site (76ha) is to be retained by SWC, which will continue to utilise this area for water supply purposes (Figure 2).

1.3.2 Environmental assessments

Landcom arranged for a number of specialist investigations of the site, including ecological, heritage, geotechnical, environmental/contamination, traffic and planning, as part of an early economic and risk analysis (EERA) process for the main body of the Potts Hill site. This culminated in a concept Structure Plan for the surplus land in September 2006.

Subsequent to the EERA process, additional lands to the north of the main body of the Potts Hill site, adjacent to Bagdad Street, were investigated for ecological constraints, and were subsequently included in this proposal.

The, scoping investigations into the ecology of the Potts Hill site by Eco Logical Australia identified the presence of endangered ecological communities and threatened species.

In parallel, Sydney Water sponsored investigations into the condition of the soil. These found areas of minor contamination originating from the initial construction of the two Potts Hill Reservoirs and subsequent site management practices. Remediation of some areas will be needed.

In the context of assessing the potential development and proposed remediation works, it was found that some areas of vegetation on the site that had moderate to high conservation value would be adversely affected by the proposal. A portion of the lands to be retained by Sydney Water was identified as an offset site suitable for environmental management works, to compensate for the loss of vegetation within the future development area.

This assessment draws on the results of previous studies of the site, the EERA investigations, the subsequent additional investigation of the Bagdad Street site including additional targeted threatened species survey. A summary of the methodology used is provided in section 6 (full details are provided in Appendix 1). A separate application for approval under the EPBC Act will be lodged.

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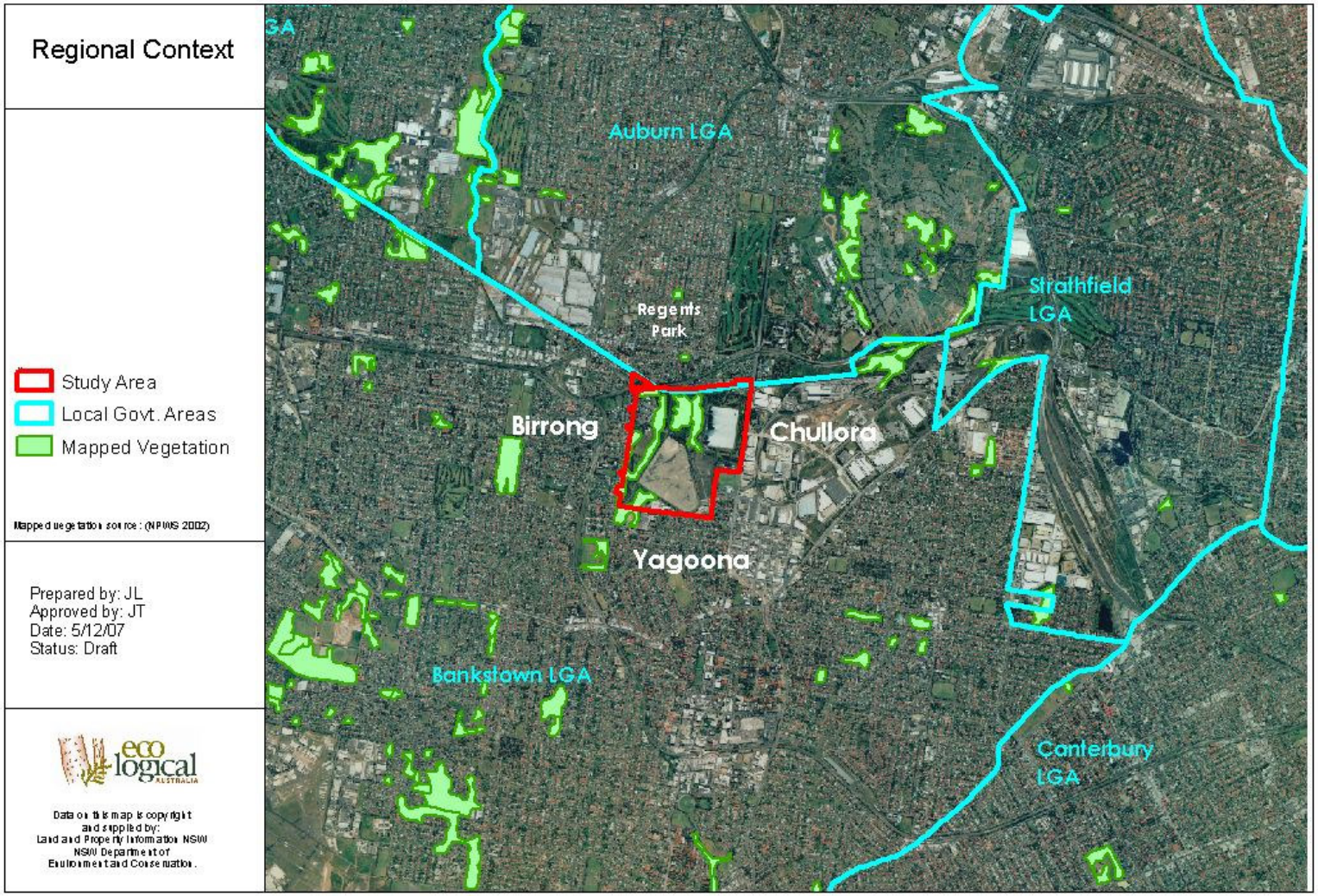

Figure 1. Regional context of the subject site showing remnant vegetation in the surrounding area.

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2. Land Covered by the Concept Plan

2.1 Site History

European settlement in the region commenced in 1798 with a settlement of marines near the junction of the Georges River and Prospect Creek. Subsequently, Land Grants, and use of lands for agriculture, were a feature of the area.

The site was established for use as a reservoir in 1888, with installation of the water supply mains and the screening facilities. Since that time it has continued to be used for that purpose, with two large water reservoirs, and associated infrastructure, constructed on site. Although the site still has a crucial role in Sydney's water storage and management, Reservoir 1 (in the northwest) is no longer used for water storage purposes. Further details of the site's history are available in the Conservation Management Plan for the site (Sydney Water Corporation 2005).

2.2 Site Description

The Potts Hill site is situated on a gently sloping hilltop. The high point of the site is situated between the two reservoirs and is approximately 66m asl. The main body of the site is 116ha in size. An additional 0.7ha is contained within the Bagdad Street site located north of the freight rail line.

The eastern half of the site drains to the Cooks River while the western half drains to Duck River. There are no recognised rivers within the site, and acid sulphate soils do not occur within the site or immediate surrounds.

Vegetation on site comprises remnant or regenerating stands of open forest/woodland in varying condition, remnant native trees with a mown understorey and planted native and exotic trees, including some identified as of cultural heritage significance.

The site also contains a variety of water management infrastructure associated with SWC's current operations on site as described below.

2.3 Current Uses

The site is currently managed by SWC for water supply purposes. Infrastructure present on the site includes Reservoir 1 (though most elements of Reservoir 1 are no longer operational), Reservoir 2, which is protected by a bladder, and utilised to store water, ancillary water delivery infrastructure (pipelines and canals) pump stations, and a variety of maintenance and administration buildings in the south, northeast, and northwest of the site. A water supply pipeline is also present, with major distribution pipelines running generally in an east-west direction along the northern boundary of the site.

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3. Proposed Land Use

3.1 Proposed Development of Surplus Lands

Proposed development areas within the surplus lands are described below and illustrated in Figure 2.

3.1.1 Residential Development

Residential development, incorporating open space areas, is proposed for the western side of the site (24.9ha), including the small parcel of land accessed from Bagdad Street.

Areas of open space will be located in the west section of the site (see Figure 2 – 'Open Space'). Both planted heritage trees and remnant native vegetation will be retained within these areas. A large area of open space is proposed be located in the southwest of the site. Remnant native vegetation in this area will be retained.

Remaining native vegetation within the residential development areas will be retained where possible and incorporated into the development design and landscaped areas (e.g. street trees, within yard space for dwellings, etc.).

3.1.2 Employment Land

Land in the southeast of the site (15.3ha) is proposed for employment-related development. The employment area will include a SWC operations facility.

3.2 Retained Land

The retained land (Figure 2) will remain under SWC ownership and will continue to be used principally for ongoing water management activities. SWC has taken a proactive and strategic approach in identifying the long term use and management of the retained lands to provide for current and future operational needs and positive ecological outcomes.

Within the lands to be retained by Sydney Water, two stands of remnant vegetation in the northern and southwest sections of the site will be retained (Figure 2). A number of ecological outcomes are proposed, including the rehabilitation and restoration of the retained native vegetation, and the creation of an ecological corridor (30m width) to the west of Reservoir 2 to promote functional connectivity between the retained stands of vegetation (Figure 3).

These ecological outcomes will need to integrate with Sydney Water's continued use of the site for water management purposes. For example the water supply pipeline and associated infrastructure in the north of the site will continue to be used for water supply, necessary access roads and tracks within the ecological footprint will be retained, and administration buildings may also continue to be utilised.

An Environmental Management Plan and Vegetation Management Plan are to be prepared for the retained lands to enable SWC to undertake operational activities in a manner that protects the natural environment values of the site, and to meet its

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legislative obligations and commitments to the rehabilitation and conservation of areas of retained vegetation.

To provide greater certainty with respect to the security of ecological outcomes over the longer term on site, SWC has identified two potential future use areas within the retained lands that may be required to meet the operational needs for water management infrastructure over the next 10-20 years (Figure 2).

These sites have been strategically located within areas of lower ecological value to reduce the potential for adverse impacts on the natural environment. Native vegetation within these potential future use areas will be managed for weed control in the interim period to assist in protecting adjoining retained native vegetation. Consideration will also be given to the potential for the retention of native vegetation and/or supplementary planting within buffer zones in appropriate areas if future development is required.

SWC has identified the area of land between Reservoir 1 and Rookwood Road as a possible site for future vegetation rehabilitation. This would include extensive weeding and supplementary plantings of indigenous plants. This area contains planted native and exotic trees, as well as exotic weeds, and is currently of low ecological value. Given its low ecological value, this area was not surveyed for this report and has not been included in the current 'maintain or improve' assessment for the retained lands. However, it provides an opportunity for future ecological gains (approx. 3.5 ha) on site through proposed weeding, and the provision of supplementary habitat for native fauna (such as birds and bats) through native vegetation plantings.

It is envisaged that this area of the retained lands will be included in more detailed weed surveys and planning undertaken for the preparation of the Vegetation Management Plan (VMP) for the site. It will also be incorporated into the lands subject to the VMP.

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Figure 2. Proposed future land use zones on the Potts Hill site.

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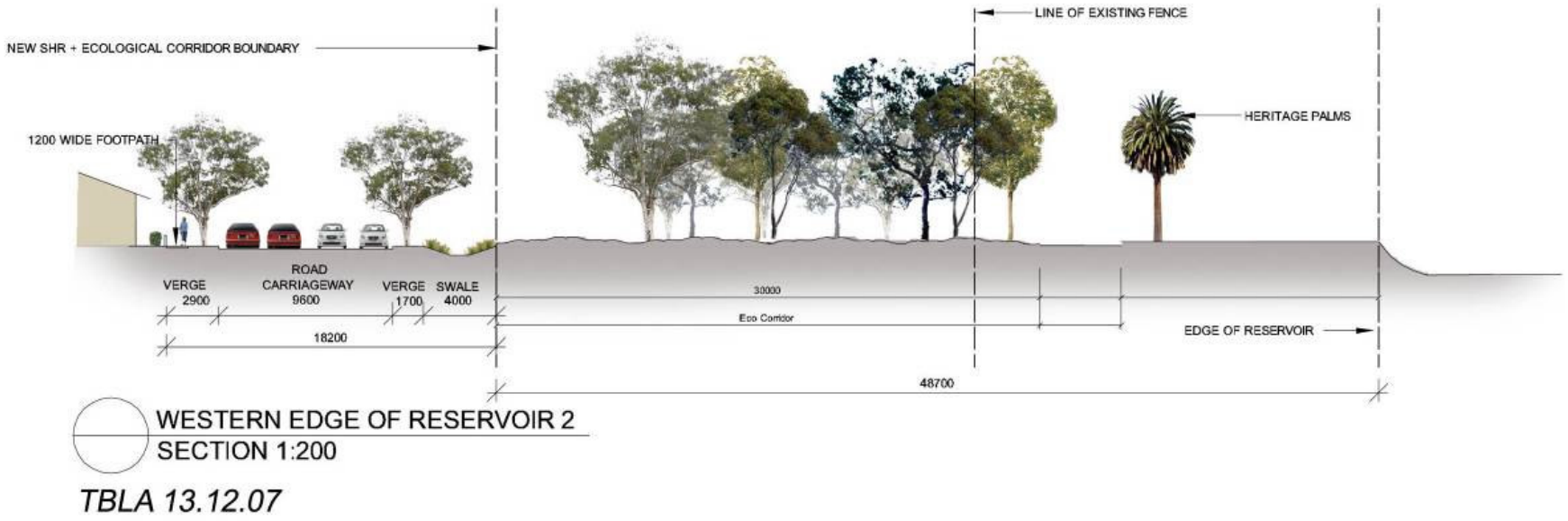

Figure 3. Cross Section of proposed ecological corridor (width = 30m).

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4. Environmental Outcomes

The proposed Concept Plan for the Potts Hill site seeks to achieve the environmental outcomes illustrated in Figure 2.

The specific ecological outcomes proposed are:

- Protection and enhancement (rehabilitation) of native vegetation communities on the retained lands
- Restoration of vegetation communities in selected areas to consolidate or link currently fragmented native vegetation
- Creation of an ecological corridor to link areas of retained native vegetation thus enhancing their long term viability and integrity (Figure 3).
- Protection of threatened plant species and areas of habitat
- Improvements to habitat quality for certain threatened fauna species
- Provision for ongoing vegetation management within the retained land by Sydney Water, and integrating these management outcomes with continued water management activities

To provide security for proposed ecological outcomes SWC has made the following commitments:

- The restriction of future water management infrastructure potentially required over the next 10-20 years to identified future use areas;
- The preparation of an environmental management plan and vegetation management plan for retained lands for implementation on site;
- Implementation of the vegetation management plan over a 5 year period; and
- Allocation of appropriate funding to ensure the success of management actions for the retained land, including for the vegetation management works for the proposed 5 year period.

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5. Legislative and Policy Framework

This section provides a brief review of the legislation and policy framework relevant to the management and conservation of biodiversity on the Potts Hill site.

5.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The Commonwealth (EPBC Act) provides a national scheme for protecting the environment and conserving biodiversity values. Approval from the Commonwealth Environment Minister is required under the EPBC Act if the action (which can include a project, development, undertaking or activity) will, or is likely to, have a significant impact on matters considered to be of national environmental significance (NES matters). NES matters relevant to this proposal include threatened species and endangered ecological communities that are listed under the Act.

The protection of aspects of the environment that are matters of National Environmental Significance" (pursuant to the EPBC Act) are anticipated environmental outcomes of the Planning and Assessment Process under Part 3A of the EP&A Act as outlined below.

5.2 *Environmental Planning and Assessment Act 1979*

Development of the site will fall under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Under Part 3A, the proponent and consent authority must consider all aspects of the environment, including biological, physical, social and economic factors and the principles of ecologically sustainable development, when assessing the impacts of the project. Assessment under Part 3A of the EP&A Act includes consideration of threatened species, endangered populations and communities listed under the TSC Act, Matters of National Environmental Significance listed under the EPBC Act and requires a Maintain or Improve Outcome with respect to biodiversity values.

Part 3A of the EP&A Act negates the requirement to assess the significance of impacts on threatened species, populations and ecological communities or their habitat pursuant to Section 5A of the EP&A Act (the 7-part test). However, an assessment of the magnitude and extent of impacts and the significance of the impacts as related to the conservation importance of the habitat, individuals and populations likely to be affected is required (DECC DPI, 2005).

5.2.1 Part 3A Threatened Species Assessment Guidelines

The Department of Environment and Climate Change (DECC) and the Department of Primary Industries (DPI) have prepared Draft Guidelines for the assessment of impacts on threatened species, populations or ecological communities or their habitats arising from development applications assessed under Part 3A of the EP&A Act (DECC & DPI 2005). These guidelines are provided for in section 75F in Part 3A of the EPA Act.

The Assessment Guidelines outline guiding principles for the provision of information to "enable decision makers to ensure that developments deliver the following environmental outcomes:

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1. Maintain or improve biodiversity values (i.e. there is no net impact on threatened species or native vegetation);
2. Conserve biological diversity and promote ESD;
3. Protect areas of High Conservation value (including areas of critical habitat);
4. Prevent the extinction of threatened species;
5. Protect the long-term viability of local populations of a species, population or ecological community; and
6. Protect aspects of the environment that are matters of National Environmental Significance "(pursuant to the EPBC Act)".

5.3 *Threatened Species Conservation Act 1995*

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. There are three Endangered Ecological Communities, and three threatened species listed under the TSC Act that occur on site as well as other threatened flora and fauna species considered as potentially occurring on site. Potential impacts on these communities, species and their habitats are assessed as part of the Part 3A assessment process with reference to the Assessment Guidelines (DECC & DPI 2005) described above.

5.4 *Sydney Water Act 1994*

This Act established the Sydney Water Corporation to provide for water supply to Sydney residents. The Act also defines the objectives of the Corporation under s.21, including the following principal objectives (shortened):

(a) To be a successful business
(b) To protect the environment
(c) To protect public health

A memorandum of understanding (MoU) was entered into between Sydney Water and the then Department of Environment and Conservation (DEC) under s.35 of the Sydney Water Act (DEC and Sydney Water 2006). This MoU provides for Chief Executive Officer, Strategic Liaison Group, and Operational Policy Committee meetings, for regular dissemination of information, and discussion of environmental issues between the two agencies.

5.5 Bankstown LEP 2001

The LEP is the principal planning document for the Bankstown Local Government Area. The LEP identifies a variety of landuse 'zones' with details of objectives and permissible actions with different zones. The site is currently zoned Special Uses 5.

5.6 Auburn LEP 2000

The LEP is the principal planning document for the Auburn Local Government Area. Lands to the north of the water supply pipeline, which is orientated in approximately

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an east-west direction (the most northerly portion of the Potts Hill site), are subject to Auburn LEP 2000, and are zoned 5(a) Special Uses.

5.7 Bankstown Biodiversity Strategy

This Biodiversity Strategy incorporates a detailed review of the natural environment of Bankstown Local Government Area (LGA), threats to the existing biodiversity values, and statutory and organisational context relevant to biodiversity management.

A list of strategies are provided for biodiversity management in the LGA, covering the areas of planning, ecological corridors, ground reserve management, education, participation and many others.

Two proposed biodiversity corridors identified in the Bankstown Biodiversity Strategy pass through the site. The first is along the "Sydney Water Pipeline corridor" which runs along the northern boundary of Potts Hill Reservoir. The second is the "Alternative east-west corridor" and occurs along the southern boundary of the site. A discussion of these corridors is include in Appendix 2 (Bankstown Biodiversity Strategy section).

The objectives of this strategy will be addressed through the maintain or improve assessment in Section 9 of this document.

5.8 Bankstown City Council Tree Preservation Order

Development Control Plan (DCP) No 15 – Tree Preservation Order requires Council to consider the amenity provided by trees when considered applications to remove or prune trees (plants ≥5m in height). Certain tree species are excluded from this DCP. A condition of consent may be no action, or growing / planting other suitable replacement trees.

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6. Ecological Assessment Methodology

6.1 Methods

A summary of the methods used are provided below. Full details are provided in Appendix 1.

- *Literature Review*: Previous assessments of the ecological condition of the site were reviewed.
- *Database Audit*: A 10km radius search of Bionet and EPBC database.
- *Assessment of likelihood of occurrence:* Habitat assessment for threatened species based on previous studies, habitat on site, known distributions and professional opinion.
- *Site Survey*: Eco Logical Australia staff conducted inspections, flora and fauna surveys in 2006 and 2007 (approximate total of 75 person-hours survey).
- *Vegetation Community Mapping*: Bankstown City Council mapping (2002) was utilised as a base layer, validated, and modified where necessary.
- *Conservation Significance Assessment* (CSA): CSA analysis was conducted on vegetation within the site by considering community type, condition, patch size and connectivity.
- *Targeted Survey for Threatened Species* (January 2007): Targeted surveys were conducted on site for two threatened species, *Acacia pubescens* and the Cumberland Plain land snail.
- *Supplementary targeted surveys for threatened species* (November 2007): Green & Golden Bell Frog (habitat assessment/call playback/diurnal and nocturnal habitat searches), and microchiropteran bats (anabat surveys).
- *Survey of Bagdad Street Site* (November 2007): Validate existing vegetation mapping and assess conservation significance of vegetation and fauna habitats present
- *Fauna Habitat*: Hollow bearing trees were mapped and notes taken on potential fauna habitat in development areas.

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7. Results

A summary of the results are provided below. Full details are provided in Appendix 2.

7.1 Literature Review & Data Audit

Previous assessment reports had mapped and classified vegetation communities on site, including endangered ecological communities, and highlighted the occurrence of threatened species, including *Acacia pubescens,* the Grey-headed Flying Fox and Common Bent-wing Bat.

Searches of the NPWS Wildlife Atlas and EPBC Act MNES databases indicated 49 threatened species and two migratory species previously recorded in the locality (within 10km radius) of the Potts Hill site (see Section 7.3 below).

7.2 Vegetation Characteristics

- Five (5) plant communities were identified on the site, along with areas of exotic grassland and cultural plantings.
- Three plant communities recorded (Cumberland Plain Woodland, Cooks River/Castlereagh Ironbark Forest and Sydney Turpentine Ironbark Forest) are listed as endangered ecological communities under the TSC Act.
- Two plant communities recorded (Cumberland Plain Woodland and Sydney Turpentine Ironbark Forest) are listed as endangered ecological communities under the EPBC Act.
- Two of the plant communities recorded (Cooks River/Castlereagh Ironbark Forest and Sydney Turpentine Ironbark Forest) are classified as 'critically endangered ecological communities' under conservation significance assessment guidelines for western Sydney region (NPWS 2002b).
- The classification of much of the vegetation on the site as 'critically endangered ecological communities' under the NPWS (2002b) guidelines means that a large proportion of the remnant vegetation is classified as 'core' vegetation, and consequently has 'high' conservation significance (see results in Appendix 2).
- The site contains vegetation with a mixture of recovery potential classifications, reflecting variance in vegetation condition and disturbance levels.

7.3 Fauna Habitat

- The site currently has poor connectivity to surrounding remnant vegetation due to the urban landscape, roads, rail and water pipeline easement, though it does facilitate 'stepping stone' connectivity for mobile fauna species.
- Potential exists for mobile species (birds and bats) to utilise habitat on site for roosting or foraging.
- The best areas of habitat in terms of floral and structural diversity comprise those remnant stands to be retained and managed on site.

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- Vegetation within the surplus lands is not favourable habitat for the Cumberland Plain Land Snail, as areas are regularly mown and leaf litter therefore does not accrue. Habitat within the lands to be retained has understorey and leaf litter in some areas, and hence is potential habitat.
- 57 hollow bearing trees were mapped, most of which were exotic peppercorn trees (*Schinus areira)*. Some of these will be retained within proposed open space in the residential development area (Figure 2).
- The majority of tree hollows recorded were of sufficient size to accommodate bats, small birds or gliders, but were not large enough for use as nest sites by medium to large birds, including forest owls.
- Frog habitat is very limited and isolated. The Green and Golden Bell Frog is considered unlikely to occur.

7.4 Threatened Species

Of the 49 threatened flora and fauna species previously recorded in the locality, 18 are considered to have the potential to occur on site, including 12 species of threatened fauna and six (6) species of threatened flora.

- A threatened plant species identified from previous reports and field-surveys, *Acacia pubescens*, has been recorded at six locations on the site.
- Two threatened fauna species have been recorded:
    - Eastern Bent-wing Bat (*Miniopterus schreibersii*)
    - Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Targeted searches were conducted for the Cumberland Plain land snail within the surplus lands proposed for rezoning, but no Cumberland Plain land snail specimens or shells were recorded on site.
- Call-back surveys and habitat searches were conducted for the Green and Golden Bell Frog, but no evidence for this species was recorded.
- Anabat call surveys were undertaken for micro-bats but no threatened species were identified.

7.5 Soil Contamination

Assessment of the soils within the Potts Hill site that is surplus to Sydney Water needs has identified some contamination. The soil analysis results are consistent with the site history. It indicates a lack of significant chemical contamination and identifies a number of isolated contamination hotspots.

There is little correlation between the location of the hotspots and significant vegetation within the Potts Hill site.

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8. Mitigation

8.1 Native Vegetation Management

8.1.1 SWC Retained Lands

Remnant vegetation is proposed to be retained in both the north and southwest portion of the site. This vegetation will be rehabilitated, and in places revegetated to achieve a consolidated area of native vegetation. These areas of vegetation will also be linked through the creation of an ecological corridor to the west of Reservoir 2. The purpose of the corridor will be to link the two areas of vegetation, facilitating movement between these areas by native fauna, and enhancing the overall functionality of the retained lands. Where possible, local provenance native plant species should be used to 'recreate' appropriate ecological communities.

The total size of the proposed vegetation management areas within the retained lands is 19.26 ha, with the size of individual components listed below in Table 1. The proposed retained land includes existing vegetation that is part of recognised endangered ecological communities (8.04 ha), revegetation of areas to link existing vegetation, including establishment of the proposed ecological corridor (6.96 ha), future use areas subject to interim weed management regimes (0.73 ha) and an additional area with opportunity for weed removal and planting in the northeast of the site (3.53 ha).

These outcomes will be integrated with Sydney Water's ongoing use of the site for water management purposes. These will include the ongoing use of the 1800mm water supply pipes and associated infrastructure in the north of the site. Necessary access roads and tracks within the ecological footprint will be retained, and administration buildings may also continue to be utilised. There is a need to ensure that this infrastructure will continue to operate, and be accessible for ongoing maintenance. Clearly any rehabilitation or plantings in the vicinity of these operational areas will need to ensure that any species used are appropriate to SWC's operational needs (ie. no trees). The specific area to be the focus of revegetation will be refined in the preparation of the site EMP.

Table 1. Indicative zonation of retained land and size (ha).

Subject Area	Rehabilitation of Existing Vegetation	Revegetation	SUB TOTAL	Weed Management of 'future use' vegetation *	Additional Opportunity for Revegetation	TOTAL
Ecological	8.04	4.67	**12.71**	0.73	3.53	**16.97**
Corridor	-	2.29	**2.29**	-	-	**2.29**
Total	8.04	6.96	**15.00**	0.73	3.53	**19.26**

* This vegetation may be developed (ie. Cleared) within the next 10-20 years. See Figure 4 , section 9, for locations of zones.

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An Environmental Management Plan (EMP) and a Vegetation Management Plan (VMP) are to be prepared for the retained lands to enable SWC to undertake operational activities in a manner that protects the natural environment and to meet their legislative obligations and commitment to the rehabilitation and conservation of areas of retained vegetation on site (see below), without prejudicing SWC's ongoing operational activities.

The EMP will, amongst other things (see section 9.1.3 below), define appropriate interim weed management works for the identified 'future use' areas. SWC has also identified an additional area in the northeast of the site (3.53ha), currently dominated by weeds, that could be targeted for weed control and planted with local native species.

8.1.2 Development Area

The Concept Plan includes a provision for areas of open space in the northwest portion of the site. This will incorporate 0.45 ha of Cooks River/Castlereagh Ironbark Forest (Table 3). Some planted heritage trees in this area will also be retained. These lands are proposed to pass to Council ownership and management.

A large area of open space (2.78 ha) is provided for in the southwest of the site, and includes 1.01 ha of vegetation.

Elsewhere in the development area, remnant native vegetation will be retained within the residential development design where possible. However, it is anticipated that the majority of this vegetation will be lost (total area of 1.60ha).

8.1.3 Environmental Management Plan

SWC is committed to undertaking all of its activities on the Potts Hill site (planning, design, operation, maintenance and contracting) in a manner that protects the natural environment. In this regard, SWC is currently in the process of preparing an Environmental Management Plan (EMP) that will address all aspects of environmental management within the retained lands of the Potts Hill Site.

Key environmental issues for the Potts Hill site to be considered in the EMP include:

- Protection and management of retained vegetation and habitat values, including consideration of Endangered Ecological Communities (EECs), threatened species, and weed control
- Soil and contamination management
- Fire management
- Protection and management of heritage values (Aboriginal and non-Aboriginal)
- Waste management

The EMP will identify management items, milestones, timeframes and commitments.

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An example SWC EMP shell document and an indicative VMP framework are provided in Appendices 7 & 8. Both the EMP and VMP are proposed for completion by mid-2008 for implementation on site.

8.1.4 Vegetation Management Plan (VMP)

A Vegetation Management Plan (VMP) will also be prepared for vegetation on the retained lands. The VMP will complement the EMP, by identifying the specific management measures to be implemented in the areas of retained vegetation and the ecological corridor to achieve the environmental outcomes for the retained lands.

The VMP will outline management actions required within the retained lands, including areas of native vegetation to be retained and identified potential future use areas. This will ensure that desired ecological outcomes are achieved. Management actions under the VMP will focus on the rehabilitation and revegetation of existing and future vegetation to ensure that it reaches an appropriate condition, and provides increased ecological benefits.

The objectives of management works within the component areas of the retained lands are outlined below:

a. Areas of retained Vegetation

All management activities within areas of retained vegetation need to take into account SWC's existing operational requirements. Key objectives include:

- Improve the condition and integrity of native vegetation present at the site (e.g. through weed removal and control, and appropriate plantings)
- Restore local native vegetation communities in cleared or disturbed areas (e.g. planting, weed control, fire management etc.)
- Maintain operational access, where required, through use of appropriate plantings (indigenous grasses and groundcovers)

b. Ecological Corridor and Landscaping Areas

Key objectives include:

- Provide ecological connectivity between the two areas of retained land for both flora and fauna through creation of a ecological corridor
- Screen Sydney Water operational areas
- Protect planted palms of cultural heritage significance adjacent to, or within, the corridor through appropriate plantings in adjoining areas
- Utilise appropriate species in landscaping that will support, and where possible enhance, areas of native vegetation that have been retained

c. Potential Future Use Areas

All management activities within future use areas will need to take into account SWC's future operational requirements within these areas. Key objectives include:

- Removal and control of weeds to prevent adverse impacts on adjoining areas of retained vegetation
- Future planting of indigenous vegetation/landscaping to provide buffer areas between infrastructure and adjoining areas of retained vegetation

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8.1.5 Management Measures and Protocols

a. Areas of retained Vegetation

The VMP will provide details of specific measures and protocols for the retention, protection and rehabilitation of native vegetation within the retained lands, including:

- Management in retained land of mowing and slashing to maintain landscaped areas, operational access, and if required, asset protection zones;
- Weed removal and control protocols, including an initial assessment of weed prevalence in retained lands;
- Details of appropriate plant species and planting densities to be utilised in the revegetation sectors;
- Use of seed and vegetative material of local provenance which is is representative of the surrounding indigenous vegetation communities
- Compliance with legislative and regulatory requirements when collecting native seed
- Identification of seed collection protocols: identification of optimal collection zones, sampling regime and quantities required;
- Planting in corridor areas to provide appropriate vegetation structure for native fauna passage and linkage between vegetation patches;
- Protocols for the staged removal of existing native non-indigenous plantings in the conservation corridor over the medium to long term where considered necessary (e.g. species displaying aggressive recruitment).
- Management measures to protect threatened species including *Acacia pubescens* (eg. fencing), by seeking to increase the number of individuals and the long-term security of the local population within the retained lands;
- Measures to control grazing herbivores to protect regenerating vegetation and planted seedlings (if required);
- Restriction of access: the retained land will be within Sydney Water's perimeter fence, and will be part of their usual site security monitoring;
- Establishment of an appropriate ecological fire regime that encourages the creation of a mosaic of vegetation with different burn frequencies (note that this is distinct to management for asset protection purposes). This will be a key element in controlling weeds and ensuring recruitment and regeneration of native plants in areas that are currently lacking in understorey and canopy structure. Further, controlled burning will be important in maximising diversity;
- Measures to protect retained vegetation from operational activities where possible, including use of existing access tracks, parking of vehicles and location of equipment and stockpiles in existing cleared areas; and
- A monitoring program with performance criteria and measures for restitution of damage or supplementary plantings, if necessary.

b. Ecological Corridor and Landscaping Areas

The following management measures will be considered for the ecological corridor and landscaping areas:

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- Use of naturally occurring species of local provenance in landscaped areas to maintain the genetic integrity of the native vegetation within the retained lands;
- Planting of trees to provide foraging resources for mobile native species known to occur on site and on surrounding lands;
- Avoiding use of potentially invasive indigenous plant species in landscaping areas;
- Incorporation of existing native trees and vegetation in landscaped areas (in particular buffer areas between retained vegetation and future infrastructure) where possible; and
- Future landscaping of retained lands to utilise native vegetation so as to integrate with vegetation rehabilitated retained vegetation.

c. Potential Future Use Areas

The following management measures will be considered for the future use Areas:

- Protocols for the removal and control of weeds;
- The destruction of weed material removed from future use areas;
- Minimising areas disturbed during future construction activities, as far as possible;
- Use of naturally occurring species of local provenance in landscaped areas to maintain the genetic integrity of the native vegetation within the retained lands;
- The use of shredded native plant material removed from the site as a mulch and groundcover on disturbed soil surfaces to reduce the potential for weed establishment; and
- Seeding of exposed soil stockpiles with a nursery crop to reduce the potential for weed infestation.

8.1.6 Timing

It is proposed that the management actions will cover a 5 year time frame to align with other SWC environmental strategies and programs.

To ensure management actions achieve their intended aims, a monitoring program will be designed and implemented. This will involve monitoring of vegetation within the retained land before, during and after the identified 5 year period. Monitoring will involve measuring indicators of vegetation condition, response of vegetation to fire regime and utility of the corridor for native fauna.

At the end of the five year period covered by the VMP, Sydney Water will review the outcomes and determine whether further actions are required, and any other appropriate management actions.

8.1.7 VMP Funding

Appropriate funding to ensure the implementation of proposed management actions for the retained lands is to be allocated by SWC. Costings for actions will be prepared in the VMP identifying the management action costs over the 5 years. An indicative calculation of the areas which will be the subject of management under

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the VMP has been prepared (see Table 2 below). Funds to cover the projected expenses for the 5 year period will be identified in the Sydney Water Natural Environmental Management Program, and commitment to the project will be maintained through the Sydney Water Environmental Management System.

Table 2. Indicative areas for bush regeneration works on retained land over a 5 year period.

Area	Works	Area (ha)
Retained lands	Rehabilitation	7.31
	Rehabilitation + significant weed management	0.73
	Revegetation	4.67
	Landscaping Opportunity (East of Reservoir 1)	3.53
Future Use Areas	Weed Management	0.73
Corridor	Revegetation	2.29
Total Area		**19.26**

8.2 Contamination management

Should there be contamination in the retained land this will be dealt with through the site EMP.

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9. Impact Evaluation

The proposed development of the surplus SWC lands will involve the loss of some ecological values on the Potts Hill site, primarily through the removal of 1.60 ha of native vegetation (Table 3). The development footprint has been designed to minimise vegetation loss and those areas of vegetation to be removed generally comprise the more disturbed areas of the three endangered ecological communities that occur on site. Vegetation will also be retained in the open space in the southwest and northwest corners of the main Potts Hill site.

In addition SWC has identified potential 'future use' areas within the lands to be retained. Infrastructure development for water supply purposes may be required on these lands within the next 10-20 years. These 'future use' areas include a further 0.73 ha of native vegetation. The vegetation would be integrated and retained where possible with these developments, but it is likely that the majority of vegetation would be lost should these developments occur.

The areas of vegetation considered to be of highest ecological value are proposed to be retained, and consolidated through rehabilitation and revegetation activities. Connectivity on site will also be enhanced through the creation and revegetation of an ecological corridor linking areas of retained vegetation.

The potential for adverse impacts on fauna species known to occur, or to potentially occur, on site has been substantially reduced through habitat retention and enhancement proposed on site. Retained stands of open forest/woodland will maintain habitat for the species recorded, or with potential to occur, on the site, including threatened bats. Additionally, proposed rehabilitation and revegetation works have the potential to improve the current condition and connectivity of fauna habitats on site.

The site currently has poor connectivity to other remnant vegetation in the surrounding area. However, it will contribute to an identified east-west corridor along the northern boundaries by acting as a 'stepping stone' for more mobile fauna species in the locality. The proposed retention and consolidation of remnant vegetation in the north of the site will improve the value of this area as will become a larger 'stepping stone' for fauna.

An assessment of the potential effects of the proposed development on threatened species and endangered ecological communities that occur on the Potts Hill site has been made by addressing the criteria outlined in the Part 3A Threatened Species Assessment Guidelines (Appendix 6). This assessment has concluded that the proposed development is unlikely to have a substantial adverse impact on threatened species, endangered ecological communities or their habitat, given the habitat retention and rehabilitation proposed.

The following aspects of the proposed Concept Plan are of particular relevance in this regard:

- Retention of *Acacia pubescens* and areas of surrounding habitat, and management of these areas to encourage population growth of this species;

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- Rehabilitation of retained vegetation through weed removal and the encouragement of natural regeneration of native species;
- Revegetation of currently disturbed areas to consolidate areas of native vegetation retained on site, and to improve area to edge ratios and community integrity;
- Enhancement of connectivity of vegetation retained on site through the creation of an ecological corridor linking stands of retained vegetation; and
- Retention of many hollow-bearing trees (58%) recorded on site within open space or retained vegetation.

Table 3. Area of vegetation communities within proposed landuse zones.

Vegetation Community	Status *		Vegetation Area (ha)				
	TSC	EPBC	Development Area	Open Space	Retained Land	Potential Use (10-20 yrs)	Total
Cooks River/Castlereagh Ironbark Forest †	EEC	-	0.26	1.11	6.36	0.57	**8.30**
Creek (Riparian)	-	-	0.07	0.04	-	-	**0.11**
Cumberland Plain Woodland	EEC	EEC	0.72	0.32	-	-	**1.04**
Grassland - Native	-	-	-	-	0.33	-	**0.33**
Sydney Turpentine Ironbark Forest †	EEC	CEEC	0.55	-	1.35	0.70	**2.60**
Total			**1.60**	**1.47**	**8.04**	**1.27**	**12.38**

* TSC = *Threatened Species Conservation Act 1995*; EPBC = Environmental Protection and Biodiversity Conservation *Act 1999*; EEC = Endangered Ecological Community; CEEC = Critically Endangered Ecological Community

† Classified as Critically Endangered Ecological Community in western Sydney (NPWS 2002a,b)

9.1 Assessment under Part 3A Criteria

An assessment of the potential effects of the proposed development on threatened species and endangered ecological communities which occur on the Potts Hill site according to the criteria outlined in the Part 3A Threatened Species Assessment Guidelines has concluded that there is unlikely to be a substantial adverse impact on threatened species, endangered ecological communities or their habitat given the habitat retention and rehabilitation proposed (see Appendix 6 for details).

The proposed ecological outcomes of the Concept Plan have been assessed with respect to the key thresholds outlined in the Part 3A Threatened Species Assessment Guidelines as follows:

- *Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.*

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Based on the ecological outcomes proposed in this document, the proposal passes the 'maintain or improve' assessment for biodiversity values.

- *Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community*.

The proposed vegetation management actions on the Potts Hill site will enhance the condition of the ecological communities present, improving their likely viability over the longer term, and hence making a positive contribution to the conservation of biodiversity within the locality. Anticipated improvements in vegetation condition, connectivity within the site, should improve habitat quality for threatened bat species that are known to occur on site. They are likely to contribute to the long-term viability populations in the locality.

The long-term viability of the *Acacia pubescens* population on site will be enhanced through the retention and management of known and potential habitat. and measures to protect plants on SWC retained land during activities on site.

- *Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction*.

The proposed development of the Potts Hill site will not accelerate the extinction of threatened species or ecological communities of relevance to the site. As noted above, the proposed vegetation retention and management actions will improve the integrity of the ecological communities and habitats present, improving their likely viability over the longer term and hence making a positive contribution to the conservation of biodiversity within the locality.

- *Whether or not the proposal will adversely affect critical habitat*.

Critical habitat for threatened species or ecological communities as defined and listed under the TSC Act will not be affected by the proposed development of the Potts Hill site.

9.2 Assessment of proposal against Maintain or Improve Principles

The proposal for development of the surplus lands will involve the loss of some ecological values, primarily areas of vegetation. The development footprint has been designed so as to minimise these losses, and where vegetation will be lost, it is vegetation that is heavily disturbed. Vegetation will be retained within the proposed development areas where possible. However, for the purposes of this assessment it is assumed that all vegetation in areas marked for residential development will be lost. This is a total loss of 1.60 ha of vegetation (Table 4).

Some vegetation (1.47 ha) will be retained in open space in the north and southwest of the site. Landscaping may support, or possibly enhance, the value of the retained vegetation in the proposed open space. Detailed landscaping plans have not been prepared at this stage. Consequently, these areas have been treated as 'neutral' for the purposes of the maintain or improve assessment (Table 4).

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Identified potential future use areas have not been included in the Maintain or Improve assessment as environmental gains because the long term security of these areas is not guaranteed and will be dependent on future operational decisions. Vegetation within these areas will be retained in the interim and managed to remove weeds and so protect adjoining retained communities from adverse impacts, and are therefore identified as 'interim gain' in Table 4.

A total of 8.04 ha of vegetation will be retained and rehabilitated. The majority of this is either Cooks River/Castlereagh Ironbark Forest (79%) or Sydney Turpentine Ironbark Forest (17%). No Cumberland Plain Woodland or creek areas are included within the retained land and thus an offset for these communities are not proposed.

Comparing the loss of 1.60 ha, with the retention, management and rehabilitation of 8.04 ha in the retained land, gives an offset ratio of approximately 1 : 5 (loss vs gain).

Table 4. Ecological gains and losses by vegetation community

Vegetation Community	Ecological Gains – Retain/ rehabilitate (ha)	Ecological Gains - revegetation (ha)	Losses (ha)	Neutral (ha)	Interim Gain (10-20 year - weed management only)
Cooks River/Castlereagh Ironbark Forest	6.36	-	0.26	1.11	0.22
Riparian (Cumbungi-dominated drainage)	-	-	0.07	0.04	-
Cumberland Plain Woodland	-	-	0.72	0.32	-
Grassland - Native	0.33	-	-	-	-
Sydney Turpentine Ironbark Forest	1.35	-	0.55	-	0.51
Revegetation (includes corridor - 2.23 ha).	-	10.49	-	-	-
Total	**8.04**	**10.49**	**1.60**	**1.47**	**0.73**

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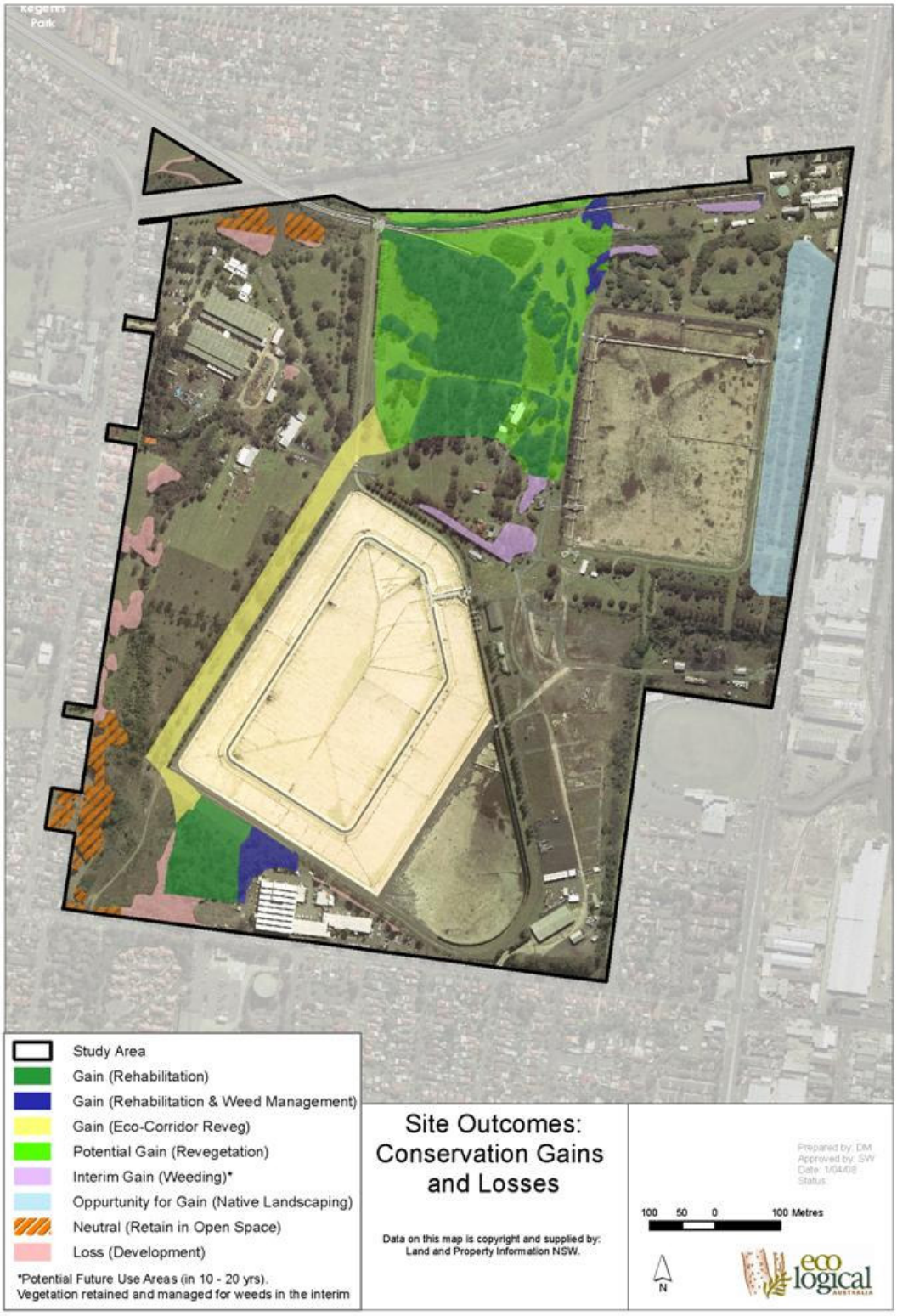

Figure 4. 'Maintain or improve' assessment.

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Additionally, up to 10.49 ha of vegetation will be revegetated, which will consolidate existing fragmented patches of high conservation value vegetation. Revegetation within the proposed corridor will also promote connectivity between vegetation patches, thus 'linking up' the proposed ecological gains. These works will partially assist the achievement of the ecological corridor along the northern boundary of the site, which is identified as a desirable outcome in the Bankstown Biodiversity Strategy (BCC and ELA 2002). The overall outcome for this corridor will be dependant on the detail of proposals for the northern future use area within the land to be retained by SWC.

Retention of vegetation within the southwest of the site will provide 'stepping-stone' connectivity for mobile fauna. Connectivity through the southeast portion of the site will be very low, but creation of the ecological corridor will improve ecological connectivity to the north of the site.

One *Acacia pubescens* site with 4 plants (site AP6, see Appendix 2), will be retained within open space, while the remaining five sites are within the retained land. The management of the retained land will aim to improve the number of plants, and the security of the local population.

For other threatened, migratory and regionally significant species that may potentially use the site, it is considered potential habitat values will be improved through the proposed 19.26 ha of rehabilitation and revegetation works and retention of approximately 33 hollow-bearing trees, to adequately offset the losses of 1.60 ha of vegetation cleared and 24 hollow-bearing trees proposed. The majority of the hollow-bearing trees containing hollows, and of those that will be lost, are cultural plantings, particularly peppercorn (*Schinus areira)*.

There is also an opportunity for future ecological gain (3.53 ha) on the Potts Hill site through the rehabilitation of the area of land between Reservoir 1 and Rookwood Road (indicatively shown in Figure 2). This area was not surveyed in detail for this report and has not been included in the current 'maintain or improve' assessment for the retained lands. The current ecological value of the land could be improved through weed management and supplementary native planting, which would also be subject to management under the VMP.

The retained SWC land will continue to be under Sydney Water ownership, and will continue to be used for ongoing water management activities. To provide greater security for proposed ecological outcomes, SWC has made the following commitments:

- Future water management infrastructure that may potentially be required over the next 10-20 years will be restricted, to identified future use areas;
- The preparation of an Environmental Management Plan (EMP) and Vegetation Management Plan (VMP) for retained lands will be prepared by mid-2008 for implementation on site;
- Implementation of the works identified in the Vegetation Management Plan over a 5 year period; and

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- Allocation of funding to ensure implementation of proposed management actions for the retained land, including the vegetation management works, for the proposed 5 year period.

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9.2.1 Summary of Improve or Maintain Assessment

Based on the outcomes proposed in this document, the Part 3A Concept Plan proposal passes the 'maintain or improve' assessment for biodiversity values, because:

- Loss of 1.60 ha of vegetation will be offset by ecological gains of 8.04 ha of rehabilitation of existing vegetation (offset ratio 1: 5, loss v gain) and up to 10.49 ha of revegetation (offset ratio 1: 6, loss v gain) in retained lands
- Rehabilitation of 8.04 ha of vegetation proposed to be retained will improve the current condition of vegetation and habitat values.
- A loss of 0.26 ha of Cooks River/Castlereagh Ironbark forest will be offset by ecological gains of 6.36 ha of rehabilitated Cooks River/Castlereagh Ironbark forest (offset ratio 1: 24, loss v gain)
- A loss of 0.55 ha of Sydney Turpentine Ironbark Forest will be offset by ecological gains of 1.35 ha of rehabilitated Sydney Turpentine Ironbark Forest (offset ratio 1: 2.5, loss v gain)
- Enhanced connectivity on-site will be provided by a proposed 30m wide corridor connecting areas of retained vegetation in the north of the site to areas of vegetation in the south of the site.
- Potential impacts of the proposal on threatened species *Acacia pubescens*, Eastern Bent-wing Bat and Grey-Headed Flying Fox have been assessed following Part 3A Draft Assessment Guidelines for Threatened Species listed under TSC Act (Appendix 8).

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10. Conclusions

The Potts Hill site has a long history of use for water management purposes. Nevertheless, the site has relatively high biological value supporting remnant stands of three endangered ecological communities, one threatened plant and two threatened bat species. In addition, the remnant vegetation present is likely to act as fauna 'stepping stones' and contribute to identified local ecological corridors.

The impact of the proposed development under the Concept Plan is proposed to be offset by the vegetation rehabilitation, regeneration and landscaping within lands retained by SWC, with rehabilitation of 8.04 hectares of existing native vegetation, and revegetation to appropriate native vegetation communities and landscaping with native species of up to 10.49 ha.

The proposed vegetation retention and management will consolidate and strengthen existing remnant vegetation on site, improve internal habitat connectivity, area to edge ratios, and integrity. The offsets will contribute to broader local biodiversity objectives of restoring and protecting the biological values of the site.

This 'Improve or Maintain' assessment has concluded that the proposed development is unlikely to have a substantial adverse impact on threatened species, endangered ecological communities or their habitat, given the habitat retention and rehabilitation proposed.

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Appendix 1. Details of Ecological Methods

Literature Review

Previous assessments of the ecological condition of the Potts Hill site, including habitat assessment, have been reviewed as part of this proposal, including:

- Flora and Fauna Study of Potts Hill Reservoir (SMEC 1997),
- Native Vegetation Maps of the Cumberland Plain Western Sydney Interpretation Guidelines (NPWS 2002),
- Bankstown Biodiversity Strategy (BCC and ELA 2002).
- A transect across a wide valley landscape showing changes in vegetation influenced by different aspects (West 1996)
- Rail corridor *Acacia pubescens* Management Plan (RailCorp 2000)

The information review was conducted to assess the ecological condition of the site, current level of ecological knowledge, and requirements for further survey work. We note that the surveys were undertaken at differing scales and levels of detail. Further, since the earliest surveys were completed changes have occurred in names and definitions of some vegetation communities on site.

Database Audit

A search of Bionet and the Atlas of NSW Wildlife, for threatened flora and fauna within 10km of the central point 150.9206, -33.802, was conducted on 25/01/2007 (10km radius search). The same search was conducted on 25/01/2007 using the EPBC database (Department of Environment and Heritage) for matters of national environmental significance.

Site Inspections/Field Surveys

Representatives from Eco Logical Australia, Sydney Water and Market Research undertook an inspection of the Potts Hill site (excluding the Bagdad Street land) in November 2005. The purpose of the visit was to become familiar with the site layout and features, and to note the condition of vegetation communities to assist in the review of previous vegetation mapping conducted on the site.

Fieldwork surveys were conducted by ELA staff, including:

- Vegetation community assessment within the main body of the site (excluding northeast section) over two days (approximately 40 person hours) on the 21st of February 2006 and on the 11th of January 2007.
- Targeted surveys for two threatened species: *Acacia pubescens* and the Cumberland Plain land snail on 25/01/07 (approximately 10 person hours).
- Additional targeted surveys on 28/11/2007 and 29/11/2007 for threatened species: Green and Golden Bell Frog (approximately 2 person hours of habitat assessment, and 10 person hours of frog survey over two nights), Grey-headed Flying Fox (spotlighting concurrent with frog survey over two nights), and Eastern Bent-wing Bat (Anabat survey over 2 nights).
- Bird surveys on 28/11/2007 and 29/11/2007 (approximately 2 person hours), as well as incidental observations during other surveys.
- Mapping of hollow bearing trees (in areas identified for potential development) on 25/01/07 (approximately 10 person-hours).

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- Initial scoping of Bagdad Street site in February 2007, and more detailed inspection of vegetation and habitat potential in 6 November 2007 (approximately 3 person hours).

Vegetation Community Mapping and Condition Assessment

Previous studies (SMEC 1997, NPWS 2002, Bankstown City Council 2002) had mapped different vegetation communities, with differing extents, over the site. The various vegetation map layers were compared, and one layer selected for use as base layer. This base layer was modified as necessary based on ground-truthing for vegetation in the development and retained lands (note that vegetation in the northeast of the site was not included as it was outside of the region of interest). Vegetation community type was determined by identifying diagnostic species at different structural levels (primarily the canopy, as lower layers were often highly modified), structural attributes of vegetation, and substrate condition (eg. soils) (NPWS 2002). An opportunistic list of plant species was used to assist in community identification, and weeds were noted (see Appendix 3).

Observations were made of vegetation condition throughout the site based on the structural integrity of vegetation at each floristic layer (canopy, understorey, and shrub and ground layers), the presence of native/exotic species, as well as disturbance levels. Condition was determined using guidelines developed by NPWS (2002).

Conservation Significance Assessment (CSA)

As part of the recovery planning process for Cumberland Plain vegetation communities, NPWS has classified remnant vegetation across the Plain into significance categories to assist Councils and other planners in making decisions about land use. Remnant woodland and forest vegetation has been ranked as:

- 'Core Habitat'; defined as "*areas that constitute the backbone of a viable conservation network across the landscape; or areas where the endangered ecological communities are at imminent risk of extinction*"
- 'Support for Core Habitat'; "*areas that provide a range of support values to the Core Habitat, including increasing remnant size, buffering from edge effects, and providing corridor connections*"
- 'Other Remnant Vegetation'; "*all native vegetation that does not fall within the above significance categories*"

CSA analysis was conducted on vegetation within the site using the guidelines in Table 5, Table 6 and Table 7. Vegetation was assigned to categories (listed above) on the basis of community type, condition, patch size and connectivity. Recovery potential was assessed, and combined with vegetation significance to produce a conservation significance assessment (CSA). It is noted that this CSA does not include threatened species assessment, as survey specifically targeted development lands, and hence survey effort was heavily biased.

Targeted Survey for Threatened Species

Targeted surveys were conducted on site on 25/01/07 for two threatened species: *Acacia pubescens* and the Cumberland Plain land snail.

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The extent of *Acacia pubescens* populations on the site were quantified by counting the number of stems in locations where the plant was known to exist (location records supplied by Sydney Water). Systematic sweep searches for additional populations of *A. pubescens* within suitable habitat in the development area were performed by ELA ecologists (approximately 6 person-hours of search effort).

Searches were conducted for the Cumberland Plain land snail *Meridolum corneovirens* at 10 locations (Figure 5). Each search consisted of a three minute dig around the base of trees with abundant leaf litter and, where possible, targeting trees known provide habitat (*Eucalyptus teretecornis* and *Eucalyptus crebra*, pers. comm. Josie Stokes, Australian Museum).

Additional targeted surveys were conducted on site on 28/11/2007 and 29/11/2007 for threatened species: Green and Golden Bell Frog, Grey-headed Flying Fox, and Eastern Bent-wing Bat.

Surveys for the green and Golden Bell Frog (*Litoria aurea*) were conducted on two consecutive nights on 28/11/2007 and 29/11/2007. Potential habitat areas were located in the southwest of the Potts Hill site and consisted of an ephemeral creek/wetland and drainage channels (Figure 5). These areas were wet during the surveys as a result of rainfall earlier in the week (beginning Mon 26th Nov 2007). Survey techniques used were: diurnal habitat searches, nocturnal spotlighting, and call playback surveys.

Microchiropteran bats were surveyed using Anabat echolocation call detectors. Anabat recorders were deployed on two consecutive nights (7pm to 10am) in potential bat flyways within the proposed residential development area of the site (see Figure 5). Call frequencies were analysed by Maria Adams at Wollongong University.

Incidental fauna surveys were also carried out throughout the site during the targeted searches (28/11/2007 and 29/11/2007). Sixteen bird species were recorded, along with the Common Garden Skink and several domestic cats (Appendix 4). None of the species observed during incidental surveys are listed on the *Threatened Species Conservation Act 1995*.

Hollow Bearing Tree Survey

Hollow bearing trees were mapped in patches of vegetation identified for potential development. A sweep search for hollow bearing trees was performed on 25/01/07 during the surveys for *A. pubescens.* It consisted of a search effort of approximately 10 person-hours (additional to *A. pubescens* search effort). Hollow-bearing trees were mapped and tree species, diameter at breast height (dbh) and hollow dimensions (size and likely fauna species that might utilise them) recorded.

Assessment of the Bagdad Street Site

This site was beyond the scope of the original assessment, which was restricted to the main Potts Hill site. Initial scoping of Bagdad Street site occurred in February 2007, with more detailed survey on 6 November 2007. The vegetation was assessed by

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walking over the site and taking notes on the dominant species in the canopy, mid-storey and ground layers. Vegetation mapping from BCC and ELA (2002) was ground-truthed and photos taken. Particular attention was paid to determining if *Acacia pubescens* occurred on site given its known occurrence on the wider Potts Hill site. RailCorp was contacted to obtain information on *Acacia pubescens* present in their adjoining lands, and a management plan for the adjoining lands was provided.

Survey Limitations

It is noted that the northeast portion of the site (lands to the north and east of reservoir 1) are not surplus to SWC's needs, and have not been considered for development. These lands were therefore outside of the brief for the area to be surveyed and assessed, and there was no detailed survey of these lands by Eco Logical Australia. Comments and conclusions about the ecological value, and the presence (or absence) of threatened species in this report, therefore may not apply to these lands.

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Figure 5. Location of targeted threatened species search areas.

Note: Two Cumberland Plain Land Snail searches in the east of the site were located close together.

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Table 5. Local Conservation Significance Matrix.

Adapted from Perkins 2002

Community type	Condition Code*	Patch Size	Connectivity	Code	Conservation Significance
Endangered Ecological Community (Critically endangered) ("CEEC"	ABC, TX or TXr	Any	Any	C3	Core
	TXu	Any	Any	URT	Urban remnant trees (critically endangered communities)
Endangered Ecological Community ("EEC")	ABC (with Understorey in good or moderate condition)	> 10 ha	Any	C1	Core
		< 10 ha	Adjacent to C1 or CEC	C2	Core
			Adjacent to S1	S2	Support for core
			None	O	Other remnant vegetation
	TX or TXr, ABC (with poor Understorey condition)	Any	Adjacent to any Core	S1	Support for core
			None	O	Other remnant vegetation
	TXu	Any	Any	O	Other remnant vegetation
	Native grasslands in good condition	Any	Adjacent to Core or Support for Core	S3	Support for Core

* Note: Vegetation mapped as 'Creek (riparian)' had native species present, but were not consistent with the EEC 'Sydney Freshwater Wetlands' and were assigned a conservation significance category of 'Other remnant vegetation', and a recovery potential of 'low-moderate'.

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Table 6. Recovery Potential Matrix

Current condition and land use	Past land use and disturbance	Soil Condition	Vegetation		Recovery Potential
Cleared (no woodland canopy). Includes *Bursaria* thickets in grassland A1	Recently cleared (<2 years) B1	Unmodified or largely natural. Uncultivated. C1	D1	Native dominated	High
			D2	Exotic dominated	Moderate
		Modified. Heavily cultivated and/or pasture improved. Imported material. C2	D3	Either	Low
	Historically cleared (>2 years) and consistently managed as cleared. B2	Unmodified or largely natural. Uncultivated. C3	D4	Native dominated	Moderate
			D5	Exotic dominated	Low
		Modified. Heavily cultivated and/or pasture improved. Imported material. C4	D6	Either	Very Low
Wooded/Native Canopy present or regenerating A2	No recent clearing of understorey B3	Unmodified or largely natural. Uncultivated. C5	D7	Native understorey relatively intact or in advanced state of regeneration. Native dominated.	High
			D8	Native understorey significantly structurally modified, absent or largely absent. Includes areas dominated by African Olive.	Moderate
			D9	Exotic dominated	Low
		Moderately modified by long term grazing or mowing. C6	D10	Native dominated	Low
		Modified. Heavily cultivated and/or pasture improved. Imported material. C7	D11	Native understorey significantly structurally modified, absent or largely absent. Includes areas dominated by African Olive.	Very Low
			D12	Native understorey present. Heavily weed invaded.	Low
	Understorey patchily intact B4	Disturbed C8	D13	Native dominated	Moderate
			D14	Exotic dominated	Low
	Recent clearing of understorey and or native understorey significantly structurally modified due to existing land use (eg. Mowing, grazing) B5	Unmodified or largely natural. Uncultivated. C9	D15	Native dominated. If no vegetation present, assume native dominated.	High
			D16	Exotic dominated	Moderate
		Modified. Heavily cultivated and/or pasture improved. Imported material. C10	D17	Native dominated	Low
			D18	Exotic dominated	Very Low

Note: Adapted from Perkins (2002).

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Table 7. Ecological Constraint Matrix Step 1.
Source: Eco Logical Australia (2003). This step combines the recovery potential and conservation significance maps.

	Recovery Potential				
Conservation Significance		**High**	**Moderate**	**Low**	**Very Low**
	Core	High	High	High	High
	Support for core	High	Moderate	Moderate	Low
	Other	Moderate	Moderate	Low	Very Low

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Appendix 2. Details of Ecological Results

Literature Review

SMEC Potts Hill Survey (1997)

This study recorded the following vegetation communities on the Potts Hill site:

- Grassland / planted trees
- Shale/Gravel Transition Forest
- Shale/Sandstone Transition Complex

The Grassland / planted trees were noted as being a combination of native and introduced grass species, with or without scattered planted trees. The grassland was generally mown, but some areas were left unmanaged.

The Shale/Gravel Transition Forest communities were described as having trees to 22m, understorey of grassland and scattered shrubs, and an average shrub height of 1.4 m, sparse to medium density, or with a mown understorey. The communities were noted as having varying degrees of disturbance and recovery. The area south of Reservoir 2 was noted as containing hollow bearing trees.

Dominant tree species were: *Eucalyptus fibrosa*, *Syncarpia glomulifera*, *E. moluccana, E. tereticornis* on drier sites, and *E. longifolia, Melaleuca decora, M. styphelioides* and *M. nodosa* often on low-lying sites. The shrub layer was found to be dominated by native species, with the ground layer dominated by introduced grasses and herbs.

Shale/Sandstone Transition Complex community was described as having trees to 18m, with an understorey consisting of grasses and scattered shrubs, mostly occurring on disturbed sites, with *E. punctata* common in north of site and *E. pilularis* dominant in the south of site.

Two ramets of the threatened shrub *Acacia pubescens* were noted as being present inside the site along batters for the water pipeline just north-west of Reservoir 1. The grey-headed flying fox (*Pteropus poliocephalus*) was observed along with regionally significant species, the White-winged Chough (*Corcorax melanorhamphos*) and Peregrine Falcon (*Falco peregrinus*).

Connectivity of the site to other remnant bushland was noted as being poor, as the site is surrounded by roads and a railway line. However, it was noted that the Potts Hill reservoir site may provide stepping stones for mobile fauna groups to move between remnant bushland.

Bankstown Biodiversity Strategy

The Bankstown Biodiversity Strategy (ELA and BCC 2002). noted that the Potts Hill Reservoir contains six discrete vegetation communities/types:

- Cumberland Plain Woodland
- Cooks River Castlereagh Ironbark Forest
- Sydney Turpentine Ironbark Forest
- Freshwater wetlands
- Grassland

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- Revegetated areas

The text also notes that Sydney Sandstone Gully Forest occurs on the site, on an unusual outcropping of sandstone, but is not shown on the relevant map [map A2-3]. It was thus unclear if this vegetation did or did not occur on site at the time of the survey.

Vegetation on the Bagdad Street site, which has been incoporated into the subject lands at Potts Hill, was identified as Cooks River/Castlereagh Ironbark Forest, Creek (riparian), and Grassland (Exotics) in the Biodiversity Strategy.

Several threatened species (*Acacia pubescens,* grey-headed flying-fox, and common bent-wing bat) were noted as having been recorded at the Potts Hill Reservoir site. *Acacia pubescens* is also identified outside and to the west of the site, within a RailCorp railway corridor.

Two proposed biodiversity corridors pass through the site (Figure 6). The first is along the "Sydney Water Pipeline corridor" along the northern boundary of the site. This corridor (as mapped) extends approximately 200m from the northern boundary of the site. The second is the "Alternative east-west corridor" and occurs on the southern boundary of site.

Both of the proposed corridors seek to link native vegetation remnants, and provide connectivity in an east-west direction. The Sydney Water pipeline corridor is noted as being more favourable, and that there is the potential of establishing "islands", or "stepping stones" at regular intervals along the corridor by augmenting with plantings relatively large areas of land along the pipeline. The alternative east-west corridor, linking up to the Duck River, was considered desirable, although it was considered that this corridor would likely be more difficult to implement due to the presence of industrial areas.

NPWS Vegetation Mapping

Native vegetation mapping (NPWS 2002) mapped three vegetation communities within the site:

- Cooks River Castlereagh Ironbark Forest
- Shale Hills Woodland (a sub-community of Cumberland Plain Woodland)
- Shale Plains Woodland (a sub-community of Cumberland Plain Woodland)

Some areas were also mapped as being disturbed.

The NPWS Atlas of NSW Wildlife (2005) has records for *Acacia pubescens* to the south of Reservoir 2.

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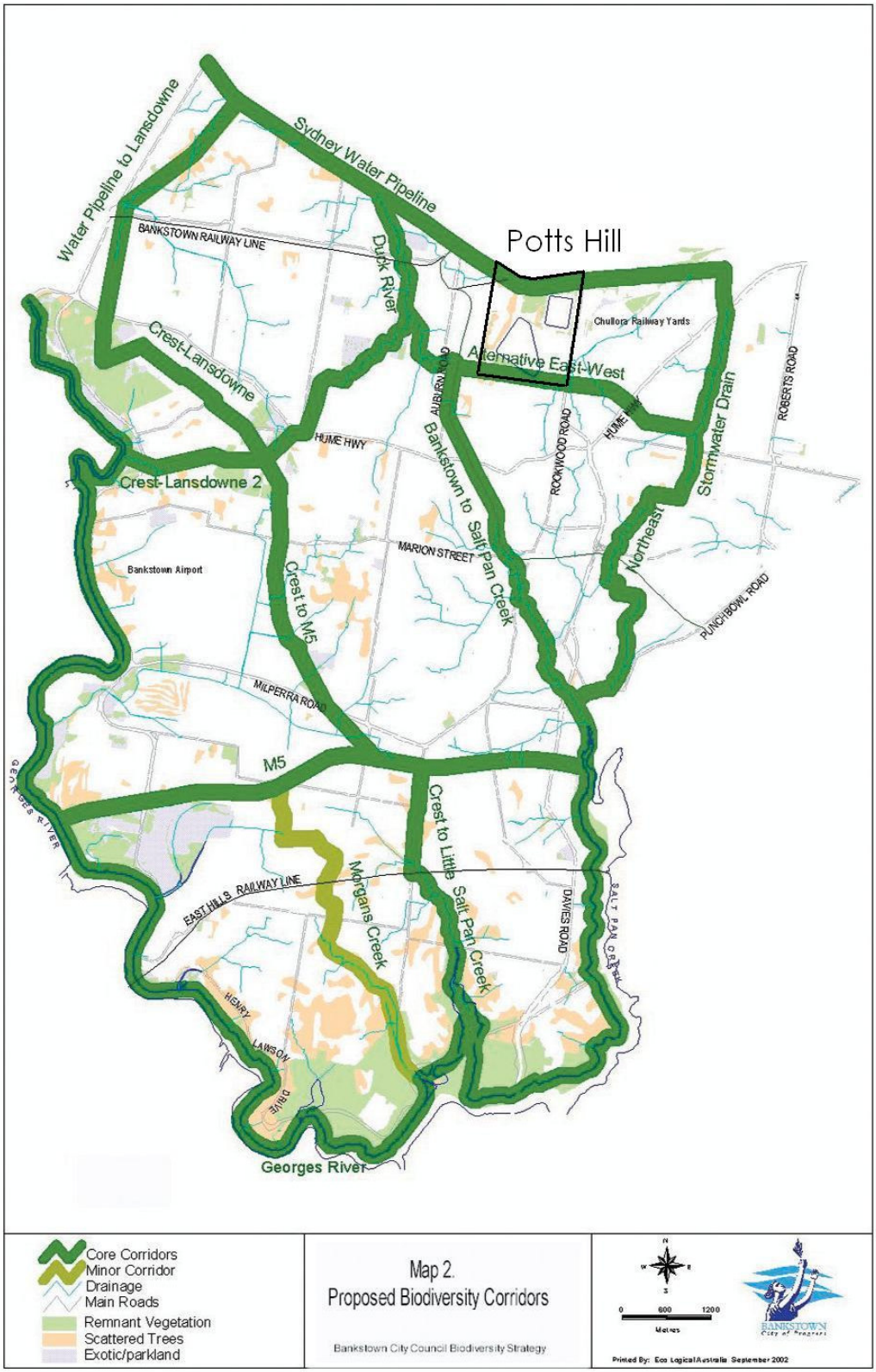

Figure 6. Bankstown ecological corridors (from BCC and ELA 2002), with Potts Hill boundary

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Vegetation Community Mapping and Condition Assessment

The Bankstown City Council (2002) mapping was found to be the most accurate, and hence was used as a base layer, with the classification and extent of some communities modified as a result of the fieldwork. After ground-truthing, a total of five remnant communities were identified as occurring on the site (Figure 7). Areas of grassland were mapped in the east of the site in the Council layer.

During site inspections it was noted that grasslands in the east occurred between rows of planted trees, and appeared to be dominated by an exotic grass species, and was therefore removed from the mapping as it did not appear to be a native vegetation community. It is noted that ground-truthing in this area was limited. The area of 'Grassland – Native' in the south of the site was noted as being dominated by *Themeda australis,* with some exotic species also present.

Table 8. Area of vegetation communities (see Figure 7 for distribution of communities).

Vegetation Community	Status *		Area (ha)
	TSC	EPBC	
Cooks River/Castlereagh Ironbark Forest	EEC	-	8.30 (67%)
Creek (Riparian)	-	-	0.11 (0.9%)
Cumberland Plain Woodland	EEC	EEC	1.04 (8.4%)
Grassland - Native	-	-	0.33 (2.7%)
Sydney Turpentine Ironbark Forest	EEC	CEEC	2.60 (21%)
Total			12.38 (100%)

* TSC = Threatened Species Conservation Act; EPBC = Environmental Protection and Biodiversity Conservation; EEC = Endangered Ecological Community; CEEC = Critically Endangered Ecological Community

The proportion of the site with mapped vegetation, including exotic dominated grasslands, is low (9.8%). This is consistent with the site having a long history of water management usage. A number of areas contain planted, non-local trees, or some regrowth, usually heavily dominated by exotic species. This type of vegetation is common throughout the site, and is visible in Figure 7 as vegetation that has not been classified as a native community. These areas differed in plant density, with some areas maintained by periodic slashing or mowing [eg. plantings of Canary Island palms (*Phoenix canariensis*) and other non-local trees around the perimeter of Reservoir 2].

The majority of mapped vegetation (67%) within the site is Cooks River/Castlereagh Ironbark Forest. Sydney Turpentine Ironbark Forest also occurs, and integrades with the Cooks River/Castlereagh Ironbark Forest. Both of these communities are rated as 'core' conservation significance (Figure 8), due to 'Critically Endangered Ecological Community' ratings.

In the north, the Cooks River/Castlereagh Ironbark Forest, and Sydney Turpentine Ironbark Forest communities appear to have an understorey which is often slashed, or mown (see plate 1). The recovery potential of these areas was rated as moderate to high (Figure 9), with areas close to Sydney Water buildings (in the east and

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northwest), and water supply infrastructure (mainly the water supply pipeline in the north) more degraded, and assigned a lower recovery potential (Figure 9).

In the south, the Cooks River/Castlereagh Ironbark Forest, and Sydney Turpentine Ironbark Forest, communities were given recovery potential ratings from low to high. A large block of Sydney Turpentine Ironbark Forest in this region had reasonable structural composition, as the understorey was not slashed or mown. There was, however, some weed species and areas of dumped fill or rubbish. Vegetation condition deteriorated markedly in the vicinity of Brunker Road and Sydney Water buildings. Weed species, particularly blackberry, and soil disturbance, were evident in these areas.

Cumberland Plain Woodland is located along the western boundary of the site as a series of fragmented patches totalling 1.04 ha. These areas usually consisted of large remnant tree species, with a frequently mown groundcover layer, and with few shrubs present. These areas were assigned a moderate recovery potential rating. It is noted, however, that these areas are immediately adjacent to an area of extensive fill (to the east of the Cumberland Plain Woodland vegetation). This fill came from material excavated during the construction of Reservoir 2.

Plates 1 (left) and 2 (right): Contrasting extremes in vegetation condition from the north of site vs. elsewhere. Note the weedy understorey and inconsistent canopy in plate 2.

Vegetation on the Bagdad Street site was found to be highly disturbed with most of the site dominated by exotic species. Two drainage line lines occur on the Bagdad Street site that had been mapped as Creek (riparian) by BCC and ELA (2002). These artificial drainages were highly degraded and dominated by weeds such as large-leaved privet (*Ligustrum lucidum*), blackberry (*Rubus fruticosus* spp. agg.), willows (*Salix* spp.) and crofton weed (*Ageratina adenophora*). However, some native species were present, including patches of bullrush (*Typha orientalis*), some scattered bottlebrush (*Callistemon* sp.), *Melaleuca decora* and *Acacia parramattensis.*

A small patch of exotic grasslands was mapped on the Bagdad Street site by BCC and ELA (2002). It is likely that this area was once grassy woodland, however the canopy has now been removed and the soil disturbed. The dominant species were

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