## Key Points

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Status of Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5.1 Changes in land use</strong></td>
<td>The number of development applications submitted to the SCA for review and concurrence decreased during the 2007 Audit period.</td>
</tr>
<tr>
<td></td>
<td>Large areas of agriculture and increased urbanisation and rural residential development may put pressure on water quality in the Catchment, unless best management practices are adopted.</td>
</tr>
<tr>
<td><strong>5.2 Sites of pollution and potential contamination</strong></td>
<td>Overall the total number of assessed sites in the very high, high, and medium risk categories has decreased by 17 per cent.</td>
</tr>
<tr>
<td><strong>5.3 Soil erosion</strong></td>
<td>Active gully erosion has been observed in only 776 ha of the Catchment, but local impacts can occur and remediation is required.</td>
</tr>
<tr>
<td></td>
<td>Eleven percent of the Catchment has very high or high estimated rill or sheet soil erosion.</td>
</tr>
<tr>
<td><strong>5.4 Dryland salinity</strong></td>
<td>A small area of the Catchment (three per cent) is susceptible to salinity.</td>
</tr>
<tr>
<td></td>
<td>Localised salinity has been identified in 0.14 per cent of the Catchment.</td>
</tr>
</tbody>
</table>

Land condition can directly affect water quality and ecosystem health. Land condition is a function of the inherent characteristics of land, natural processes such as drought and flood, and human land use and land management practices. This audit focuses on:

- human induced pressures on land condition; namely land-use change and sites of potential pollution and contamination
- the state of soil erosion and dryland salinity risks in the Catchment.
Pressures in the Catchment

The primary human induced pressure on land condition in the Catchment is land use and land-use change. The land uses in the Catchment include varying densities of urban development, variable types and intensity of agricultural activities, extractive industry, electricity generation and restricted areas around drinking water storages. Poorly managed land use can cause erosion, degradation and contamination of soil, dryland salinity, and the loss of riparian zones and habitat which can ultimately impact upon Catchment ecosystems and water quality. Examples of human land use and activities that can cause risk of impacts are:

- urbanisation and rural residential development, especially during the site preparation and construction phase when vegetation is cleared and soil is disturbed, increasing the risk of soil erosion
- industrial activities, which if inappropriately managed can have significant impacts on land condition. Activities including extractive industries, waste disposal, and intensive livestock industries can cause land pollution or contamination, which may spread to other areas including water bodies
- underground mining, particularly long-wall coal mining can cause subsidence, with impacts on the environment, including soil erosion, diversion of water flow, reduction in water quality, and physical disturbance of the geological and built environments.

Land use and land-use change at a sub-catchment and catchment scale has a potentially cumulative impact on land condition, water quality and ecosystem health. The extent to which each activity actually alters the natural landscape in the Catchment depends on the inherent risks of that land-use type, the intensity of the land use and the level and appropriateness of management practices adopted at each site. This audit assesses the pressures to land condition that are caused by land use on a Catchment wide scale, as well as sites of potential pollution or contamination in the Catchment.

5.1 Changes in land use

Background

A clear understanding of land use in the Catchment is critical in identifying likely impacts on water quality in drinking water storages. Changes in land use include transferring from one type of land use to another or changing the intensity of land use. Examples include moving from native pasture to improved pasture, pasture to cropping or intensive agriculture and agriculture to urban or rural residential. Land-use change has the potential to increase pressure on ecosystem health and water quality in the Catchment, and yet also offers the opportunity in some cases to reduce impacts from past land uses and poor land management practices.

Land use mapping of the entire Catchment is not undertaken at a frequency which enables an assessment of land-use change at two-year audit intervals. Further, land-use changes over a two year audit period are likely to be relatively minor on a Catchment wide scale. The assessment of land use change at a Catchment scale is therefore a more useful longer term measure of the pressures on land condition. In 2000, the former Department of Infrastructure Planning and Natural Resources (DIPNR) carried out land-use mapping in the Catchment at a more descriptive scale than was presented in the 2003 Audit report. The 2007 Audit report presents this land-use information in Map 5.1. In 2007, DECC undertook mapping of land-use change. The change in land use was determined by comparing 2004 land-use information and recent changes in land use. The areas were identified using aerial photographs dated 2006.

The audit also examines the number and type of development applications submitted to the SCA during the 2007 Audit period as a surrogate measure of short term land use change. The Regional planning instruments that apply or have applied to the Catchment (REP 1/SEPP58) require certain development applications to be referred to the SCA for concurrence (see Actions and Response section in this chapter).
Findings

Land use

Land use across the Catchment is shown in Map 5.1. The Wollondilly River (priority), Upper Wollondilly River (priority), Mulwaree River (priority), Wingecarribee River (priority) and Reedy Creek sub-catchments have large areas of pastureland.

Large urban areas are located at Goulburn (Mulwaree River (priority) sub-catchment), Bowral and Moss Vale (Wingecarribee River (priority) sub-catchment), Lithgow (Upper Coxs River (priority) sub-catchment) and Katoomba (Lower Coxs River (priority) sub-catchment). There is also a large rural residential area in the Wollondilly River (priority) and Nerrimunga River sub-catchment.

The land use change data show that the majority of new urban/rural residential developments between 2004 and 2006 occurred in the Wollondilly River (priority) sub-catchment. There were also small areas in the Wingecarribe River (priority), Upper Wollondilly River (priority), Mulwaree River (priority) and Nattai River sub-catchments.

Development applications

There was a seven per cent decrease in the total number of development applications (DAs) submitted to the SCA under the REP/SEPP during the 2007 Audit period compared to the 2005 Audit period.

The greatest number of DAs for dwellings and subdivisions submitted to the SCA during the 2007 Audit period were in the Kangaroo River (priority), Wingecarribee River (priority) and Wollondilly River (priority) sub-catchments (Figure 5.1).

Areas that had increases in the number of applications submitted for dwellings and subdivisions during the 2007 Audit period were the Grose River, Lake Burragorang, Lower Cox River (priority), Mulwaree River (priority), Upper Cox River (priority), Upper Wollondilly River (priority), Werriberri Creek (priority) and Woronora River sub-catchments (Figure 5.1).

During the 2007 Audit period, areas having the greatest number of development applications submitted to SCA that did not include dwellings or subdivisions were the Nattai River, Kangaroo River (priority), Upper Nepean River, Wollondilly River (priority) and Wingecarribee River (priority) sub-catchments (Figure 5.2). These developments include agriculture, effluent/biosolid disposal, forestry, mining, poultry farm, tourism and vineyards.
Map 5.1: Land use and percentage of area in the Sydney drinking water catchment
Figure 5.1: Number of development applications for dwellings and subdivisions per subcatchment for the 2003, 2005 and 2007 Audit periods

Figure 5.2: Number of development applications excluding dwellings and subdivisions per subcatchment for the 2003, 2005 and 2007 Audit periods

Source: SCA 2007
Implication

New urban/rural residential developments between 2004 and 2006 occurred in the Wollondilly River (priority) sub-catchment. There were also small areas in Wingecarribee River (priority), Upper Wollondilly River (priority), Mulwaree River (priority) and Nattai River sub-catchments.

The overall number of development applications submitted to the SCA decreased during the 2007 Audit period. However, a large number of urban, rural residential and commercial developments are still occurring in the Wingecarribee River (priority), Wollondilly River (priority), Kangaroo River (priority), Mid Coxs River (priority), Mulwaree River (priority), and Nattai River and Upper Nepean River sub-catchments. This may put pressure on water quality, ecosystem health and land condition in these sub-catchments unless specific management practices are adopted or incorporated to mitigate the potential impacts of vegetation clearing, soil erosion, stormwater and sewage management associated with these developments. The adoption of recommended practices endorsed by the SCA is an appropriate response to these pressures (see Actions and Response section in this chapter).

The Auditor understands that the SCA referral requirements focus on development proposals with potential sewage management issues that may impact on the water quality in the Catchment. Other development proposals that could affect local stormwater quality, for example, and which may also have an impact in the Catchment, are not referred to SCA. Data on this broader dimension of development pressure in the Catchment were not provided to the Auditor.

Other changes in land use such as improvement to pasture through cultivation and application of fertiliser are more difficult to quantify as they are not subject to planning approval processes. Similarly, changes in management practices can significantly change the impact of activities for better or worse but again these are difficult to quantify.

A number of councils in the Catchment predict further residential developments over the next 10 years:

- **Goulburn Mulwaree City Council**
  - Marys Mount on the North West side of Goulburn. The area of land available for urban development is approximately 234 ha, with a predicted 2,025 residential lots.
  - The Ducks Lane precinct located in the south east of Goulburn contains a total area of approximately 916.5 ha with a predicted 680 residential lots.
  - Clyde Road. The area of land available for development is approximately 169 ha with a predicted 505 residential lots.
  - Marulan village with a predicted 621 new residential lots.
  - Tallong Park Estate

- **Lithgow City Council**
  - Lithgow potentially 1,424 lots.
  - Wallerawang potentially 1,201 lots
  - Marrangaroo potentially 1,530 lots
  - Lidsdale, 19.6 ha potentially 157 lots

- **Wingecarribee Shire Council**
  - Wensleydale, 7.5 km north of Mittagong and east of Colo Vale. 248.33 ha with a predicted 910 dwellings
  - Chelsea Gardens, 2km south of Moss Vale. 123.7 ha with a predicted 1000 dwellings
  - Gibbergunyah, south west of Mittagong. 33.23 ha with a predicted 150 residential lots.

- **Wollondilly Shire Council**
  - Warragamba/Silverdale, up to 150 lots
  - The Oaks, up to 150 lots

Future directions

Given the anticipated rate of land-use change across the Catchment it is envisaged that land use maps could be updated at five-year intervals depending on advances in remote sensing technology and analysis. Such maps provide useful information for catchment managers and land-use planners in identifying where there are changing pressures on land condition, water quality and ecosystem health, and concurrently provide a
useful layer of information for modeling other catchment indicators. Given these potential uses of detailed land maps, the Auditor considers that the SCA should have an interest in ensuring such land use maps remain up to date, and reinforces the recommendation made in 2005 that detailed land-use maps be updated every five years.

Changes in land use, particularly those changes leading to the removal of native vegetation and disruption of soil almost inevitably lead to increased impact on land condition and water quality. However, with appropriate design and management, such impacts can be minimised and potentially lead to overall improved outcomes especially where degraded landscapes are rehabilitated and best practice water-sensitive design principles are implemented.

The SCA’s Water Quality Risk Management Framework and rectification action planning process should enable high risk locations and land uses to be identified. The next step would be to identify the areas in which there is potential for improved management practice. Various agencies have already published best management practice guidelines and the SCA has Current Recommended Management Practices. Further guidelines should be developed for remaining high-risk activities and management practices.

5.2 Sites of pollution and potential contamination

Background
Many industrial or agricultural processes can pollute the land during operation and/or by leaving a legacy of contaminated materials. Land pollution and contamination can occur where appropriate management practices are not implemented. Land contamination can potentially be mobilised by surface and groundwater movement and erosion, resulting in migration of contaminants into the broader Catchment. Therefore, it is important to identify operational and historical sites in the Catchment that have a potential to contaminate land and pollute water.

This audit examines:
- sites of potential pollution and contamination identified during the audit period
- risk assessment of the potential sites of pollution and contamination during the audit period
- level of compliance during the audit period of sites licensed to discharge to waters under the POEO Act
- new remediation and rehabilitation works at sites of pollution or contamination during the audit period.

Findings

Risk assessment
The SCA prepared the Pollution Source Risk Management Plan in December 2000 which identified activities that were expected to occur in the Catchment and that have the potential to pollute land. The SCA then commissioned assessments of nine potentially high risk industry types in the Catchment to identify specific sites of potential pollution in the Catchment. These assessments are known as the Environmental Assessment of Sites and Infrastructure (EASI) assessments. EASI assessments were undertaken for Commercial and Manufacturing Facilities, Commonwealth Facilities, Intensive Horticulture/Forestry, Intensive Livestock Industries, Sewage and Water Treatment, Telecommunications and Energy Production, Waste Disposal, Mines and Quarries. The EASI process identified 1,776 sites of pollution or potential contamination in the Catchment.

During the 2007 Audit period the SCA updated its assessments of potentially polluting sites. The total number of sites currently in the SCA’s Compliance Support System has increased from the original 1,776 EASI sites to 2,391 sites. Of these, 1,381 priority sites were reassessed, with 65 sites are rated as very high risk to water quality, 195 sites as high risk, 246 sites as medium risk, 500 sites as low risk and 315 sites as negligible risk. The type of assessed sites in the very high, high and medium risk categories are presented in Table 5.1. The locations of very high, high or medium risk assessed sites are shown in Maps 5.2 and 5.3.
Table 5.1: Type and number of assessed sites in the Catchment rated by SCA as very high, high and medium risk to water quality

<table>
<thead>
<tr>
<th>Type of site</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
<th>Type of site</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intensive Horticulture/Forestry</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>Sewage and Water Treatment</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Vegetable growing</td>
<td>8</td>
<td>3</td>
<td></td>
<td>Sewage Treatment plant</td>
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<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Cropping</td>
<td>4</td>
<td>11</td>
<td>3</td>
<td>Sewage pumping station</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Grapes</td>
<td>2</td>
<td></td>
<td>1</td>
<td>Effluent irrigation</td>
<td>6</td>
<td>5</td>
<td>52</td>
</tr>
<tr>
<td>Flowers</td>
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<td>1</td>
<td></td>
<td>Biosolids disposal</td>
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<td>3</td>
<td>3</td>
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<tr>
<td>Forestry</td>
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<td></td>
<td></td>
<td>Swimming pool</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fruit Trees</td>
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<td>11</td>
<td>21</td>
<td>Small STP</td>
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<td>2</td>
<td>4</td>
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<td>Nursery</td>
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<td></td>
<td>2</td>
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<td>Olives</td>
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<td>1</td>
<td>1</td>
<td>Water filtration plant</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Berries</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>Water Treatment Plant</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>Water pumping station</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mushrooms</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glasshouse (Hydroponics)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of site</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
<th>Type of site</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waste Disposal</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>Telecommunications and Energy Production</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Landfill</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>Substation</td>
<td>1</td>
<td>7</td>
<td></td>
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<tr>
<td>Former landfill</td>
<td></td>
<td></td>
<td></td>
<td>Power station</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recycling drop off</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer station</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of site</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
<th>Type of site</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commercial and Manufacturing Facilities</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>Intensive Livestock Industries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automotive sites</td>
<td>1</td>
<td></td>
<td></td>
<td>Aquaculture</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm &amp; grain supply</td>
<td></td>
<td></td>
<td></td>
<td>Dairy</td>
<td>20</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Food manufacture</td>
<td>1</td>
<td></td>
<td></td>
<td>Feedlots</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction Industry</td>
<td>1</td>
<td>6</td>
<td></td>
<td>Saleyard</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Horses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Piggery</td>
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<td></td>
<td></td>
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<td>4</td>
<td></td>
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</tr>
<tr>
<td>Poultry</td>
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<td>5</td>
<td>1</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic animals</td>
<td></td>
<td></td>
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<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mines</strong></td>
<td>2</td>
<td>1</td>
<td>3</td>
<td><strong>Quarries</strong></td>
<td>4</td>
<td>81</td>
<td>29</td>
</tr>
<tr>
<td>Derelict Mines</td>
<td>3</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source:* SCA 2007
Map 5.2: Sites of pollution or potential contamination assessed in 2007 with a medium, high or very high risk rating in the Sydney drinking water catchment
Map 5.3: Mines and quarries assessed in 2007 with a medium, high or very high risk rating in the Sydney drinking water catchment.
Overall, the total number of assessed sites with potential for contamination in the very high, high and medium risk categories decreased during the 2007 Audit period by 17 per cent (Table 5.2). The number of assessed sites of potential contamination (other than mines and quarries) in the very high, high and medium risk categories decreased by 21 per cent during the 2007 Audit period (Table 5.2). There was, however, an increase in the number of assessed sites in the very high risk category. The majority of the assessed sites of potential contamination in the very high, high and medium risk categories are located in the Wingecarribee River (priority), Kangaroo River (priority) and Werriberri Creek (priority) sub-catchments (Map 5.2).

The majority of the assessed mines and quarries in the very high, high and medium risk categories are located in the Kangaroo River (priority), Bungonia Creek, Lake Burragorang, Nerrimunga River and Upper Nepean River sub-catchments (Map 5.3). There was a 35 per cent decrease in the number of assessed mine sites in the very high, high and medium risk categories. The number of assessed quarry sites in the very high, high and medium risk categories, however, increased slightly during the 2007 Audit period (Table 5.2).

The Yerranderie Silver Field is the number one site published in the (former) Department of Mineral Resources (DMR) top 50 derelict mine sites list of NSW. The Yerranderie Silver Field was rated as high risk to water quality by SCA during the 2005 Audit period. During the 2007 Audit period the risk rating of the Yerranderie Silver Field was reduced to medium, in the light of rehabilitation works undertaken.

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Sites of potential contamination</th>
<th>Mines</th>
<th>Quarries</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2005</td>
<td>2007</td>
<td>% Change</td>
<td>2005</td>
</tr>
<tr>
<td>Very High</td>
<td>32</td>
<td>47</td>
<td>+32</td>
<td>3</td>
</tr>
<tr>
<td>High</td>
<td>136</td>
<td>97</td>
<td>-29</td>
<td>12</td>
</tr>
<tr>
<td>Medium</td>
<td>153</td>
<td>108</td>
<td>-29</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>321</td>
<td>252</td>
<td>-21</td>
<td>57</td>
</tr>
</tbody>
</table>

Source: SCA 2007
Note: Cells highlighted in orange increased from the 2005 to the 2007 Audit periods; all other categories decreased.

**Compliance levels of sites licensed under the POEO Act**

DECC regulates major point sources of potential pollution using Environment Protection Licences issued under the POEO Act. Activities that require an Environment Protection Licence include industries in certain categories and at higher levels of activity, sewage treatment systems (STSs), electricity generation and waste facilities. The licences include requirements for pollution control, monitoring, and reporting. There are 88 sites in the Catchment that are licensed under the POEO Act. A summary of the non-compliances with discharge and volume limit requirements for licensed sites (other than STSs) during the 2003, 2005 and 2007 Audit period is presented in Table 5.3. Sewage treatment systems were examined in Chapter 3 of this report.

Four mines had non-compliances under their Environment Protection Licences during the 2007 Audit period (Table 5.3). The mine site non-compliances included exceedences of discharge limits for pH, BOD, TSS and oil and grease. Only three other licensees in the Catchment had non-compliances during the 2007 Audit period.
Table 5.3: Discharge and volume limit non-compliances for the 2003, 2005 and 2007 audit periods at sites licensed under the POEO Act.

<table>
<thead>
<tr>
<th></th>
<th>PH limit</th>
<th>Discharge</th>
<th>BOD</th>
<th>Conductivity</th>
<th>Total P</th>
<th>Total N</th>
<th>TSS</th>
<th>Oil &amp; grease</th>
<th>Fe</th>
<th>Mn</th>
<th>Salt</th>
<th>Volume Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angus Place Colliery</td>
<td>2003-04</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004-05</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>2006-07</td>
<td>2X</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Berrima Colliery</td>
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<td>Berrima Feedmill</td>
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<td>Mittagong Sands</td>
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Source: DECC 2007
Note: * non-compliance data not available until December 2007
There are 11 licensed quarries in the Catchment and none of these sites reported discharge or volume limit non-compliances during the 2003, 2005 or 2007 Audit periods. The risk rating at three licensed quarried increased and one decreased during the 2007 Audit period (Table 5.4).

**Table 5.4: Quarries licensed under POEO Act in the Catchment and SCA’s risk assessment**

<table>
<thead>
<tr>
<th>Quarry</th>
<th>EPA licence no.</th>
<th>Risk Rating</th>
<th>Quarry</th>
<th>EPA licence no.</th>
<th>Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braidwood Sand Pit</td>
<td>4483</td>
<td>Low</td>
<td>Marulan Pit – Bungonia Rd</td>
<td>944</td>
<td>Medium - High</td>
</tr>
<tr>
<td>Bunnygalore Quarry</td>
<td>4249</td>
<td>Low - Negligible</td>
<td>Penrose Sand Quarry</td>
<td>4720</td>
<td>Low</td>
</tr>
<tr>
<td>Exeter Quarry</td>
<td>870</td>
<td>High</td>
<td>Rivervale</td>
<td>3517</td>
<td>Low</td>
</tr>
<tr>
<td>Hartley Rhyolite Quarry</td>
<td>12323</td>
<td>Low - Medium</td>
<td>Soapy Flat Sand Pit</td>
<td>3132</td>
<td>Low</td>
</tr>
<tr>
<td>Kangaloon Flat Sand Pit</td>
<td>4232</td>
<td>Low - Medium</td>
<td>Welby Quarry</td>
<td>2223</td>
<td>Low - Medium</td>
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<tr>
<td>Marulan Limestone Quarry</td>
<td>1371</td>
<td>High</td>
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</tbody>
</table>

**Source:** SCA and DECC 2007

**Note:** For cells highlighted in orange the risk rating has increased from previous audit period; cells highlighted in yellow the risk rating has decreased from previous audit period.

There were two quarry-related development applications referred to SCA during the 2007 Audit period. One application was in the Endrick River sub-catchment and one in the Mongarlowe River sub-catchment.

**Remediation and rehabilitation works**

There are also four sites in the Catchment that are listed on the DECC’s Contaminated Land Record under section 58 of the *Contaminated Land Management Act 1997*. The remediation orders to the waste oil storage facility in Larbert, the former shale oil refinery at Hartley Vale and the investigation order to the Joadja shale oil refinery were still current during the 2007 Audit period. The Hartley Vale shale and the Joadja shale mines are on the (former) Department of Mineral Resources Derelict Mine List as sites in need of remediation works to prevent contamination of waterways. The remediation of the former shale oil plant at Mittagong commenced in February 2005 and received funding in June 2005 from the Environmental Trust. A notice of the End of Declaration was issued to this site in June 2006.

Seven derelict mines were identified for rehabilitation as part of the EASI process. In 2005 a risk assessment of these seven derelict mines was carried out as part of an investigation into the derelict mines in the Catchment and a priority ranking of the sites was determined. The sites in decreasing rank order are Mulloon Copper Mine, Tuglow Copper Mine, Black Bob’s Creek Coal Mine, Joadja Oil Shale Mine, Hartley Vale Shale Mine, Tolwong Mine and Nattai Shale Mine (Holden, 2005). A rehabilitation plan for Black Bob’s Creek was also prepared as part of the investigation.

During the 2007 Audit period, the SCA jointly with DPI began rehabilitation of the Black Bob’s Creek derelict coal mine (in the Wingecarribee River (priority) sub-catchment), carried out an initial assessment of the Mulloon Copper Mine site (in the Reedy Creek sub-catchment) and prepared a plan to rehabilitate the former Oakdale mining site (in the Werriberri Creek (priority) sub-catchment).

Black Bob’s Creek derelict mine site is located at Belangalo State Forest in the Southern Highlands. The rehabilitation works included removing coal fines from old stockpile areas, concealing exposed coal seams, removing conveyor belts and rubbish, demolishing and removing the office block, brushmatting eroded and treated areas, constructing contour banks along access roads and improving drainage.

The Mulloon derelict mine is on private property about 20 kilometres east of Bungendore. The site lies adjacent to Mulloon Creek. There are five areas of concern, three of which occur on steep land and include tailings and open shafts. Elevated concentrations of various metals in the mine tailings, creek sediment, shaft water and creek water were found, and rehabilitation options will be negotiated with the landholder in the coming year.
Yerranderie silver mining field is located within the Warragamba Special Area adjacent to the Tonalli River, which runs into Lake Burragorang. During the 2007 Audit period, soil and water management works were successfully completed at four former processing sites within the Yerranderrie mine site: Silver Peaks; Colon Peaks; West Wollondilly; and Kerry’s Shaft. Arsenic contamination of the tailings areas was also found, with concentrations of up to 36 per cent arsenic. These arsenic deposits are located on the surface and exposed to weather which increases the potential for them to run off into waterways. The SCA contributed $100 000 to DPI for the removal of 100 tonnes of materials with arsenic levels above two per cent. The tailings will be disposed of in a licensed treatment facility outside SCA catchment areas.

During the 2007 Audit period Lithgow Council continued remediation works on part of the former gasworks site in Mort Street, Lithgow.

Implications

There are a large number of activities in the Catchment with the potential to impact land condition and water quality if they are not appropriately managed. These sites are concentrated in the Kangaroo River (priority), Werriberri Creek (priority), Wingecarribee River (priority), Bungonia Creek, Lake Burragorang, Nerrimunga River and Upper Nepean River sub-catchments. Overall, the total number of assessed sites with the potential of contamination in the very high, high and medium risk categories decreased during the 2007 Audit period by 17 per cent. This was primarily due to a 35 per cent decrease in the number of assessed mine sites in the very high, high and medium risk categories.

Future directions

The SCA should continue to work with DECC, DPI, councils, operators and landholders to address sites identified as very high, high and medium risk to water quality. The assessment of actual risk at sites of potential pollution and contamination should be continued, and actions implemented to reduce risks where necessary. The risk of pollution and contamination at operational sites should be reassessed at a frequency commensurate with the inherent risk of the activity type, site specific risks and known performance history of the landholder/operator.

The SCA should be working with DECC, DPI, councils, landholders and operators to ensure there are pollution prevention or rehabilitation programs at sites identified as posing a risk to water quality or ecosystem health in the Catchment. The pollution prevention or rehabilitation programs should be formalised where necessary, through regulatory instruments such as Environment Protection Licences and Pollution Prevention Notices under the POEO Act, or through formal programs such as derelict mine programs. The SCA should therefore be continuing to develop the prevention or rehabilitation programs at each site in consultation with the landholders as well as with other relevant agencies such as DECC or councils, in accordance with the 2005 Audit recommendation that SCA develop pollution prevention or rehabilitation programs at sites identified as very high, high and medium risk to water quality, in consultation with relevant agencies, operators and landholders.
State of the Catchment

5.3 Soil erosion

Background

Soil erosion is a natural process that can be accelerated by human activities. The slow rate of soil formation means that soil is effectively a non-renewable resource. Increased rates of erosion can also impact water quality and aquatic ecosystems due to the deposition of sediments and nutrients.

The risk of erosion is linked to a range of factors, such as land use, geology, geomorphology, climate, soil texture, soil structure and the nature and density of vegetation in the area. The clearing of native vegetation and agricultural land-use activities have been major contributors to accelerated rates of erosion. The potential for soil erosion increases wherever vegetation cover is removed, soil is disturbed or exposed, and where high intensity rainfall or wind occurs. The main categories of soil erosion are sheet, rill, gully, tunnel, stream bank and wind erosion. The management of areas with erosion risk, and the remediation of areas that are affected by soil erosion, is important in protecting Catchment productivity, water quality and ecosystem health.

Estimated sheet and rill erosion was calculated by the National Land and Water Resources Audit (NLWRA 2001) using the Revised Universal Soil Loss Equation (RUSLE). The following attributes were used in the RUSLE: soil erodibility (data derived from NSW Soil and Land Information System and the Australian Soil Resource Information System); rainfall erosivity (data from National Rainfall erosivity surface); slope gradient and length (derived from the National Digital Elevation model); and ground cover (Satellite imagery from Normalised Difference Vegetation Index – NDVI).

Observed soil erosion is not currently mapped at regular intervals. The SCA has developed a new dataset to identify active gully erosion across the Catchment. This has been field tested and the total area of gully erosion in each sub-catchment has been derived.

Findings

The SCA estimates that the total area of the Catchment with observed gully erosion is 776 ha. Several gully erosion sites were visited during the Audit inspections (Figure 5.3 and 5.4). The sub-catchments with the greatest area of observed gully erosion were Wollondilly River (priority), Upper Wollondilly River (priority), Mulwaree River (priority), Bungonia Creek and Boro Creek sub-catchments (Map 5.4).

Figure 5.3: Gully erosion (Tarlo River NP)
Source: DECC 2007

Figure 5.4: Gully erosion
Source: DECC 2007
As presented in the 2003 and 2005 Audit report using information from the NLWRA, 11 per cent of the Catchment was estimated to have very high or high risk of sheet and rill erosion. Five per cent of the Catchment is estimated to have very high risk of sheet and rill erosion, including parts of the Upper Coxs River (priority) and Wollondilly River (priority) sub-catchments. The Upper Wollondilly River (priority), Mulwaree River (priority), Reedy Creek and Braidwood Creek sub-catchments (six percent of the Catchment) contained areas with high erosion risk.

The Catchment Protection Scheme, funded by SCA and CMAs, aims to repair severe gully, stream bed and stream bank erosion. During the 2007 Audit period, the following erosion management measures were undertaken in the Catchment:

- 5,223 ha was treated for moderate to severe gully erosion by H-N and SR CMAs
- 93 km of fences were constructed to protect severe gully and stream erosion from livestock by H-N CMA
- 63 flumes were constructed by H-N CMA
- 75 gully erosion control structures were built by H-N CMA.

The Auditor notes the apparent discrepancy between the quoted 776 ha of observed gully erosion, and the reported 5,223 ha of treated areas in the Audit period. The Auditor understands that the ‘treated area’ in a project is a much larger area than the area of ‘observed gully erosion’ being remediated, because the former area includes regraded, fenced and revegetated areas surrounding the immediate site of the erosion.

**Implications**

The Wollondilly River (priority), Boro Creek, Mulwaree River (priority), Upper Wollondilly River (priority) and Endrick River sub-catchments had the greatest observed area of gully erosion. Areas within the Upper Coxs River (priority), Reedy Creek and Braidwood Creek sub-catchments have been identified as the most susceptible to soil erosion. Programs addressing soil erosion need to specifically target these areas to ensure that appropriate strategies and management controls are in place to respond to actual cases of soil erosion and minimise the risk of erosion.

**Future directions**

Erosion management programs need to reduce the risks of erosion as well as manage and rehabilitate actual cases of erosion. Programs to manage the risk of erosion should also be integrated with programs to protect and rehabilitate native and riparian vegetation (see Chapter 6) to obtain multiple benefits from on-ground works.

There is inadequate information about the location of erosion management works in the Catchment (see 2005 Recommendation 19). The location, type and area of all erosion management works in the Catchment should be recorded on a centralised spatial information system to enable the co-ordination of erosion management works between programs and agencies and to maximise the potential for integrating erosion works with other potentially complementary programs such as nutrient reduction and riparian and native vegetation rehabilitation works (see Recommendation 6 and 12).
Map 5.4: Observed gully erosion in the Sydney drinking water catchment
Case Study – Gully erosion control at Arthursleigh

Arthursleigh is a 7,000-hectare farm near Goulburn, and is one of the oldest properties in the area. It was donated to the University of Sydney in 1979 by the late Eric Thomas William Holt. Prior to this time, the property was heavily grazed and poorly managed, and consequently experienced severe land degradation and erosion. Stephen Burgun has been manager of the property for 17 years, and has been quoted as saying that when he arrived, the property was scarred by a 12 km long erosion gully (NRM, 2006).

“There was one erosion gully that ran almost the whole length of the property. It had dry red and yellow walls and a raw lifeless creek at the base”.

Erosion gullies mobilise large volumes of sediment which are transported downstream during rain events, and then impact on water quality, stream structure and aquatic life.

During 2005-06 works began at Arthursleigh, as part of the joint SCA/CMA Catchment Protection Scheme (CPS) project which aims to restore eroded land and protect water quality in the Catchment.

On Arthursleigh, the remediation works have included an earth weir, a flume structure, fencing, and revegetation. The 2007 Audit Team inspected the site with an officer of the Hawkesbury-Nepean CMA, observed the weir actively trapping large volumes of sediment, and noted the improved conditions downstream where there had previously been large active erosion gullies.

Stephen Burgun has been quoted as saying, ”Now the gully walls are green and a live creek runs through it, with native grasses covering the creek floor. These play a really important role in filtering water. We're in Sydney's catchment area, so it means we're making a significant difference to the quality of Sydney's water.”

The works are estimated to have prevented 18,000 tonnes of sediment from entering the Wollondilly River (priority) sub-catchment.

Figure 5.5: Dam created behind the weir
Figure 5.6: Flume

Source: DECC 2007
Source: NRM 2006
5.4 Salinity

Background
Salinity can be a threat to the health and productivity of a catchment, as excessive salinity can be lethal to plants and soil organisms or severely limit their productivity. Salinity occurs when the natural balance and distribution of salt in the landscape is disturbed. The removal of native vegetation through land clearing and the adoption of unsuitable land uses and practices have resulted in rising groundwater tables in some locations. This allows naturally occurring salts to migrate close to the soil surface where they are concentrated by evaporation or discharged into surface waters. Discharges of saline waste water from mines, power stations and STPs are other sources of salts reaching waterways.

The risk of salinity was determined by the former DIPNR using the Soil Landscapes data for the Catchment. The risk was placed into three categories:

- widespread – areas where saline soils occur or where scalding, salt efflorescence, vegetation dieback, salt tolerant vegetation and water logging can be found
- localised – scattered areas of scalding and indicator vegetation have been noted, or
- no risk – small likelihood of salinity occurring.

During the 2005 Audit period, the Goulburn, Braidwood and Taralga 1:100,000 map sheets in the Catchment were surveyed for actual salinity as part of DNR’s (now DECC) Surface Salinity Mapping Project.

Findings
From the Surface Salinity Mapping Project, the area of the Catchment with observed salinity cases was 2,157 ha (less than 0.2 per cent of the Catchment), and were located in the Wollondilly River (priority), Upper Wollondilly River (priority), Mulwaree River (priority), Nerrimunga River, Boro Creek, Reedy Creek and Bungonia Creek sub-catchments (Map 5.5). The area of the Catchment with a widespread risk of salinity is 3 per cent, located in the Boro Creek, Mid Shoalhaven River and Nerrimunga River sub-catchments (Map 5.5).

Thirty two hectares of salinity-affected land was treated during the 2007 Audit period under the Catchment Protection Scheme by the H-N CMA.

Implication
Areas within the Wollondilly River (priority), Upper Wollondilly River (priority), Mulwaree River (priority), Nerrimunga River, Boro Creek, Reedy Creek, Bungonia Creek and Mid Shoalhaven subcatchments have been identified as containing observed salinity or are the most susceptible to salinity in the Catchment. SCA, DECC and CMAs need to ensure that appropriate management action is taken to prevent salinity in high risk areas and also remediate existing areas of salinity to prevent salinity from becoming an issue in the Catchment. Programs to manage salinity should target these high risk areas, and other locations where land management practices increase the risk of salinity such as at sites where long term irrigation is practiced.

Future directions
There is no complete information about the location and extent of actual salinity cases over the entire Catchment, as recognised in the 2005 Audit (see 2005 Recommendation 19 that “The DECC develop systems in consultation with the SCA and CMAs for recording the location, nature and extent of actual cases of soil erosion and land salinity in the Catchment.”). The Natural Resource Commission (NRC) has agreed on land salinity as a resource condition indicator, and considers that the size of salinity outbreaks should be re-measured every five to ten years and the intensity re-assessed during the re-measurement.

Salinity management programs need to reduce the risks of salinity as well as manage and rehabilitate actual cases of salinity. Programs to minimise the risk of soil salinity need to be developed for sub-catchments and specific locations identified as having widespread and localised risk of developing dryland salinity. The Auditor recommends that these programs should be integrated with other relevant on-ground programs.
Map 5.5: Salinity risk and observed salinity in the Sydney drinking water catchment
Recommendation 6: The SCA, DECC and CMAs should undertake programs that address soil erosion and salinity in the areas with identified and observed risk, and integrate them with other programs for riparian and vegetation management where possible.

The location, type and area of all dryland salinity management works in the Catchment should be recorded in existing spatial information systems to enable the coordination of dryland salinity management works (see Recommendation 12).

**Actions and Response**

**Response to issue**

The two primary responses to protecting and improving land condition are:

i) to ensure new activities in the Catchment incorporate appropriate measures to prevent pollution, contamination and land degradation

ii) where technically and economically feasible, to repair lands already degraded.

This section outlines the major actions aimed at protecting and improving land condition in the Catchment. These include:

- general programs to reduce land degradation from different land uses
- programs to reduce land degradation from identified high risk industries
- programs to manage areas of soil erosion
- programs to manage areas of high salinity risk.

**General programs to reduce land degradation from different land uses**

**Land use planning**

The regulation of land-use type and location within the Catchment is primarily guided by the *Environmental Planning and Assessment Act 1979*. Local councils also have a range of powers under the *Local Government Act 1993* and the POEO Act that can be used to manage specific land-use issues. Land-use planning instruments that cover the control and management of land uses include:

**State Environmental Planning Policy 58 (SEPP 58)** - SEPP 58 Protecting Sydney’s Water Supply was gazetted in December 1998 and was introduced as an interim measure to ensure that development in the hydrological catchment from which Sydney draws its water did not have a detrimental impact on water quality. It was replaced by Regional Environmental Plan (REP 1) on 1 January 2007.

**Drinking Water Catchments Regional Environmental Plan No.1 (REP 1)** (SCA & DoP, 2007a) - The *Sydney Water Catchment Management Act 1998* requires an REP to be prepared. The plan designated REP 1 came into effect on 1 January 2007, and aims to:

- create healthy water catchments that will deliver high quality water while sustaining diverse and prosperous communities
- provide the statutory and non-statutory components in Sustaining the Catchments
- achieve the water quality management goals of:
  - improving water quality in degraded areas and critical locations where water quality is not suitable for the relevant environmental values
  - maintaining or improving water quality where it is currently suitable for the relevant environmental values.

**Local Environmental Plans (LEP)** – All councils within the Catchment have LEPs that specify the land-use zones and specific controls on land. LEPs must be consistent with relevant REP 1 or SEPPs.

**Rectification Action Plans (RAPs)** – The *Sydney Water Catchment Management Act 1998* requires the development of rectification action plans to rectify existing land uses that do not have a neutral or beneficial
effect on the quality of water, within certain time limits after the gazettal of the REP 1. The RAP Decision Support System will map and rank sources of four priority pollutants. The maps will inform the preparation of RAPs and the Healthy Catchments Program.

Strategic Land and Water Capability Assessments (SLWCAs) – REP 1 requires the SCA to prepare SLWCA for the Catchment. A SLWCA is an assessment of the physical capability of natural features of land and waterways to identify appropriate types and intensities of land use that will not adversely impact on water quality and catchment health. In 2006 the SCA developed a new and enhanced SLWCA model that utilises criteria directly available from the SCA spatial database. The model directly aligns with the standard template land-use table and local environmental plan zones. Local councils in the Catchment will be provided with Stage 1 SLWCA data during the next audit period. Stage 2 and the final SLWCA maps will be finalised during the next audit period.

Healthy Catchments Program (HCP) – has seven strategies including a land management and rural lands strategy, and uses tools such as grants and assistance schemes, education programs and regulation to improve land management practices. The HCP will be the primary SCA mechanism for implementing actions identified under RAPs.

Catchment Action Plans – The CMAs are required to develop Catchment Action Plans that consolidate and build on the existing native vegetation plans and catchment blueprints.

The Sydney Drinking Water Catchment Management (Environment Protection) Regulation 2001. This enables the SCA to exercise certain regulatory functions under the POEO Act with regard to non-scheduled premises and activities.

Neutral or Beneficial Effect on Water Quality Assessment Guidelines (NorBE) (SCA & DoP, 2007c) accompany REP 1, and provide guidance on the application of the NorBE principles. A neutral or beneficial effect can be demonstrated when the development:

- has no identifiable potential impact on water quality, or
- will contain any such impact on the site of the development and prevent it from reaching any watercourse, waterbody or drainage depression on the site, or
- will transfer any such impact outside the site by treatment in a facility and disposal approved by the consent authority (but only if the consent authority is satisfied that the water quality after treatment will be of the required standard).

The NorBE Guidelines include a range of current recommended practices which have been endorsed by the SCA. There are current recommended practices in place or under development in the areas of:

- wastewater management
- erosion and sediment controls in urban development
- erosion and sediment controls in non-urban development
- rural roads standards
- low density subdivision
- water sensitive urban design
- stormwater management
- waste and recycling
- agricultural management practice.
To ensure land use in the Catchment protects water quality, the current Drinking Water Catchments Regional Environmental Plan No. 1 (REP 1) (2006-289) and its predecessor, the State Environmental Planning Policy 58 (SEPP 58) (1998-725) have required all developments that need consent under a council’s local environmental plan to demonstrate a neutral or beneficial effect (NorBE) on water quality. NorBE Guidelines accompanying REP1 provide directions on the meaning of a neutral or beneficial effect on water quality, on how to demonstrate it, on how to assess a proposed development against the NorBE test, and on how the test will assist councils and proponents.

Example: Bowral sewage treatment plant (STP)

The augmentation of the Bowral STP was completed in the 2007 Audit period. Increasing sewage inflows could have caused increased frequency of overflows of the local sewer carriers, and increased loads of nutrients discharged in the treated effluent from the augmented plant to the local Mittagong Rivulet. The 2002 environmental assessment for the plant applied an earlier variant of the NorBE test required by SEPP58, whereby the post-development pollution load leaving the site should be the same or less than the pre-development load. To satisfy this test, the constructed works increased the STP’s capacity to store wet weather inflows and reduce bypasses, increased the level of treatment to further reduce nutrient loads, and transferred treated effluent past the old discharge point in Mittagong Rivulet to the Wingecarribee River for direct discharge, thereby removing a dry weather impact in the Rivulet. Figures 3.4 and 3.5 in Chapter 3 of this report show that reductions in nutrient loads have been achieved in the Audit period, confirming that the Bowral STP augmentation met the requirements of the NorBE test, and delivered a positive environmental outcome in the Wingecarribee River (priority) sub-catchment.

Rural lands

A number of new guidelines have been developed for the sustainable management of agriculture during the 2007 Audit period:

- Best Practice Guidelines for using Poultry Litter on Pastures (DPI, 2007a) - These guidelines aim at ensuring that poultry litter is used wisely to optimise pasture production and minimise the risk of problems concerning stock health, stock feeding bans, pollution and the environment.

- Improving Water Quality in Catchments Using Compost (DPI & DEC, 2005a) – A fact sheet based on field trials at Bungonia in the Shoalhaven Catchment that demonstrated the effectiveness of composted mulch and soil conditioners in controlling sheet erosion and assisting vegetation establishment on degraded sites

- Spray Sense – Information for Uses of Agricultural Chemicals (DPI, 2006g) - Spray Sense is a series of leaflets which focus on providing up-to-date information on a range of pesticide issues. Everyone who is involved in the manufacture, sale, distribution, use of pesticides and provision of advice is encouraged to use this information to apply pesticides more effectively.

- Deep Litter Housing for Pigs (DPI, 2006b) – This fact sheet reviews deep litter housing for pigs including construction, controlled drainage and storage and treatment of spent litter. It also offers practical design, performance and process guidance.

- Farming Meat Rabbits in Australia (DPI, 2006c) - provides a brief overview of the meat rabbit industry in Australia and the requirements for the farming of meat rabbits in NSW.

- Recycled Organics in Catchment Management (DPI & DEC, 2005b) - The main aims of the project are, to determine desirable product specifications for composted recycled organics (RO) products for use in runoff and erosion control in water catchments in NSW.

- Best Management Practices for Temperate Perennial Pastures in NSW (DPI, 2006a) - provide a basis for sustainable management of grazing lands in the tablelands and adjacent high rainfall, temperate pasture areas of NSW. The BMP’s primarily target dryland beef and sheep production on grazed pastures, but the principles will apply to other grazing enterprises in these areas.
• A Guide for Agricultural Development (SCA & DoP, 2007b) - provides advice on the definition of ‘intensive plant growing’ and the development assessment requirements for agriculture.

• Environmental Guidelines for Composting and Related Organics Processing Facility. (EPA, 2005). - The focus of these guidelines is on the appropriate environmental management of organics processing facilities. It lists the items to be included in an environmental management plan and the minimum performance and design requirements for the protection of waters.

• Nursery Industry Water Management Best Practice Guidelines. (NGIA, 2005) - A practical guide to sustainable water use, water use efficiency, recycling, nutrient management, responsible use of pesticides and site sediment and litter control.

• Wool Industry River Management Guide: High Rainfall Zones Including Tableland Areas. (IWA, 2006) - A guide to help woolgrowers improve and protect the health of water courses and riparian land on their farms and minimise the impacts of wool production on water quality and stream health.

Through the SCA’s Rural Lands Strategy under its Healthy Catchments Program, SCA and DPI have commenced a grazier education partnership which supports graziers through education and follow-up activities. DPI has engaged a coordinator to manage the delivery of the accredited grazier training courses including LANDSCAN, PROGRAZE and Pasture Identification.

The Goulburn Mulwaree Council has also developed a Rural Living Handbook in partnership with SCA. This publication informs landholders of their rights and responsibilities when buying land in rural residential areas and can easily be adapted for use by all interested Catchment councils (Goulburn Mulwaree Council, 2006).

During the 2007 Audit period, the SR CMA provided capacity building courses for landholders including Property Management Planning workshop and Weed Removers Pasture Improvers Course as well as a number of field days.

The DPI and HN CMA’s Implementing Best Practice for Sustainable Grazing Management in the Hawkesbury-Nepean Catchment Project began in April 2006. The project aims to recognise and improve the capacity of land managers to develop and implement grazing practices that lead to profitable, sustainable and productive enterprises, and which also contribute to drinking water quality and healthy catchments.

The DPI’s Sustainable Grazing Project expands the above project to a larger geographical area (including Goulburn and Mulwaree) and works with graziers to provide access to training in CRPs and whole farm management to improve the area of land being managed within its capability.

The Blue Mountains City Council Environment Levy provides funding to spend specifically on additional environmental protection and natural resource management projects within the Blue Mountains local government area. The Rural Practice Improvements Project was funded from the Environmental Levy. The environmental objectives of this project are to improve weed and feral animal control in rural lands, adopt best practice pasture management strategies and protect significant remnant native vegetation communities in rural areas.

Special Areas

Strict access control is enforced over the Special Areas to protect water quality and ecology. Using these measures together with regular catchment patrols, the SCA has issued penalties for a number of offences, notices and warning letters under the Sydney Water Catchment Management Regulation 2001 since 2002 (Table 5.5). There has been a decline in the formal regulatory action by the SCA over the period, due to an increase in educational activities related to access to the Catchment, an increase in signage, and construction of barriers. During the 2007 Audit period, SCA spent $180,000 to maintain and install new gates, barriers and warning signs to prevent illegal access in the Special Areas.
Table 5.5: Offences, notices and warning letters issued under the Sydney Water Catchment Management (Environment Protection) Regulation 2001 (2002-03 to 2006-07)

<table>
<thead>
<tr>
<th>Type</th>
<th>2002-03</th>
<th>2003-04</th>
<th>2004-05</th>
<th>2005-06</th>
<th>2006-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean up notices</td>
<td>5</td>
<td>8</td>
<td>19</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Notices (s192) requiring Information / documents</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Penalty infringement notices</td>
<td>10</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Pollution prevention notices</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Littering reports referred to DECC</td>
<td>28</td>
<td>190</td>
<td>154</td>
<td>45</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: SCA 2007

The Compliance Strategy under the SCA’s Healthy Catchment Program also aims to protect water quality in the catchment by regulating activities under the POEO Act. The SCA also contributed $35,000 to the Greater Southern Regional Illegal Dumping Squad to tackle illegal dumping in the Wingecarribee, Shoalhaven and Eurobodalla local government areas.

In accordance with Special Areas Joint Management Agreement and the Services Contract between the SCA and DECC, an Annual Land Management Program of land management activities within Special Areas (National Parks), which was jointly developed by DECC and the SCA to meet requirements of the Special Areas Strategic Plan of Management (SASPoM). The Annual Land Management Program encompasses the delivery of services within identified subprogram areas of the land management program. The subprograms included are pests; weeds; fire management; asset maintenance; cultural heritage; and ecosystem management.

The Catchment Remote Area Fire Fighting Team (CRAFT) program involves the engagement by DECC of experienced, dedicated fire fighters to provide an immediate and effective first response during the outbreak of a bushfire within, and threatening, all Special Areas during each annual fire season. The CRAFT funding assists with fire suppression activities, the deployment of the CRAFT helicopter to active fires and the employment of CRAFT staff for hazard reduction work, trail maintenance and upgrades. The approximate cost of this program is $1.5 million per annum.

Programs for high risk industries

Sites licensed under the POEO Act

DECC regulates major point sources using licences issued under the POEO Act. The licences include requirements for pollution control, monitoring and reporting. DECC negotiates Pollution Reduction Programs (PRPs) with licensees to address environmental issues and risks, and imposes the programs as formal licence requirements. Selected PRPs in force during the 2007 Audit period are summarised in Table 5.6.

Table 5.6: Pollution reduction programs for mines, quarries and miscellaneous activities licensed under the POEO Act for the 2007 Audit period.

<table>
<thead>
<tr>
<th>Licensed Activities</th>
<th>PRP</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goulburn Wool Scour</td>
<td>PRP2</td>
<td>Cease effluent irrigation and implement evaporation technology (completed)</td>
</tr>
<tr>
<td>Southern Meats</td>
<td>PRP3</td>
<td>Three stage programme investigation works to ensure effluent irrigation is sustainable</td>
</tr>
<tr>
<td>Woodlawn Mine</td>
<td>PRP8</td>
<td>Rectification works – leachate contamination of Stormwater Dam 2</td>
</tr>
</tbody>
</table>

Source: DECC 2007
Derelict mine

The Derelict Mine Committee sets priorities for the Derelict Mine program which is aimed at reducing the safety and environmental risks posed by derelict mines. The program is administered by the NSW DPI and overseen by the Derelict Mines Steering Committee. The aims of the program are to:

- manage risks to public health and safety
- stabilise sites
- manage sources of site contamination and address offsite contamination migration
- remove features limiting beneficial reuse of the site and its surroundings
- maintain or increase the biological diversity of species in the vicinity of the site
- conserve items of heritage value
- improve the visual amenity of sites and their surroundings.

Subsidence management

To address the issue of river bed cracking due to mine subsidence any mining activity that may cause subsidence must prepare a Subsidence Management Plan (SMP) in line with a new approval process under the Mining Act 1992. These plans must account for all possible impacts of potential subsidence to provide adequate protection for the natural and built environments. A SMP Review Committee has been established to review draft subsidence plans, provide advice on conditions of approval, and participate in ongoing monitoring of subsidence management. Alteration of habitat following subsidence due to long-wall mining has been listed under the Threatened Species Conservation Act 1995 as a threatening process.

An Independent Inquiry into the NSW southern coalfield was set up during 2007 to investigate underground coal mining in the southern coalfields. The terms of reference for the inquiry are to:

- undertake a strategic review of the impacts of underground mining on significant natural features including rivers and streams, swamps and cliff lines, with particular emphasis on risks to water flows, water quality and aquatic ecosystems
- provide advice on best practice in regard to:
  - assessment of subsidence impacts
  - avoiding and/or minimising adverse impacts on significant natural features
  - management, monitoring and remediation of subsidence and subsidence-related impacts
- report on the social and economic significance to the region and the State of the coal resources in the Southern Coalfield.
Case Study – Mining under the Woronora sub-catchment

The NSW Southern Coalfield is the group of underground coal mines south and southwest of Sydney, principally located in the Illawarra Region, but extending southwest to Bargo and Berrima under the Catchment. Coal is a valuable resource; a one metre advance of a longwall face can cut coal worth approximately $70,000. The Coalfield is the most important source of coking coal in Australia, supplying both the Port Kembla steelworks and export markets. The coal industry also provides jobs for an estimated 12,500 NSW residents.

Longwall mining is now the predominant method used to extract coal. It is an automated form of underground mining characterised by high recovery and extraction rates using high powered cutting machines and a conveyor system. The mining takes place under movable roof supports that are advanced as the bed is cut. The roof in the mined-out area is allowed to fall (subside) as the mining advances.

Mining-induced subsidence has been associated with ground cracking at the surface, which can distort creek beds and affect surface flow, which disappears underground and may either leave the catchment or emerge further downstream polluted with minerals such as iron and manganese (CRC e-Water, 2006). These processes threaten ecosystems and water quality, and are especially problematic within a drinking water catchment.

The NSW Government now requires longwall miners to seek approval for each new panel extraction and to present a subsidence management plan (SMP) in support of the operation. In December 2006, the Government announced an independent inquiry to investigate underground mining in the Southern Coalfield. A panel of five experts was appointed to conduct the inquiry and hold public hearings. The findings of the inquiry are due for release in early 2008.

Waratah Rivulet

Waratah Rivulet is a major tributary in the catchment of the Woronora Dam, which is the sole water supply storage for Sydney’s southern suburbs. The area is a declared ‘Special Area’ for water supply catchment purposes. Since 2000, longwall panels have been extracted beneath the area by Metropolitan Colliery. This has caused serious stream bed cracking, loss of surface flow and extensive rust-coloured iron discharges at groundwater exit points (CRC e-Water, 2007). The 2007 Audit Team inspected a section of the Rivulet and viewed widespread damage and modification to both the rivulet bed and the flow over it.

A collaborative research project between SCA and Parsons Brinkerhoff Pty Ltd on the ‘Impact of longwall mining on subsidence, flow and water quality in the Waratah Rivulet’ began in January 2007. This three-year study will assess land subsidence, water flow, water quality, and yield, as well as the interactions between surface waters and groundwater. Monitoring of water quality and surface flow has commenced. Results from both this project and the Independent Inquiry will inform governmental decisions about the future of longwall mining in Sydney’s drinking water catchment.
Programs to manage soil erosion

The Catchment Protection Scheme is a joint project between CMAs and SCA that assists landholders to control severe and moderate erosion and repair severe gully, stream bed and stream bank erosion in the Upper Shoalhaven River and Kangaroo River (priority) sub-catchments. The scheme offers financial support and practical advice on erosion control and stock management. The types of activities supported by the scheme include:

- fencing of sensitive riparian areas
- revegetation of eroded areas with local native species
- stabilisation of creek stock crossings
- installation of off-stream watering points
- construction of stream bank and streambed erosion controls such as V notch log weirs and engineered log jams
- construction of diversion banks and dams (gully control structures)
- construction of flumes and rock chutes.

The SCA has developed a new dataset to identify active gully erosion across the Catchment, this has been field tested and the information will be used to model sedimentation rates across the Catchment. It is also proposed by SCA, that the information will be used to prioritise assessment of sites for the Riparian Management and Assistance Program.

The SR CMA’s Brogers Creek Erosion Control Project involved a demonstration trial of engineered log jams to control large scale stream-bank erosion along a 300 m stretch of Brogers Creek, immediately upstream of the confluence with the Kangaroo River. Prior to these works, stream-bank erosion along this stretch of Brogers Creek was very active, with the bank height averaging about 3 m. SCA provided substantial funding towards this project.

The SR CMA’s Barrengarry Creek Erosion Control Project site is 2.5 km upstream of the confluence with the Kangaroo River. Prior to the works, about 160 m of stream-bank was actively eroding, with the stream-bank measuring up to 7 m in height. Nine rock groynes and two log sills were constructed along this stretch of Barrengarry Creek during May 2007. These works should protect gazing land and significantly reduce the sediment load in Barrengarry Creek. SCA provided substantial funding towards this project.

The DPI and DEC 2005 factsheet Improving water Quality in Catchments using compost is based on field trials in the Bungonia Creek sub-catchment that demonstrated the effectiveness of composted mulch and soil conditioners in controlling sheet erosion and assisting vegetation establishment on degraded sites. As part of SCA’s grants for non-government community groups the Mt Alexandra Reserve Bushcare Group was awarded a grant to carry out erosion control along Nattai Creek.

Programs to manage salinity

The National Action Plan for Salinity and Water Quality (NAP) is a commitment by the Australian, state and territory governments to jointly fund actions tackling two major natural resource management issues facing Australia's rural industries, regional communities and our unique environment. The Plan commits $1.4 billion over seven years to June 2008 to support action by communities and land managers in 21 highly affected regions. NAP investment is largely facilitated at a regional level through regional planning. At this level, the NAP is jointly delivered with the Natural Heritage Trust.

The NSW Salinity Strategy is designed to achieve the below outcomes and thereby slow down the rate of increase in salinity:

- protect and manage our native vegetation
- use our land so less water goes into the watertable
- use water more effectively and efficiently
- use engineering solutions
- make better use of land affected by salt
• focus our efforts on priority salinity hazard landscapes.

The NSW Salinity Strategy has eight key tools to do this. Setting targets, Market-based solutions, Salinity-related business opportunities, Regulation, Government advice, Information, Scientific Knowledge and Planning Systems.

The Local Government Salinity Initiative, part of the NSW Salinity Strategy, is helping local council develop the capacity to manage urban salinity. It provides information, training and technical support for the development and implementation of salinity management strategies and land-use planning instruments. As part of the Local Government Salinity Initiative a Urban Salinity Planning Guide was developed. The Land Use Planning and Urban Salinity guide presents an overview of the way land-use planning can play an important role at council level in preventing and managing urban salinity.

DECC and CMAs are carrying out Salinity Investigations in High Risk subcatchments. The project aims to identify recharge areas through groundwater flow systems and salinity outbreaks in high risk sub-catchments such as the Mulwaree River (priority) sub-catchment.

The Salinity Research and Development Coordinating Committee has prepared a Strategic Framework for Salinity Research and Development in NSW. The framework identifies the key knowledge questions that need to be answered for effective salinity management in NSW and criteria that could be used to evaluate the potential for research proposals to answer those research questions. The framework seeks to inform research and development providers, purchasers and advisers such as CMAs, research and development corporations, universities, government agencies, and industry organisations.

Gaps in the response

There are a number of programs to reduce land degradation from different land uses. The gazettal of the REP 1 will lead to the much needed RAPs and SLWCAs which will provide direction for on-ground actions to reduce land degradation and rehabilitation areas of land that are already degraded in the Catchment.

The Independent Inquiry into the NSW Southern Coalfield and the results of research should better inform future management decisions on coal mining in the Catchment.

Active on-ground response programs need to be further developed and implemented in high risk salinity areas in the Catchment and in locations subject to actual salinity.