

Mill Creek Catchment Strategic Management Plan



**for the Mid Georges River
Sustainability Initiative**

June 2010

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Sustainability Initiative**

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Gondwana Consulting Pty Ltd

**ISSUED JUNE 2010
FINAL STRATEGIC MANAGEMENT PLAN
(VERSION D.4)**

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1. INTRODUCTION

1.1 PROJECT BACKGROUND AND LOCATION

This Strategic Management Plan for the Mill Creek Catchment has been prepared as part of the Mid Georges River Sustainability Initiative (MGRSI).

The MGRSI is a collaborative project involving Bankstown City Council, Sutherland Shire Council and the community – with funding assistance under the NSW Environmental Trust via the (then) Department of Environment and Climate Change – aimed at improving the environmental health, recreational value and sustainability of the mid Georges River.

The Mill Creek Catchment is one of the major tributary drainage systems, or sub-catchments, feeding into the middle reaches of the Georges River. It has been selected as one of two locations where projects will be developed and implemented under the MGRSI to address the diverse impacts affecting the river and its catchments. The overall aim of these projects is to establish on-going management and works to restore the target area's environmental and recreational values in the face of a myriad of urban pressures.

The Mill Creek Catchment is situated on the southern side of the Georges River in the south/south-west of the Sydney Metropolitan area, approximately 25 kilometres south-west of the Sydney central business district – as shown in Figure 1. Covering around 20 square kilometres it is bordered by Heathcote Road and Holsworthy in the west and Old and New Illawarra Roads and the suburbs of Bardens Ridge (a developing residential area), Menai and Alford's Point in the east. Lucas Heights is at the head of the Mill Creek Catchment in the south.

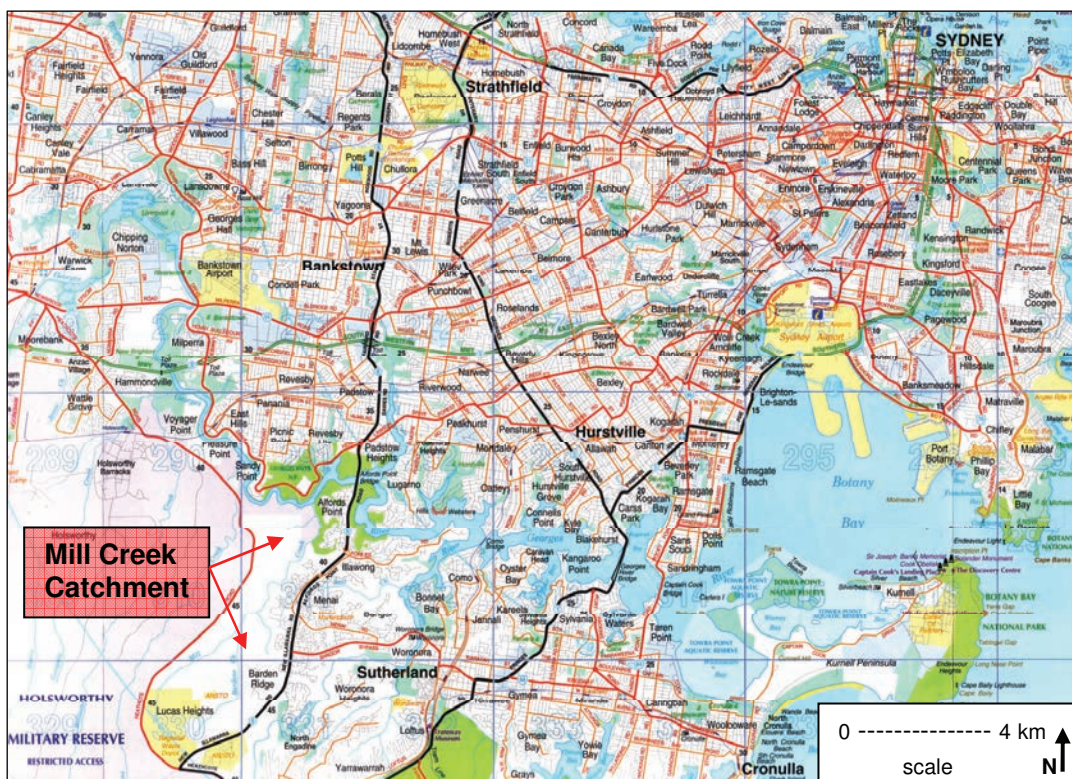


Figure 1
Location plan
Source: UBD Sydney

Mill Creek, which takes its name from an historic mill previously located in the area, and Bardens Creek are the principal drainage lines. The area retains a significant amount of natural Sydney sandstone bushland, although in varying conditions and regenerating from disruptive prior land uses in some areas, and so has a suite of significant biodiversity, landscape and Aboriginal cultural heritage values. It also serves an important water quality function for the Georges River and is a recreation asset valued and used by the local community and others.

The catchment is under a number of land tenures with several major landholders or managers – both public and private – and so hosts a wide range of land uses, from waste management or landfill sites and nuclear research facilities to national park. The area is also traversed by numerous easements and utilities. The eastern boundary of the catchment has seen considerable residential development and associated land uses (such as sports facilities) in recent decades, with the attendant impacts these land uses have for adjoining bushland areas and waterways. This urban development is continuing in several places. These activities, and their histories, have had varying adverse impacts on the catchment and its values – as both on-site and “downstream” impacts. Overall the catchment is subject to the pressures and impacts that are typical to large natural, and seemingly un-managed, bushland areas on the fringes of Sydney – such as urban stormwater discharge and pollutants, weed invasions and spread, altered fire regimes, habitat loss and fragmentation, erosion and sedimentation, recreational use (both intensive and extensive), sewer overflows, uncontrolled vehicle access and use, track proliferation, damage to Aboriginal heritage sites, rubbish dumping, illegal activities, and on-going development pressures. These have all impacted the catchment’s environmental, cultural, recreational and amenity values.

Addressing these impacts, and where possible their underlying origins or pressure, within a strategic framework that can be co-operatively implemented by all catchment landholders and stakeholders is central to this Strategic Management Plan.

1.2 AIMS AND OBJECTIVES

The aim of the Strategic Management Plan is to identify both tangible on-ground works and other management actions aimed at the protection and more sustainable management of the Mill Creek Catchment’s natural, cultural and recreational values as well as its contribution to the water quality and environment of the Mid Georges River. In doing so it will also endeavour to engage both landholders and managers, as well as the community, in the area’s future management and set out a co-ordinated direction and accompanying actions that can be endorsed by all parties.

Within this overall aim the Strategic Management Plan is focused strongly on the catchment’s natural and environmental values, water quality and recreational uses. As set out in the project brief, specific objectives to be realised by the Plan are to incorporate proposals to:

- reduce the impact of damaging recreational activities;
- reduce the impacts of stormwater in the catchment, and identify opportunities for water sensitive urban design (WSUD);
- protect and enhance habitat, vegetation communities within the catchment;
- manage noxious and environmental weeds within the catchment; and
- improve the overall environmental and passive recreational values of the catchment.

The Strategic Management Plan is also required to build on previous management plans and reports relevant to the catchment and its management within the wider context of the Georges River and Sutherland Shire’s natural landscapes (including those described in Section 3.1.4).

1.3 PREPARING THE STRATEGIC MANAGEMENT PLAN

This Strategic Management Plan has been prepared by Gondwana Consulting for the MGRSI, Sutherland Shire Council and Bankstown City Council (host Council for the MGRSI).

1.3.1 Project Steering Committee

Preparation of the Strategic Management Plan was overseen by a Project Steering Committee comprising representatives from:

- Sutherland Shire Council;
- Bankstown City Council;
- the National Parks and Wildlife Service (part of the Department of Environment, Climate Change and Water);
- Sydney Metropolitan Catchment Management Authority;
- the Georges River Combined Councils Committee (GRCCC);
- Land and Property Management Authority (formerly the NSW Department of Lands); and
- NSW Maritime.

The Steering Committee provided direction and advice at key stages in the Strategic Management Plan's preparation, including the review of draft products (such as the Issues and Options Paper of August 2009, and the Preliminary Draft Strategic Management Plan of September 2009, and the Draft Strategic Management Plan of April 2010). Day-to-day guidance for the project was provided by the Project Manager MGRSI, based within Bankstown City Council.

1.3.2 Agency and Landholder Liaison

Preparation of the Strategic Management Plan involved discussions with numerous State Government agencies considered likely to have an interest in the catchment and its management (beyond those represented on the Steering Committee).

The full list of agencies consulted is provided at Appendix 1, however the following agencies had the most input/involvement in the Strategic Management Plan's preparation:

- Sydney Metropolitan Catchment Management Authority;
- Rural Fire Service;
- Land and Property Management Authority (formerly the NSW Department of Lands);
- Department of Commerce; and
- TransGrid.

Meetings were also held with representatives from the Australian Nuclear Science and Technology Organisation (ANSTO) and WSN Environmental Solutions.

The Gandangara Local Aboriginal Land Council declined to be involved in preparation of the draft version of the Strategic Management Plan. However following development of the draft version of this Plan meetings were held between the Project Manager MGRSI, staff from the Sydney Metropolitan Catchment Management Authority and senior representatives of the Land Council around the future management of their current and pending lands within the catchment and input to the Strategic Management Plan. Their feedback, comments and management

directions have subsequently been incorporated into this document where they relate to management of the catchment's vegetation and habitats, water quality, and recreational uses and impacts – the three core areas of this Strategic Management Plan.

1.3.3 Community Consultation

Engaging with those members of the community living close to, using for recreation or other purposes, or otherwise likely to have an interest in the catchment and its management was another important element in the Strategic Management Plan's preparation.

A "Community Information Sheet and Feedback Form" was developed to inform members of the local community, and other interested people/groups, of the Strategic Management Plan project and assist them in providing input to the Plan's preparation. The feedback component of the Form comprised six simple questions, and a reply-paid facility, as shown in Appendix 2.

A number of avenues for community consultation and engagement were pursued, including:

- ❑ a letter to all residents of the catchment (by household, approximately 2,500 letters in total) informing them of the project and its purpose, and inviting them to an evening community consultation/information meeting – as shown in Appendix 3;
- ❑ advertisements placed in the local paper, and notices posted on the Sutherland Shire Council website;
- ❑ an evening community consultation/information meeting, run as a "participatory" information sharing and "issues and ideas" session, held at the Menai Community Centre on 16 June 2009 – the meeting was attended by over 30 residents (despite a cold wet evening);
- ❑ follow-up letters, with a copy of the Community Information Sheet and Feedback Form, mailed to all participants who registered at the community consultation evening – as shown in Appendix 4;
- ❑ contact, mainly by telephone and/or e-mail, with stakeholder or community groups known or expected to have an interest in the catchment – predominantly recreational users and interest groups – including 19 recreational groups (13 4WD or trailbike clubs, 2 mountain bike clubs, 1 pony club [with premises within the catchment], 1 bushwalking club, 1 fitness/running club and 1 canoe club), 6 groups with conservation or environmental interests (including 1 non-government organisation undertaking programmes within the catchment), and 3 local residents groups or progress associations (a full list of the groups contacted is provided at Appendix 5);
- ❑ follow-up meetings, where requested, with stakeholder groups – 2 with local residents groups and 1 with a conservation interest group;
- ❑ letters, with the Community Information Sheet and Feedback Form, mailed to 21 local public schools (16 primary schools and 5 high schools);
- ❑ letters, with the Community Information Sheet and Feedback Form, mailed to 14 local Scouts, Cubs or Guides groups;
- ❑ a mailout of the Community Information Sheet and Feedback Form, with an explanatory letter, to a random sample of 200 local households – as selected from Sutherland Shire Council's residents/ratepayers database; and
- ❑ distributing the Community Information Sheet and Feedback Form to people encountered within the catchment during fieldwork – approximately 25 surveys in total.

Despite the above efforts only 15 completed Feedback Forms were received from individuals or families. These were analysed and the results are summarised in Table 1, these results mirror very closely the feedback and comments received at the public meeting of 16 June 2009.

Despite concerted efforts to obtain input from the 13 4WD or trailbike clubs, and 2 mountain bike groups, approached very little was forthcoming from these stakeholder groups.

Table 1 Community Feedback/Views from Information Sheet and Feedback Form

What do respondents Value about the catchment	How do respondents Use the catchment	What do respondents see as Issues or Problems to be addressed	What do respondents suggest as Management Directions or Priorities	What do respondents see as a “Preferred Future” for the catchment
<p>VEGETATION AND NATURAL BUSHLAND</p> <p>Habitat area for flora and fauna</p> <p>Proximity to houses, easy accessibility</p> <p>Adds to “bush suburb” character</p> <p>Birdlife</p> <p>Undeveloped</p> <p>Quite/peaceful</p> <p>“Green corridor”</p> <p>Lots of tracks/access</p> <p>Recreation/appreciation</p> <p>Clean waterways</p> <p>Open space</p> <p>Scenic</p> <p>“A good place to be”</p> <p>Buffer between residential areas and waste</p>	<p>BUSHWALKS OR LONG WALKS</p> <p>Casual or short walks</p> <p>Mountain biking</p> <p>Scenic views from residences</p> <p><i>Walking</i></p> <p><i>Birdwatching</i></p> <p><i>Wildflower viewing</i></p> <p><i>Running/jogging</i></p> <p><i>Orienteering</i></p> <p><i>Use Bardens Ridge</i></p> <p><i>Sports Complex</i></p> <p><i>School visits</i></p> <p><i>Fishing, along Georges River foreshore</i></p> <p><i>Canoe/kayak on lower reaches of Mill Creek and along Georges River frontage</i></p>	<p>IMPACTS OF 4WD AND TRAILBIKE USE</p> <p>RUBBISH DUMPING</p> <p>Containing waterway contamination and sediment from upstream landfill and old disposal sites</p> <p>Weeds</p> <p>Threat of further residential development</p> <p>Stormwater flows and water-borne rubbish</p> <p>Fire safety and bushfire risk management</p> <p>Poorly maintained access tracks</p> <p>4WD and trailbike noise impacting residents</p> <p>Closure of current waste disposal site</p> <p>Threats from masterplanning and management intervention</p> <p><i>Habitat protection</i></p> <p><i>Erosion</i></p> <p><i>Feral animals</i></p>	<p>Prevent/police 4WD and trailbike use</p> <p>Fire trail clearing and greater fire management access</p> <p>Classify it “as a no development sector” for bushland preservation</p> <p>Manage by NPWS/extend Georges River NP</p> <p>Area designated for 4WD and trailbike use</p> <p>“More ranger patrols” or Police presence</p> <p>Reduce bushfire risks</p> <p>Rubbish clean-ups</p> <p>Encourage greater recreational use, provide low impact recreational use/facilities around perimeter</p> <p>More and better bushwalking tracks</p> <p>Monitor leachate and waterways pollution from landfill sites</p>	<p>UNDEVELOPED AND NATURAL, AND MANAGED TO PRESERVE THESE ATTRIBUTE</p> <p>Cleaner, no further waste disposal land uses (formal or informal) and change its character as “unregulated wasteland”</p> <p>As is/same as now</p> <p>Natural-setting recreation area</p> <p>Monitor/manage leachate and pollutants from landfill areas</p> <p>As is, but with reduced bushfire risks</p> <p>Cleaner water in the creek</p> <p>National park</p> <p>Improved walking tracks</p> <p>Restricted 4WD/trailbike access</p> <p>“Leave it as it is – don’t touch it”</p> <p><i>Joint SSC and NPWS management</i></p> <p><i>Bardens Creek Valley protected as high quality bushland</i></p> <p><i>Reintroduction of native animals</i></p>

What do respondents Value about the catchment	How do respondents Use the catchment	What do respondents see as Issues or Problems to be addressed	What do respondents suggest as Management Directions or Priorities	What do respondents see as a “Preferred Future” for the catchment
<p>disposal site Bardon Ridge Sports Complex is “a very positive development” Cultural heritage</p>	<p>Lack of biodiversity and water quality baseline data and monitoring Poor water quality in creek Identify sources of pollution and contaminants Better access to deeper waterholes Lack of “defined” picnic areas Odours from waste disposal site Need a cleared firebreak along Heathcote Road Need to limit public access Light pollution from surrounding residential areas reducing habitat values Mosquito breeding area in unmanaged water/swamp</p>	<p>Leave it alone/un-managed Preservation as bushland to balance development areas Improve/restore degraded areas “Have one manager and Dedicated manager and landholder co-ordinator for Valley in SSC Waterflow management Biodiversity and water quality monitoring Clean the river Picnic areas Education and public awareness regarding area Chance to visit Aboriginal sites Restore historic sites Improved fencing, gates and signage Less public access Manage light pollution Mosquito traps/control</p>	<p>Manage residential area runoff and stormwater impacts Improve value and “respect” for area by the community Improved creek/water access Low impact recreational user/facilities around perimeter Better interpretation and access to heritage sites Pedestrian accessed lookouts Bush seats Very restricted public access, management access only Protect Aboriginal sites Residents’ involvement – bushcare, volunteering and decision-making role Upgrade sewer lines to prevent leaks</p>	

CAP BOLD = cited by over 50% of responses

Bold = cited by 27-47% of responses

Text = cited by less than 20% of responses

Italic = cited in only a single response

1.3.4 On-site Assessments

More than 6 days were spent on-site within the catchment ground-truthing values information, identifying issues, assessing opportunities and constraints, and investigating solutions on-the-ground.

2. CATCHMENT DESCRIPTION AND VALUES

2.1 INTRODUCTION AND OVERVIEW

Mill Creek is a sub-catchment of the Georges River located in the north-west corner of Sutherland Shire – as shown in Figure 1. The Mill Creek Catchment covers approximately 20 square kilometres – as shown in Figure 2 – representing 2.3% of the total catchment area for the Georges River. The catchment is typified by the rugged topography of an incised sandstone valley and less dissected uplands, mostly covered by remnant or regenerating urban bushland, with a range of residential and peri-urban land uses around the catchment's upland margins.

2.2 GEOLOGY, TOPOGRAPHY AND SOILS

The geology of the Mill Creek Catchment is dominated by Hawkesbury Sandstone – as uniform, massive, thickly bedded medium to coarse grained quartzite and sandstones. The interaction between the blocky massive nature of this sandstone – with well-developed jointing patterns (trending east-west and north-south) – and the erosive/drainage forces of Mill Creek have been the dominant factors in shaping the area's landforms. A thin capping of Wianamatta Group Shales occurs on some ridges, particularly in the Little Forest area in the south where lenses of light to medium grey silty clays up to 8 metres in depth have been extensively quarried. Smaller and thinner areas of shale also occur along Heathcote Road on the catchment's western boundary, and also previously overlaid the Hawkesbury Sandstones across much of the catchment. Lateritic gravel deposits now occur as residual cappings over the sandstones on the plateaus and higher ridgelines, and these have been extensively exploited in the catchment's more extensive western uplands.

The Mill Creek Catchment is predominantly a small entrenched river valley flanked by deeply dissected plateaus and ridgelines. The catchment ranges from sea level to over 150 metres in height. Local relief can be up to 70 metres at some of the Georges River clifflines and along the more incised sections of Mill Creek. It is the rugged nature of the catchment's landscape that has deterred urban development and retained much of the area in its natural or semi-natural state.

The Mill Creek valley has been formed in a north-tilted sandstone plateau into which Mill Creek has cut a relatively deep, narrow sided-valley, with steep hillslopes and occasional escarpments.



Rugged incised terrain typical of the middle sections of Mill Creek valley.

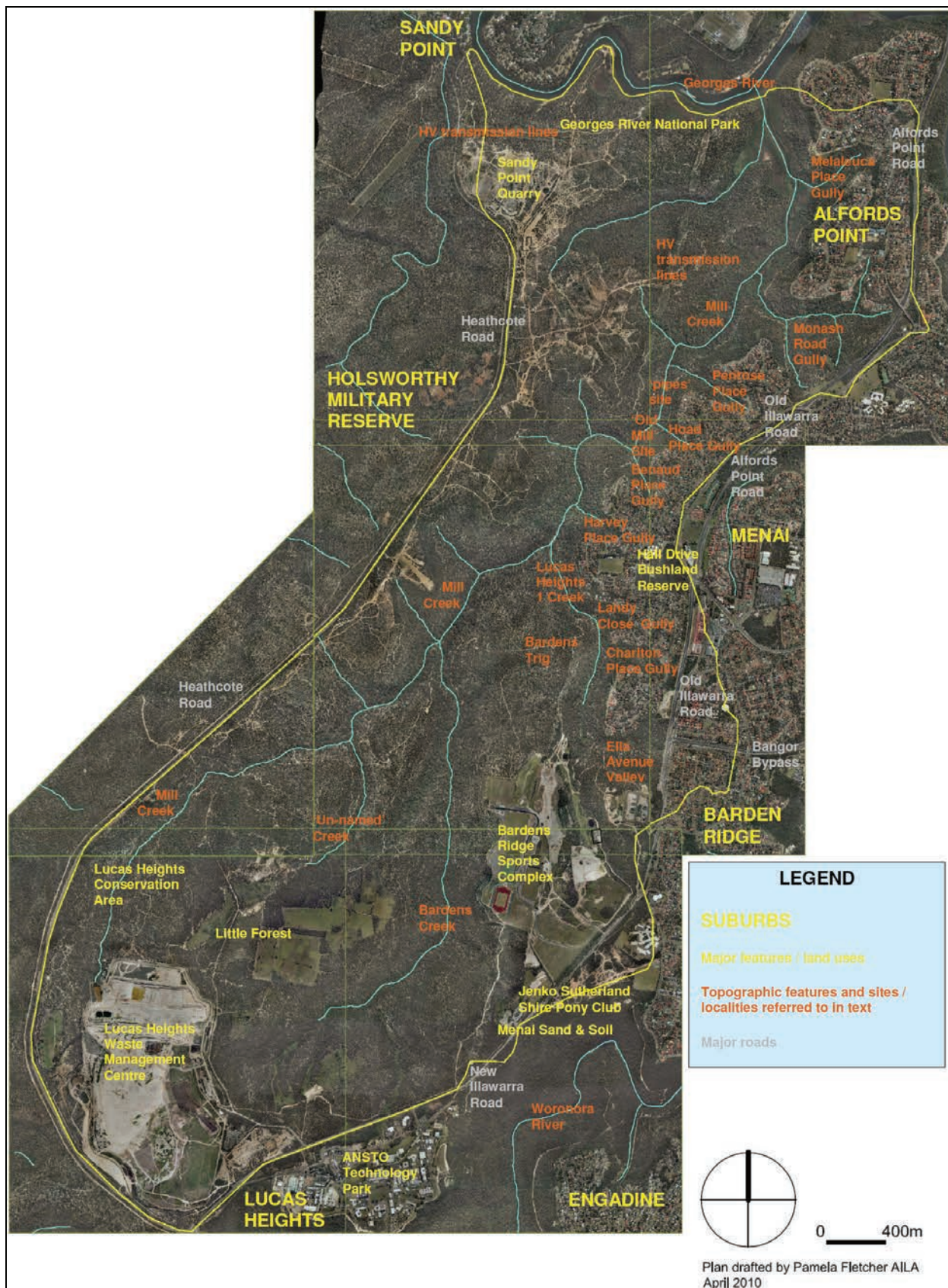


Figure 2 Mill Creek Catchment

The major landscape elements of the catchment are the western plateau and ridge area which is cut by a number of deep valley and drainage lines flowing steeply eastwards to the main creek, and the deep and steep-sided south to north valley of Mill Creek itself. Smaller or secondary areas are a narrower ridgeline flanking much of the valley's eastern side (which is also cut by deep gullies), the Georges River frontage with high sandstone cliffs above small river flats and wetlands on depositional flats, and the higher and slightly more undulating terrain of Mill Creek's upper catchment with lower local relief.

The soils of the catchment closely mirror its geology. The valley and sides of Mill Creek are dominated by the skeletal/colluvial soils and shallow sands of the Hawkesbury Soil Landscape. These shallow stony sands/soils are considered highly permeable and of low fertility, they are very susceptible to erosion by sheet or non-concentrated water flows and their erosion hazard for concentrated flows is rated as extreme. The higher flatter ridges and plateau area are covered by a mix of sandy loams, sandy clay loams and clays of the Lucas Heights Soil Landscape. These mixed, often stony, soils are of low fertility and moderately susceptible to sheet erosion (although this can vary from a slight to extreme risk in places) and highly susceptible to erosion under concentrated water flows. "Swamp soils" of the Mangrove Creek Soil Landscape occur along the flats and frontage of the Georges River in the area's north as sands and slits with high organic content and are generally of low erosion susceptibility (due to the flatter terrain).

2.3 HYDROLOGY

Mill Creek, the catchment's principal watercourse, flows south to north to discharge into the Georges River between Alfords and Sandy Points.

The headwaters of Mill Creek are now situated in the Lucas Heights Waste Management Centre, where the creek originates as discharge from the Centre's northern sediment basin. Mill Creek's upper reaches are gently sloping, and in dry weather consist of a series of pools with no flow. Downstream, as tributaries join from the south-east, the flow becomes more consistent. The creek soon enters an incised rocky bed with a channel of sandstone outcrops interspersed with rockpools and riffles between narrow, if any, banks. The creek's tidal limit is today formed by the remains of an old weir, around two-thirds of the distance downstream. Below this point the bed becomes wider and shallower with numerous sandbanks and occasional deeper sections, small flatter creekbanks also become more regular. The lower reaches of Mill Creek, near the confluence with the Georges River, is a relatively wide and straight estuarine system supporting Mangrove and Saltmarsh communities with generally small river flats. Mill Creek has four significant tributaries. Three of these – an un-named creek draining north from Little Forest, Bardens Creek, and Lucas Heights 1 Creek – drain the southern 40% of the catchment. The other major tributary is an un-named creek that flows into Mill Creek from the west just before its mouth. Numerous smaller steep drainage lines feed into Mill Creek, from both sides, at regular intervals along its more incised northern two-thirds.



Mill Creek, typical mid catchment creekbed.

2.4 NATURAL HERITAGE

Approximately 75% of the catchment is remnant bushland in varying, but generally good, condition. The natural areas east of Mill Creek could be described more typically as urban bushland – comprising strips and incursions of remnant bushland on steeper topography surrounded by residential and urban land uses. However the catchment's large western bushland areas include extensive ridgetop and plateau areas, which is terrain less common in Sydney's remnant natural areas (outside of conservation reserves) and consequently they support extensive areas of significant vegetation communities.

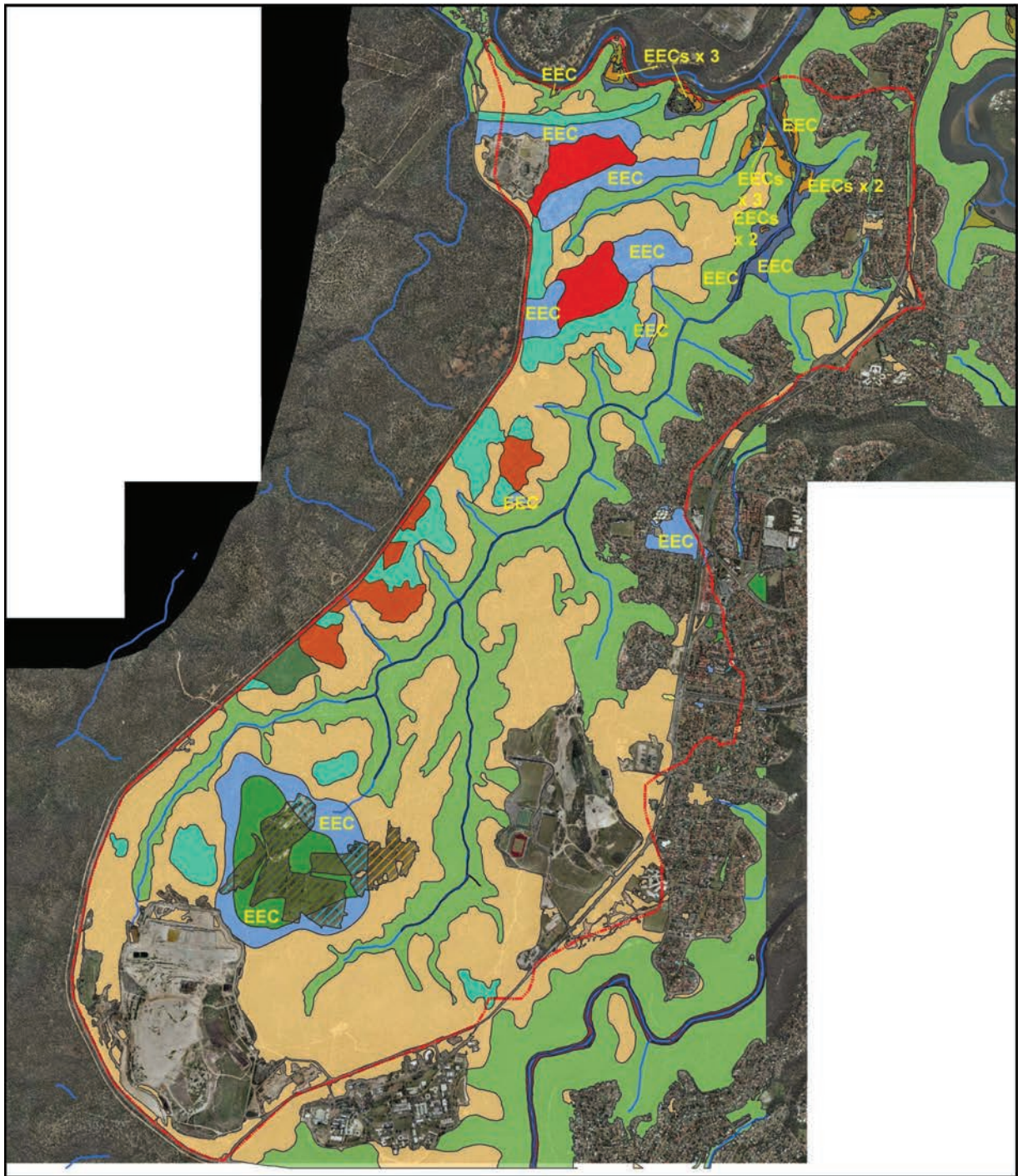
A number of vegetation surveys have been conducted within the catchment – typically site-specific or project-specific surveys, but also broader descriptions that have formed parts of regional surveys and assessments. Vegetation community mapping by Sutherland Shire Council in 2006 has identified 14 different native vegetation communities within the catchment, with the area dominated by grassy woodland communities – from extensive Sydney Sandstone Gully Forest along the steeper valley slopes flanking Mill Creek and Sydney Sandstone Ridgetop Woodland on the upland areas, that together dominant the catchment's vegetation, to minor bands of Riparian Scrub along the banks of Mill Creek itself. Figure 3 shows the location and extent of the catchment's described vegetation communities.

Estuarine complex vegetation communities occur along the Georges River frontage and the lower sections of Mill Creek. Three of these communities are listed as Endangered Ecological Communities (EECs) under the *Threatened Species Conservation Act 1995* (TSC Act) – Coastal Saltmarsh, Swamp Oak Floodplain Forest and River-flat Eucalypt Forest (as shown in Figure 3). Mangrove communities which are also found in these areas, while not listed under the TSC Act, are also protected under the *Fisheries Management Act 1994*. The then Department of Environment and Climate Change (now DECCW) included Mill Creek on the *Indicative Coastal Floodplain Endangered Ecological Community (EEC) Map Series*, which highlights areas where these communities are likely to occur.

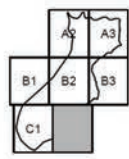


Saltmarsh and Mangroves fronting the Georges River.

The more elevated parts of the catchment – mainly along Heathcote Road and around the Little Forest Plateau – carry expanses of Woronora Plateau Dry Ironstone Heath, Sydney Sandstone Heath, and O'Hares Creek Shale Forest complex amongst the more widespread Sydney Sandstone Ridgetop Woodland. Two listed Endangered Ecological Communities also occur on these higher areas. Four reasonably large areas, and one smaller patch, of the Shale/Sandstone Transition Forest EEC occur in the north of the catchment with another smaller area of this EEC on the uplands west of the junction of Mill and Lucas Heights 1 Creeks. This EEC typically occurs on plateaus and hillsides where the shale capping thins to sandstone. A large area of the Sydney Turpentine Ironbark Forest EEC occurs in the Little Forest Plateau, this community typically occurs on shale soils on or near ridge tops. It is also a protected community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.



- Vegetation Communities 2006**
- | | | | |
|----------------------|------------------------------------|--|--|
| Coastal Saltmarsh | O'Hares Creek Shale Forest Complex | Shale/Sandstone Transition Forest - Degraded | Sydney Sandstone Ridgeline Woodland - Degraded |
| Ironstone Woodland | Paperbark Mahogany Forest | Swamp Oak Floodplain Forest | Sydney Turpentine Ironbark Forest |
| Mangrove | Riparian Scrub | Sydney Sandstone Gully Forest | Sydney Turpentine Ironbark Forest - Degraded |
| Non Natural Wetlands | River-Flat Eucalypt Forest | Sydney Sandstone Heath | Woronora Plateau Dry Ironstone Heath |
| | Shale/Sandstone Transition Forest | Sydney Sandstone Ridgeline Woodland | Georges River Creek |
| | | | Mill Creek sub catchment |



EEC
EEC = listed Endangered Ecological Community under the Threatened Species Conservation Act 1995

Vegetation Communities
Mill Creek sub catchment, Georges River

Figure 3 Vegetation communities of the Mill Creek Catchment, including Endangered Ecological Communities
Source: Sutherland Shire Council and DECCW

At Little Forest the Sydney Turpentine Ironbark Forest is ringed by a band of Shale/Sandstone Transition Forest (as shown in Figure 3). Both these EECs in this locality include areas classed as “degraded”, due to past clearing and disruptive land uses in and around Little Forest. These shale based vegetation communities have been extensively cleared from southern Sydney, with the catchment’s communities representing significant regional remnants of these types.

A combined review of all past vegetation surveys for all or parts of the catchment and appropriate flora databases provides a floristic list of approximately 1,600 species which are listed as occurring, or likely to occur, in or near the catchment. This includes 55 vascular plants of significance – either listed as threatened in accordance with the NSW *Threatened Species Conservation Act 1995* or on the CSIRO’s Rare or Threatened Australian Plants (ROTAP) list. Of these – 20 species are listed as endangered and 20 as vulnerable (with 27 of these endangered or vulnerable species also listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*) and a further 15 plants listed on ROTAP (but not currently listed as either vulnerable or endangered. Table 2 lists the 40 known vulnerable or endangered flora species from these records/databases, and their respective legal status.

A subspecies of *Allocasuarina* – *Allocasuarina diminuta* ssp. *mimica*, the Dwarf She Oak – has been recorded in the heath community north of the current Lucas Heights Waste Management Centre. This subspecies is considered to be chromosomally distinct from the species of *Allocasuarina diminuta* found in limited parts of the NSW Central and Southern Tablelands, and is considered “much rarer”. The Mill Creek population of this subspecies is thought to be the “main Australian stronghold” for this plant, however the Dwarf She Oak is not listed under the *Threatened Species Conservation Act 1995* nor as a ROTAP.



Allocasuarina diminuta ssp. *mimica*
Source: Fairley and Moore, 2000

However flora records and vegetation studies have not been undertaken evenly across the catchment. The most intensively surveyed area is the Lucas Heights Conservation Area, and former potential expansion area for landfill activity, north of the current Lucas Heights Waste Management Centre. Areas around the old Lucas Heights 1 Waste Facility and, to a lesser extent within the ANSTO Buffer Zone, have also been investigated in some detail. However beyond broadscale assessments (associated with regional or strategic planning studies) or the efforts of community groups, much less detailed information is available regarding the flora values of the catchment’s other bushland areas.

A diverse range of animal species have been recorded in the catchment during site-specific surveys and also regional surveys. In total 49 mammal species, 42 species of reptile, and 18 species of amphibians have been documented to-date. Swamp Wallabies are a relatively common, and readily observed, part of the area’s fauna across the larger western bushland zone – more so than found in many other remnant natural areas of Sydney. Eastern Grey Kangaroos and Echidnas have been confirmed as occurring in the area.

An extensive list of birds, over 350 species, that are likely to occur in or near the catchment has also been compiled from the previous reports, on-line databases and amateurs’ sighting records. Fish surveys of Mill Creek in 2004, as part of the *Georges River Catchment Biodiversity Study*, identified 4 native and 1 introduced fish species in Mill Creek.

However again these fauna records are skewed in their spatial coverage, with not all of the catchment being evenly surveyed or equally represented in these data.

Table 2 Vulnerable or Endangered Native Plants Recorded from the Catchment

Genus	Species	Legal Status (NSW TSC Act 1995)
Ferns		
<i>Grammitaceae</i>		
<i>Grammitis</i>	<i>stenophylla</i>	Endangered
Angiosperms		
<i>Casuarinaceae</i>		
<i>Allocasuarina</i>	<i>glareicola</i>	Endangered *
<i>Dilleniaceae</i>		
<i>Hibbertia</i>	<i>sp. nov. 'Menai'</i>	Endangered
<i>Sterculiaceae</i>		
<i>Lasiopetalum</i>	<i>joyceae</i>	Vulnerable *
<i>Epacridaceae</i>		
<i>Leucopogon</i>	<i>exolasius</i>	Vulnerable *
<i>Leucopogon</i>	<i>fletcheri</i> subsp. <i>fletcheri</i>	Endangered
<i>Thymelaeaceae</i>		
<i>Pimelea</i>	<i>curviflora</i> var. <i>curviflora</i>	Vulnerable *
<i>Pimelea</i>	<i>spicata</i>	Endangered *
<i>Mimosaceae</i>		
<i>Acacia</i>	<i>bynoeana</i>	Endangered **
<i>Acacia</i>	<i>gordonii</i>	Endangered *
<i>Acacia</i>	<i>pubescens</i>	Vulnerable *
<i>Fabaceae</i>		
<i>Pultenaea</i>	<i>pedunculata</i>	Endangered
<i>Dillwynia</i>	<i>tenuifolia</i>	Vulnerable *
<i>Swainsona</i>	<i>sericea</i>	Vulnerable
<i>Proteaceae</i>		
<i>Persoonia</i>	<i>hirsuta</i>	Endangered *
<i>Persoonia</i>	<i>nutans</i>	Endangered *
<i>Grevillea</i>	<i>obtusiflora</i> subsp. <i>fecunda</i>	Endangered *
<i>Grevillea</i>	<i>parviflora</i>	Vulnerable
<i>Grevillea</i>	<i>parviflora</i> subsp. <i>parviflora</i>	Vulnerable *
<i>Grevillea</i>	<i>parviflora</i> subsp. <i>supplicans</i>	Endangered

Genus	Species	Legal Status (NSW TSC Act 1995)
<i>Myrtaceae</i>		
<i>Micromyrtus</i>	<i>blakelyi</i>	Vulnerable *
<i>Darwinia</i>	<i>biflora</i>	Vulnerable *
<i>Kunzea</i>	<i>rupestris</i>	Vulnerable *
<i>Callistemon</i>	<i>linearifolius</i>	Vulnerable
<i>Melaleuca</i>	<i>deanei</i>	Vulnerable *
<i>Melaleuca</i>	<i>groveana</i>	Vulnerable
<i>Eucalyptus</i>	<i>camfieldii</i>	Vulnerable *
<i>Triplarina</i>	<i>imbricata</i>	Endangered *
<i>Rutaceae</i>		
<i>Zieria</i>	<i>involuta</i>	Endangered **
<i>Asterolasia</i>	<i>elegans</i>	Endangered *
<i>Phebalium</i>	<i>bifidum</i>	Endangered
<i>Rhamnaceae</i>		
<i>Pomaderris</i>	<i>brunnea</i>	Vulnerable *
<i>Convolvulaceae</i>		
<i>Wilsonia</i>	<i>backhousei</i>	Vulnerable
<i>Asteraceae</i>		
<i>Olearia</i>	<i>cordata</i>	Vulnerable *
<i>Poaceae</i>		
<i>Ancistrachne</i>	<i>maidenii</i>	Vulnerable
<i>Deyeuxia</i>	<i>appressa</i>	Endangered *
<i>Liliaceae</i>		
<i>Caesia</i>	<i>parviflora</i> var. <i>minor</i>	Endangered
<i>Orchidaceae</i>		
<i>Diuris</i>	<i>tricolor</i>	Vulnerable *
<i>Pterostylis</i>	<i>gibbosa</i>	Endangered *
<i>Pterostylis</i>	<i>saxicola</i>	Endangered *

* also listed (in same category) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

** also listed (as vulnerable) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The DECCW Wildlife Atlas lists 23 species of threatened native fauna (listed under the NSW *Threatened Species Conservation Act 1995*) as being recorded within, or close to, the Mill Creek Catchment – as listed in Table 3. Two of these records also represent species that are listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

However no threatened populations are known to occur, or are considered likely to occur, in the catchment.

2.4.1 Pests and Weeds

Numerous weed and pest species are known to occur within the catchment – including weeds declared noxious within Sutherland Shire and a range of serious environmental weeds. However much of this information has been collected from opportunistic or project-specific investigations, noxious weed reports, collected observations, and anecdotal evidence. A comprehensive vegetation survey – including weed occurrence and density, or bushland condition assessment – has not yet been undertaken across the catchment.

Despite this lack of systematic weed surveys, the most problematic weed species within the catchment's bushland and waterways include – Pampas Grass (*Cortaderia selloana*), Ludwigia (*Ludwigia peruviana*), Lantana (*Lantana camara*), Crofton Weed (*Ageratina adenophora*), Bitou Bush (*Chrysanthemoides monilifera ssp. rotundata*), Boneseed (*Chrysanthemoides monilifera ssp. monilifera*), Castor Oil Bush (*Ricinus communis*), Blackberry (*Rubus fruticosus*) and Privet (*Ligustrum spp.*). Numerous environmental weeds typical of roadsides and other disturbed areas are also present – including African Love Grass (*Eragrostis curvula*), Rhodes Grass (*Chloris gayana*), Kikuyu (*Pennisetum clandestinum*), Couch (*Cynodon dactylon*), *Senecio angularis*, Paspalum (*Paspalum wettsteinii*) and others.

Figure 4 shows the known weed problem areas within the catchment.

Weed invasion is most obvious in the gullies and drainage lines coming off the eastern residential/urban ridgeline. However the density and severity of the infestations appears to vary considerably between gullies – in some areas the weeds are largely confined to the drainage corridor while elsewhere they are both advancing back upslope from the drainage lines as well as invading from the urban edge above. The urban-bushland interface is, as elsewhere in Sydney, a high pressure area for invasion by introduced species – from landscape plantings, firebreak grassing/clearing, and garden escapes as well as stormwater and drainage-borne propagules.



Drainage lines from the eastern residential areas are a potent source for weed invasion.

Mill Creek has high concentrations of weeds from around and below the dam and spillway north of the Bardens Ridge Sports Complex (LH1) downstream for approximately 3.6 km to the tidal limit – with Ludwigia in the bed and sand/silt banks plus a number of other aquatic weeds, and a variety of environmental and urban-edge weeds along the banks (especially where drainage lines join from the eastern residential/urban areas). The area immediately below the dam and spillway is particularly heavily infested with a variety of environmental weeds, due to the increased water and nutrients available in this location.

Table 3 Threatened Native Fauna Species Recorded from the Mill Creek Catchment

Family	Scientific Name	Common Name	Legal Status <small>(NSW TSC Act 1995)</small>
Amphibians			
<i>Myobatrachidae</i>	<i>Pseudophryne australis</i>	Red-crowned Toadlet	Vulnerable
Birds			
<i>Ardeidae</i>	<i>Ixobrychus flavicollis</i>	Black Bittern	Vulnerable
<i>Climacteridae</i>	<i>Climacteris picumnus</i>	Brown Treecreeper	Vulnerable
<i>Meliphagidae</i>	<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater	Vulnerable
<i>Meliphagidae</i>	<i>Xanthomyza phrygia</i>	Regent Honeyeater	Endangered
<i>Petroicidae</i>	<i>Petroica rodinogaster</i>	Pink Robin	Vulnerable
<i>Strigidae</i>	<i>Ninox strenua</i>	Powerful Owl	Vulnerable
<i>Tytonidae</i>	<i>Tyto novaehollandiae</i>	Masked Owl	Vulnerable
<i>Tytonidae</i>	<i>Tyto tenebricosa</i>	Sooty Owl	Vulnerable
Gastropods			
<i>Camaenidae</i>	<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	Endangered
Mammals			
<i>Burramyidae</i>	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Vulnerable
<i>Dasyuridae</i>	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Vulnerable **
<i>Emballonuridae</i>	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	Vulnerable
<i>Macropodidae</i>	<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Endangered *
<i>Molossidae</i>	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	Vulnerable
<i>Petauridae</i>	<i>Petaurus australis</i>	Yellow-bellied Glider	Vulnerable
<i>Phascolarctidae</i>	<i>Phascolarctos cinereus</i>	Koala	Vulnerable
<i>Pteropodidae</i>	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable
<i>Vespertilionidae</i>	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	Vulnerable
<i>Vespertilionidae</i>	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	Vulnerable
<i>Vespertilionidae</i>	<i>Myotis adversus</i>	Large-footed Myotis	Vulnerable
<i>Vespertilionidae</i>	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Vulnerable
Reptiles			
<i>Varanidae</i>	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	Vulnerable

* also listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

** also listed as endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

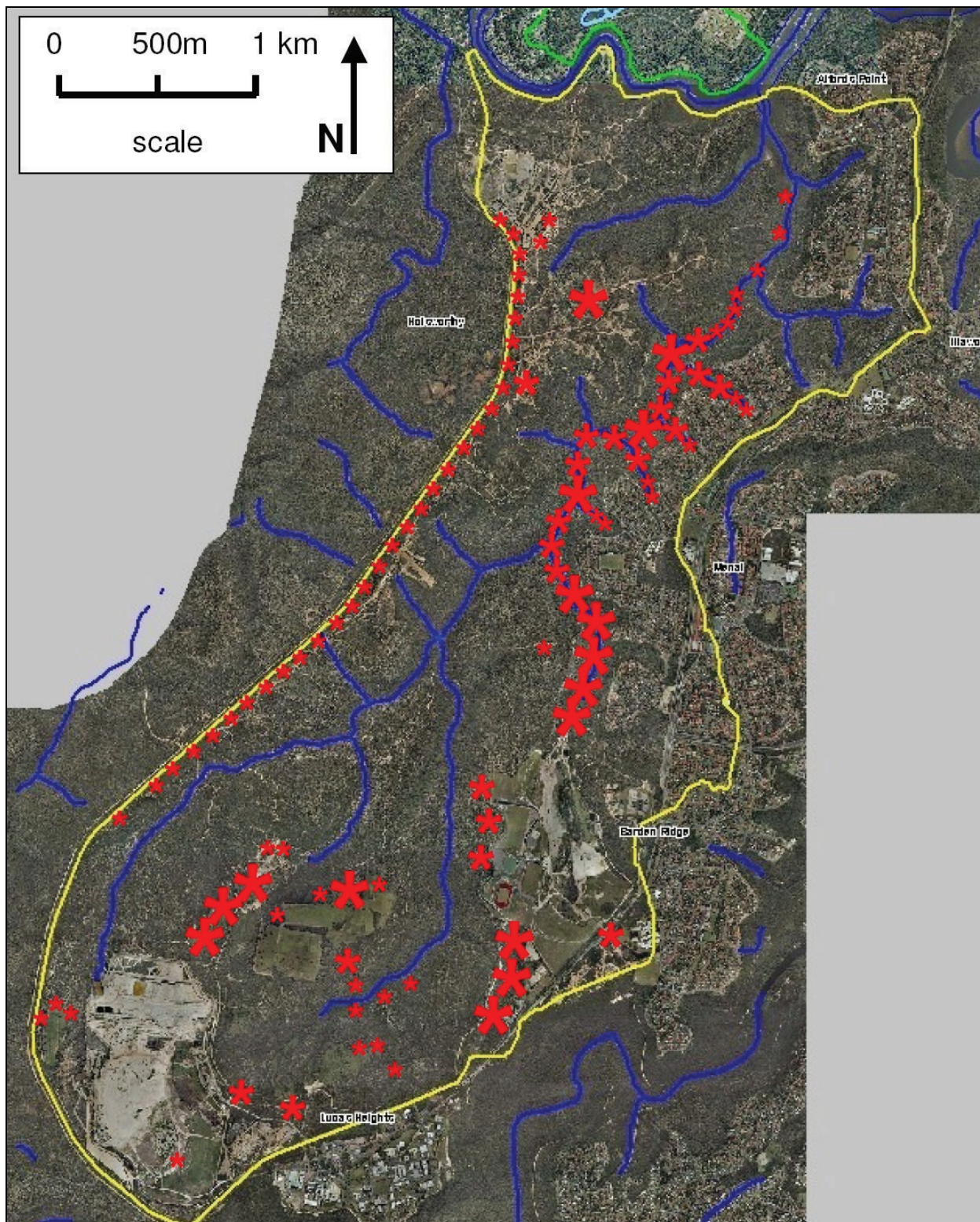


Figure 4 Known weed problems areas or concentrations within the catchment
(Note - not all areas have been surveyed, or are equally well-known, to the respective land managers, therefore some areas may be under-represented.)

Disturbed areas are especially prone to weed invasion. Disturbance weeds and introduced grasses are long-term problems in and around the former quarries and landfill sites of the Little Forest area. Occurrences of Pampas Grass and Lantana are also problems in this area. Bitou Bush and Pampas Grass are found scattered within the Lucas Heights Waste Management Centre, with Ludwigia also occurring in the facility's ponds. Occasional Bitou Bush and Castor Oil Plants are scattered across the fill slope along the western side of the Bardens Ridge Sports Complex. Similarly the slope below the Jenko Sutherland Shire Pony Club and the adjoining Menai Sand and Soil site, off New Illawarra Road, is heavily infested with Lantana and Pampas Grass (the latter has been subject to recent control efforts).

Crofton Weed has invaded the previously "clean" bushland on the upper sections of Bardens Creek, on Crown Land and into the ANSTO Buffer Zone, following the 1994 wildfire disturbance (and possibly also the recently increased levels of recreational use of this area). Occasional scattered occurrences of Pampas Grass are also found elsewhere across the ANSTO Buffer Zone bushland.

Weed infestations in the bushland areas west of Mill Creek appear more widely scattered, with concentrations along major unsealed tracks and "spot" infestations usually associated with prior land uses, garden and other waste dumping, or major disturbances. An extensive and dense Pampas Grass infestation occurs a short distance south-east of the Sandy Point Quarry, in the former gravel scrape area. Despite the extensive informal track network across this western upland area, and high levels of 4WD and trailbike usage, the regenerating bushland away from these tracks and cleared areas appears in reasonable to good condition. The bushland along the western escarpment/slope of Mill Creek itself appears to be among the least weed impacted areas of the catchment.

The margin of Heathcote Road is a particular problem area for disturbance and environmental weeds – from rubbish dumping, vehicle dispersal and the imported fill used for the barrier mound in this area. African Love Grass is a particular problem in this area, and a new infestation of Coolatai Grass (*Hyparrhenia hirta/rufa*) was treated by Council along this margin in 2006-07 (Sutherland Shire Council, 2007).

Several introduced animals are known to occur within the catchment – including Foxes, Cats (feral and domestic), Dogs, Rabbits, Deer and introduced rodents. However little is known about the distribution or population densities of these pests.

2.5 CULTURAL HERITAGE

2.5.1 Aboriginal Cultural Heritage

Many attempts have been made to map the pre-contact and contact territories of Aboriginal people in the Sydney Region. The exact boundaries are very difficult to reconstruct due to the limited information available, and differing views exist on the location of these boundaries. However prevailing views among academics, and more importantly among a majority of Aboriginal people and organisations, indicate that the study area would have been located within the boundaries of the Dharawal Language Group. Dharawal authors Bursill, Jacobs, Lennis, Timbery-Beller and Ryan identify "Dharawal Country" as the area "south of Botany Bay and the Georges River, west to Appin, down as far as Goulburn and to Wreck Bay near Nowra" (Bursill et al 2001). Dallas describes the Dharawal lands as covering a slightly more limited area, extending "from Kurnell to Nowra in the south and west as far as Camden" (Dallas 2004).

Attenbrow also locates the Dharawal language group south and east of the Georges River (Attenbrow 2002).

Language groups, or “tribes” as they are usually referred to in historical literature, share common initiation ceremonies and speak closely related languages. Within these much larger language groups Sydney’s Aboriginal society was traditionally structured into clans, or local descent groups, who traced their identity from a common (usually male) ancestor. These local descent groups, or land-using groups, typically occupied an identifiable area. The identification and recording of clans and clan areas by the early colonists was also difficult, incomplete and contradictory - making our understanding of these early traditional land use and management areas even more difficult.

According to Dallas (2004) those Dharawal People living mainly along the southern side of the Georges River (but typically west of the junction with the Woronora River) were the Norogerragal, with the neighbouring Tagary occupying the area south of Port Hacking (Dallas 2004). Bursill and his Dharawal co-authors locate the Norongeragal as living “south of the Georges River” (Bursill et al 2001).

Today the Gandangara Local Aboriginal Land Council (LALC) represents Aboriginal people living in this western section of the Sutherland Shire.

The catchment is rich in the evidence of former, and current, Aboriginal occupation and land use.

The area, or parts of it, has been the subject of several archaeological investigations and the DECCW Aboriginal Heritage Information System database lists over 90 recorded Aboriginal sites across the area. These are scattered throughout the catchment’s remnant undeveloped areas – with a slight concentration in the upper catchment (a better investigated area) and lower catchment closer to the Georges River. Some previously recorded sites have been destroyed, with DECCW consent, by development projects or land use changes – many others would have been unknowingly destroyed in the past. Of the more than 90 recorded sites within the catchment (many others no doubt remain undocumented) the majority (85%) are sheltered sites in rock overhangs and similar. Such shelters typically contain Potential Archaeological Deposits (PADs) and a mixture of art, deposit, shell middens in varying combinations. Axe grinding groves are relatively common across the catchment, being recorded in 11 locations.



Pigment (stencil) art site beneath a small c rock overhang in the upper catchment.
Source: Menai Wildflower Group

Today the Gandangara LALC is, by far, the largest single landholder in the catchment with title held, or in the process of being transferred, for approximately 40% of the catchment as a whole. This includes up to perhaps 55-60% of all the catchment’s remnant bushland areas.

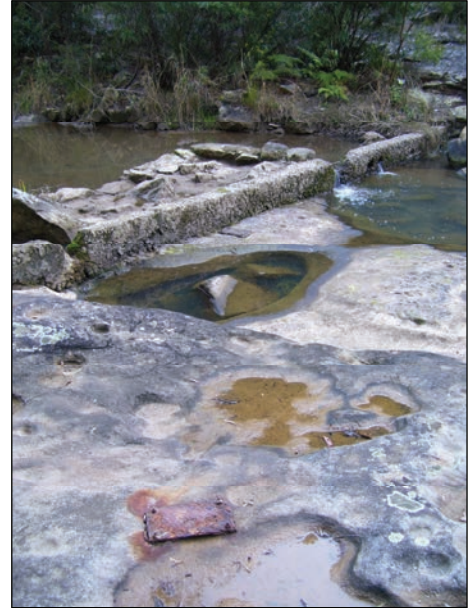
The Land Council has, and continues, to consider a variety of plans or proposed activities for these lands – including the Gandangara Living Culture and Learning Centre project and associated plans for development of a walking track network, cultural sites protection, and employment and training opportunities for Aboriginal people to carry out environmental management works and restore degraded sites within the Mill Creek Catchment.

2.5.2 Historic Heritage

Compared with other catchment values, little has been documented regarding the area's historic heritage.

At the extreme southern margin of the catchment the High Flux Australian Reactor (HIFAR), in the ANSTO site at Lucas Heights, features on the Commonwealth Heritage List (Place ID – 105723) as the first nuclear reactor built in this country. No sites within the catchment are listed on the NSW State Heritage Register. There are six listings for the catchment in the Heritage Items Schedule under the Sutherland Local Environmental Plan 2006, however none are for built or historic heritage items (all being landscape or vegetation features).

The most notable “historic” location in the catchment are the remains of what is believed to have been a flour mill dating from the 1920s (from which the creek got its name), located within the bed of Mill Creek itself below (north-west) of Kippax Place. The site consists of the base of a small structure (in brick, stone and concrete), a low weir, and metal anchor points set on a rock platform across the creek.



The "Old Flour Mill" remains on Mill Creek.

2.6 LAND USE

2.6.1 Major Landholders and Land Uses

The catchment's current major landholders, and the principal land uses they undertake, are as follows – starting from the upper catchment.

Land ownership within the catchment is summarised in Figure 5

□ ANSTO - Lucas Heights Science and Technology Centre, Buffer Zone (and Past Land Uses)

ANSTO's main built facilities area at the Lucas Heights Science and Technology Centre sits astride the watershed, south of New Illawarra Road, with only limited built developments in the catchment's extreme south. However the 1.6 kilometre ANSTO Buffer Zone around this complex extends northward into the catchment proper, with the north-east quadrant of this zone a largely natural bushland area bushland area with scattered walking, mountain bike and vehicle access tracks.

The far northern extension of the Buffer Zone is the site of ANSTO's Little Forest Burial Ground – a small fenced and grassed area that was used from 1960 to 1968 for the controlled burial of waste with low levels of radioactivity or that could not be categorically classified as non-radioactive (including laboratory wastes such as broken glassware, disposable pipettes and paper towelling; contaminated equipment such as glove boxes; solidified and solar-dried sludge from ANSTO's liquid effluent treatment plant; waste packages consigned by other organisations

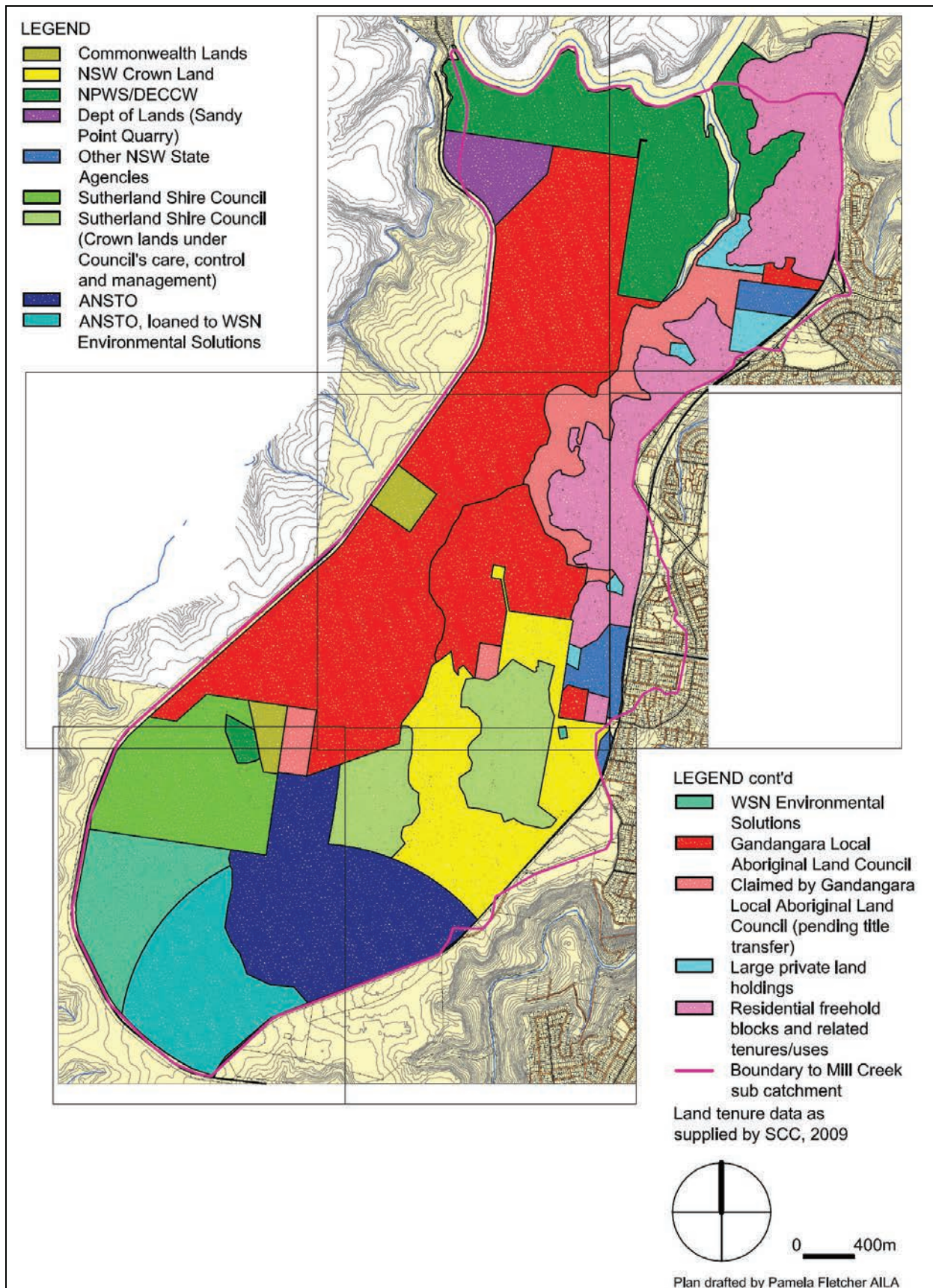


Figure 5 Land tenure

Source: Land ownership data supplied by Sutherland Shire Council, correct as at Oct '09

such as universities and government departments; and beryllium or beryllium oxide scrap). ANSTO now maintains a continuing “care, maintenance and monitoring” function over this site.

Immediately west of the burial ground the former Harrington’s Shale and Clay Quarry was leased by the Commonwealth Government between 1984 and 1987 and used for waste disposal. This site was capped and revegetated in 1989-90 and despite being owned by ANSTO the site, including a leachate control system, is managed by WSN Environmental Solutions as part of its operations at the nearby landfill site to the south-west.

North of the former Harrington’s site, just inside the Buffer Zone’s northern limit but owned by the Commonwealth Department of Finance and Administration, another former quarry was operated as a liquid waste disposal area by Industrial Waste Collections Pty Ltd from 1969 to 1980. A variety of waste, much of it unknown or unrecorded, was dumped at this site until it was closed by the State Government. Although the site has been capped, recontoured and revegetated and a limited leachate control system installed in early 1980s these measures have proven inadequate to contain the leachate and other residues (including gases and odours) emanating from this site. Brambles (who purchased IWC, via their subsidiary company Cleanaway, in 1973) is at present in legal proceedings with the Commonwealth regarding responsibility for remediation and management of this site.

Part of Sutherland Shire Council’s northernmost former nightsoil disposal area is also located within the Buffer Zone, east of the Little Forest Burial Ground. Another former nightsoil disposal area is located in Buffer Zone bushland closer to New Illawarra Road.

The western area of the Buffer Zone is leased to WSN Environmental Services (as below) as part of the Lucas Heights Waste Management Centre. Management of the Buffer Zone is subject to a separate Plan of Management prepared by ANSTO. The Centres’ operation is subject to rigorous environmental controls, monitoring and reporting requirements.

□ **WSN Environmental Services - Lucas Heights Waste Management Centre**

WSN Environmental Solutions, a State-owned corporation, operates the Lucas Heights Waste Management Centre – a solid waste landfill – in the catchment’s south-west on an approximately 205 hectare site (115 hectares leased from ANSTO and 90 hectares under freehold title). This site has been operational since 1987 and receives council, household and commercial wastes as well as limited types of industrial waste. The Centre is understood to have an operational life extending beyond 2020.



Operational landfill face at the Lucas Heights Waste Management Centre.

The Centre now includes a waste collection point servicing a landfill-based disposal zone, resources recovery centre, garden organics processing facility, a native seedling nursery, and rehabilitation areas – as shown in Figure 6.

The Centre receives approximately 575,000 tonnes of waste annually involving over 157,000 car and truck deliveries. The landfill moves progressively northwards with rehabilitation in stages at the completion of landfilling activities. It has been proposed that each stage will be rehabilitated to parklands for passive and active recreational use on the facility’s ultimate closure.



Figure 6 Lucas Heights Waste Management Centre

Source: WSN Environmental Solutions

Lucas Heights Waste Management Centre operates under licence from the Environmental Protection authority. The facility has an Environmental Management Plan with management measures in place for stormwater, leachate, dust, wind-blown litter, dust odours, and a range of other environmental factors. WSN Environmental Solutions also manages the former Harrington’s Quarry north-east of the current landfill site within the ANSTO Buffer Zone (as above).

A small area of the site, within the ANSTO lease area, is used for “green energy” production by a gas-fired power station (Lucas Heights 2 Power Station) operated by Energy Developments Ltd.

Sutherland Police Community and Youth Club has an usage agreement with WSN Environmental Solutions for a minibike and rider training circuit on 11 hectares at the junction of the Little Forest Road (the Waste Management Centre access road) and New Illawarra Road

within the ANSTO lease area. This facility is still in use, but there are tentative plans to relocate it in the near future.

The Sydney Intentional Clay Target Association leases part of WSN Environmental Solutions' freehold area adjacent to Heathcote Road for use as a clay target shooting range. This area has been partially cleared for this purposes with a central grassed "range", clubhouse and parking, and numerous tracks through the bushland.

❑ **Sutherland Shire Council - Lucas Heights Conservation Area**

Originally intended as a northward extension of the Lucas Heights Waste Management Centre, this area was owned by WSN Environmental Solutions but has been transferred to Sutherland Shire Council. It is Council's largest land ownership in the catchment and has been declared as the Lucas Heights Conservation Area.

The reserve falls within the wider "deferred matter" area under the Sutherland Shire LEP 2006, and as such the "existing zoning under SSLEP 2000 continues until resolved". The Sutherland Shire LEP 2000 zones the entire conservation area as Zone 7(b) Environmental Protection (Bushlands).

The conservation reserve has significant vegetation and habitat values – including large areas of both Sydney Turpentine Ironbark Forest and Shale/Sandstone Transition Forest Endangered Ecological Communities in the east as well as the "main Australian stronghold" for the significant Dwarf She Oak (*Allocasuarina diminuta* ssp. *mimica*). However the area is impacted by an extensive network of vehicle track and on-going unauthorised vehicle access and use. It includes another former quarry area, Bourke's Quarry, which is being progressively rehabilitated/revegetated.

The Lucas Heights Conservation Area has been subject to a range of on-ground works to protect, enhance and better manage its heritage values – including weed control and bush regeneration works around the former clay quarry site (Bourke's Quarry), vehicle track closures and fencing (jointly with WSN Environmental Solutions), and walking track and tree panting programmes (jointly with a Land Alive trainee team and the Gandangara LALC).

❑ **Commonwealth-owned Land**

The Commonwealth Government directly owns two small land parcels within the catchment – the former IWC landfill site and a larger adjoining cent block, and a square block beside Heathcote Road in the middle of the catchment (a partially cleared area used by a pistol club and a model aircraft club)

❑ **Crown Land – Bardens Creek**

A large irregularly shaped area of Crown Land is located in the Bardens Creek valley, abutting the Bardens Ridge Sports Complex in the east and extending south-east to New Illawarra Road. This area is predominantly bushland. The western part – approximately one quarter – of this Crown Land is under the care, control and management of Sutherland Shire Council (including the eastern half of Council's former nightsoil depot).

❑ **Jenko Sutherland Shire Pony Club**

This sporting club occupies 4 hectares of Crown Land, most likely on a permissive occupancy or leasehold basis, beside New Illawarra Road in the catchment's south-east.

❑ **Menai Sand and Soil**

This commercial operation occupies a Crown Land area adjacent to the Jenko Sutherland Shore Pony Club on New Illawarra Road.

❑ **Bardens Ridge Sports Complex**

This regional sports facility is being developed on the closed landfill site of the former Lucas Heights Waste and Recycling Centre (Lucas Heights 1, or the “old Menai tip”). Due for completion in 2011 this complex is planned to include an 18-hole golf course, a golf driving range, community sports and recreation club, 8 playing fields and courts, a purpose-designed athletics fields, passive recreation areas, access and carparking and associate facilities. This area is Crown Land under the care, control and management of Sutherland Shire Council. However WSN Environmental Solutions is contributing significantly to the area’s rehabilitation and redevelopment (\$50 million over 10 years) and has an on-going responsibility for water, leachate and gas management at this site extending beyond its redevelopment. A second gas-fired power station, Lucas Heights 1 Power Station also operated by Energy Developments Ltd, is located on a parcel of freehold land just east of the landfill site.

❑ **Crown Land – Lucas Heights 1 Creek**

A block of Crown Land is located across Lucas Heights 1 Creek below (north of) the Bardens Ridge Sports Complex, with a narrow extension north-west to Bardens Trig.

❑ **Gandangara Local Aboriginal Land Council – Current and Pending Landholdings**

The Gandangara Local Aboriginal Land Council (LALC) is, by far, the largest single landholder in the catchment. The Land Council owns, or is in the process of obtaining title for, approximately 40% of the catchment as a whole and up to perhaps 55-60% of all the remnant bushland areas.

The Land Council’s current landholdings include almost all of the plateau and ridgelines bushland areas, and extending down to Mill Creek, on the western side of the catchment – from the ANSTO Buffer Zone, Crown Land, and Lucas Heights Conservation Area in the south through to Georges River National Park and the Sandy Point Quarry in the north.

Much of this land, although reasonably well vegetated in most areas, has a past involving bushland clearing and extensive surfaces scrapes for the recovery of lateritic gravels and ironstone that capped many of these upland areas. Comparing aerial photography of these areas from 1994 (before the major wildfires of that year) and more recent imagery shows the extent and degree of this former disturbance as well as the amount of regeneration since.

A legacy of this clearing and track network, building on earlier uncontrolled access to these then Crown Land areas, has been the continuing high levels of 4WD and trailbike use across these western lands and the impacts associated with this - as well as other issues arising from this unregulated access such as rubbish dumping, car stripping/dumping and arson.

The Land Council also has ownership of the Bardens Trig area, between Bardens/Mill and Lucas Heights 1 Creeks. This area, due to its lesser accessibility, has fewer of the issues and impacts and so contains more intact bushland. The Land Council also owns “outlying” land parcels along the eastern ridgeline – at Angophora Place in the north, and west of Ella Avenue in the south (with this site understood to be part of a joint venture land release with LandCom in the near future).



Aerial photography from 1994 (left) and more recently (right) showing changes in the northern plateau area of the Gandangara LALC lands.

The bushland slopes along the eastern side of Mill Creek, below the residential areas, from Landy Close in the south to Lavender Place in the north are pending transfer to the Land Council at present. Two smaller blocks of Crown Land – a rectangular parcel north of the ANSTO Little Forest Burial Ground, and a former proposed quarry site (Gosford Quarries) south of Bardens Trig – are similarly in the process of being transferred to the Land Council.

□ **Eastern Ridge Residential Suburbs**

Residential areas – the suburbs of Bardens Ridge, Menai (West) and Alford's Point - dominate the ridgeline in the catchment's north-east. These suburbs – typified by detached single dwellings – plus associated urban land uses and backed by major roads along the watershed, extend almost two two-thirds of the way down the catchment's eastern margin. Most of these residential areas were developed during the late 1970s and early 1980s, just prior to the introduction of sensitive urban water management principles. However some smaller infill residential land releases are continuing along the ridge – such as at Monash Road – on the last available areas of developable land.

Small parcels of private land – not yet developed, but with limited development potential – occur in the head of gullies along this residential strip. The largest of these is below Royal Oak Drive where the private land extends almost down to Mill Creek.

Various government agencies – such as the Roads and Traffic Authority and the Department of Planning – hold minor land parcels along the eastern ridgetop, most close to the main roads.

□ **Sandy Point Quarry**

The Land and Property Management Authority (formerly the Department of Lands) owns the Sandy Point Quarry, an area of approximately 35 hectares in the north-west corner of the catchment adjacent to Heathcote Road. The site was previously leased to, and operated by, the Chipping Norton Lakes Authority – with the exception of a 3 hectare compound which was, and continues to be, leased to the Department of Commerce as a sandstone block store. The Chipping Norton Lakes Authority has been winding down its operations at the quarry which is in the final stages of being tendered by the former Department of Lands for management, under licence, by a private operator. Extractive industries will continue at the site. The existing

Operational Environmental Management Plan for the site is out of date, and the incoming private licensee will be required to prepare a new environmental plan.

□ **Georges River National Park**

The catchment's frontage to the Georges River is now part of the Georges River National Park. This area was formerly a restricted zone as part of the Holsworthy Military Reserve, however after community pressure and support from the NSW Government the land was transferred from Commonwealth ownership for gazettal as a national park addition. The western and much of the southern boundary of this outlying national park area has been fenced, using high strength steel cabling with metal posts and gates, to prevent unauthorised access by trailbikes and 4WD vehicles. Although largely effective to-date, this fencing is under continuing pressure from recreational vehicles.

A small (7.15 hectare) area held by the NSW Minister for Conservation, but not yet gazetted as a park or reserve under the *National Parks and Wildlife Act 1974*, adjoins the north-east side of the Lucas Heights Conservation Area in the catchment's south-west.

This area is predominantly Shale/Sandstone Transition Forest Endangered Ecological Community and was considered by the NPWS, in 1997, to be "of extremely high conservation significance". The area was originally mooted, by community conservation groups, as the Little Forest Nature Reserve. However it is not yet formally declared as such, and its small size and isolation from other NPWS-managed areas limits sustainable and cost-effective management by the NPWS (DECCW).

2.6.2 Recreational Use

Beyond organised recreational activities focused on the Bardens Ridge Sports Complex and the various clubs located around the catchment's margins, the area receives comparatively little recreational use by comparison with other near-urban bushland areas.

Recreational use of the catchment falls, geographically, into two distinct zones.



Long-standing recreational vehicle use has resulted in a range of adverse impacts on the catchment's values.

West of Mill Creek the ridgetop and plateau areas have a long and very entrenched history of use by 4WD and trailbike enthusiasts being heavily used by clubs, groups and individuals. This pattern of use long precedes the area's ownership by the Gandangara LALC, and appears to have been well established by the 1970s and early 1980s when the area was under the management of the (then) Department of Lands and used for a number of exploitative or urban fringe activities. The consequence is that 4WD and trailbike use has become enshrined, and in many senses inter-generational, with some present users being unaware that these activities were not permitted or endorsed in the area. Many of those who are aware of the restrictions on

access to the area do not feel constrained by them, on the basis that "we have always come here". This confusion has been perpetuated to a degree by the changing access arrangements and "permit" approvals for 4WD access since the Land Council gained ownership of these

areas. Little walking, mountain bike or passive recreation occurs across these western areas, due to their relative isolation and also the risks presented by frequent trailbike and 4WD use.

The eastern side of the catchment, and especially the north-eastern side of the Mill Creek Valley below the residential areas, are the most heavily used areas for passive recreation and nature-based activities. The management track network along the eastern hillslopes of Mill Creek is regularly used for walking, cycling, dog-walking, fitness training and casual play (bush “cubbies” and “hideouts” dot the hillslope and there are numerous exploratory tracks from the houses above). However this casual use appears very much dominated by local residents taking and advantage of the nearby bush, with little use by people from beyond the surrounding suburbs. The exception is mountain biking use with the catchment slowly developing a wider profile for this activity. Anecdotal reports indicate that this activity is increasing in certain parts of the catchment, with established use areas at Bardens Trig and on the upper reaches of Bardens Creek, and the area regularly used for organised/competitive rides.



Walkers crossing Mill Creek near the site of the former mill.
Source: Great Kai'mia Way website

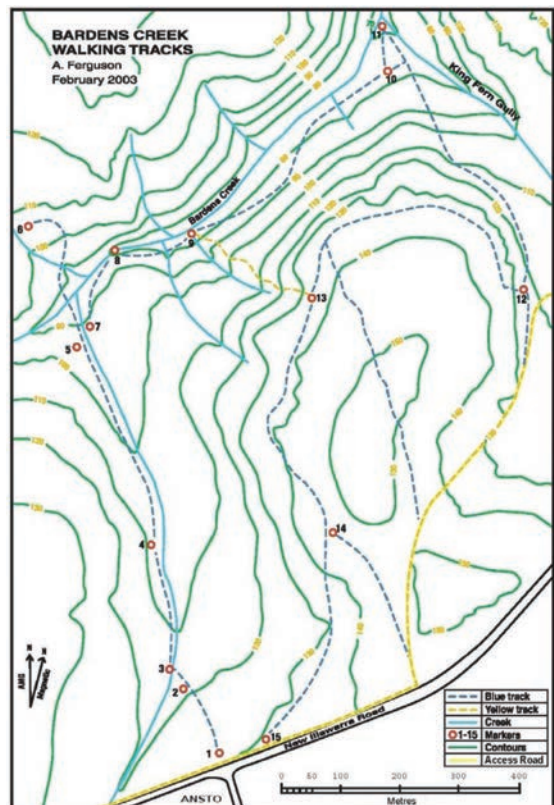
Despite the moderate level of passive recreational use of the catchment’s eastern margins and its popularity with residents, visitor facilities (such as marked walking track, visitor information, seating, low-key picnic areas or lookouts) are totally absent. The only marked and signposted walking track in the entire catchment is “The Blue Walk”, the 2.6 kilometre (2 hour) loop Bardens Creek Track in the ANSTO Buffer Zone.

The lower sections of Mill Creek receive occasional use by canoeists and kayakers, both independently and organised activities, however the shallow water depths prevent movement any distance up the creekline.

2.6.3 Amenity and Scenic Values

The catchment’s natural landscapes are appreciated by surrounding residents as a scenic backdrop and an important part of the appeal of the local area as “bushland suburbs”.

More widely, the cliffs provide both spectacular lookouts and a scenic backdrop for river users and northern residents. The catchment’s western uplands form part of the undeveloped/bushland southern skyline when viewed from the lower-lying suburbs of southern metropolitan area.



Guide map for the Bardens Creek Walking Tracks
“The Blue Track”
Source: ANSTO