Sydney Catchment Authority

Water Sensitive Design Guide for Rural Residential Subdivisions

A Sydney Catchment Authority Endorsed Current Recommended Practice
Disclaimer

The purpose of this Design Guide is to provide information to assist those persons engaged in the design of rural residential subdivisions in the drinking water catchment. The information contained in the Design Guide is current, accurate and complete at the time of publication.

The Sydney Catchment Authority does not make or give any representation or warranty that compliance with the recommended practices in the guide will produce an effective subdivision design preventing all water quality impacts and will not be liable in negligence, breach of contract or statutory duty for failure of the design or the consequences of that failure.

Acknowledgements

This ‘Water Sensitive Design Guide for Rural Residential Subdivisions’ CRP has been developed by the Sydney Catchment Authority with contributions by Hyder Consulting Pty Ltd, Innovations Planning, SEEC Morse McVey Pty Ltd and Laterals Planning.

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Executive Summary

The Sydney Catchment Authority has prepared this ‘Water Sensitive Design Guide for Rural Residential Subdivisions’ (the Design Guide) as a current recommended practice for the protection of water quality under the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (the SEPP).

This Design Guide identifies a range of water sensitive planning, design and development principles, practices and solutions that are consistent with the requirements for achieving sustainable catchment health outcomes and water quality protection principles in accordance with the ‘Neutral or Beneficial Effect on Water Quality (NorBE) Assessment Guideline 2011’. These principles mean that either there should be no impact on water quality by the development, or that the impacts are either contained on-site or treated to the required standard off site.

This Design Guide is a guide for rural residential subdivision design and assessment in the drinking water catchment. It has been created as:

- a handbook for developers and consultants in the design of proposed subdivisions using appropriate planning and water sensitive design techniques
- an educational document for both the Sydney Catchment Authority and local government staff, and any member of the community involved in rural subdivision in the drinking water catchment
- a tool for use by local government, the Sydney Catchment Authority and other authorities in the assessment of such development proposals. Any deviation from the outlined process will need to be fully justified and documented, as well as demonstrate that equivalent or better outcomes for protection of water quality can be achieved.

This document is to be read and the principles applied in conjunction with relevant council planning policies, legislative requirements and other current recommended practices under the SEPP.
CHAPTER 1

WATER SENSITIVE DESIGN FOR RURAL RESIDENTIAL SUBDIVISIONS
1. DESIGN GUIDE

**Rural residential subdivision** is the subdivision of land in any rural or environmental zone into any size allowed by the relevant local environmental plan or other statutory environmental planning instrument. In this context, rural residential subdivision is considered to be all developments ranging from lot sizes of approximately 1,500 square metres upwards, including hobby farms of 40 and more hectares. While such subdivisions are typically unsewered they may, in certain circumstances, be serviced or proposed to be serviced by a reticulated sewerage system.

The Design Guide identifies a range of water-sensitive planning and development principles, practices and solutions that are consistent with achieving the requirements of a neutral or beneficial effect on water quality, and is divided into three sections:

**Section One - Introduction** includes a context for development of the Design Guide as well as background information on the design elements and process.

**Section Two – Site Analysis** outlines the site specific information necessary to scope and identify a range of water quality issues and constraints for the design and preparation of a rural residential subdivision proposal. This section also introduces a case study, which demonstrates the practical application of the site analysis process and the Site Analysis and Design Tool.

**Section Three – Subdivision Design** identifies and describes water sensitive design elements for addressing the issues identified in the site analysis. It explains, using the case study introduced in Section Two, how to use the information gathered in the site analysis to inform the design of the subdivision, including lot layout and road placement. It also contains descriptions, technical and design guidance for the various water sensitive design measures with reference to detailed current recommended practices and relevant references.

1.1 Sydney’s drinking water catchment

Five catchments contribute to the Greater Sydney region’s drinking water supply including Warragamba, Upper Nepean, Blue Mountains, Shoalhaven and Woronora rivers (Figure 1-1).

These catchments cover an area of almost 16,000 square kilometres, are home to approximately 110,000 people and supply water to more than four million people, representing about 60% of the NSW population. The catchments extend from the headwaters of the Coxs River to the north of Lithgow, to the source of the Shoalhaven River near Cooma in the south and from the source of the Wollondilly River near Crookwell and east to the Woronora River near Heathcote.

The Sydney Catchment Authority (SCA) is a NSW Government agency created in 1999 to manage and protect Sydney’s drinking water catchment and supply raw water to Sydney Water and a number of local councils and water utilities.

The SCA has identified that healthy catchments are the first step in protecting the quality of the water supply. If catchment health is allowed to deteriorate, then water quality in watercourses will also deteriorate. This impacts on the quality of the drinking water supply,
as well as on activities such as stock watering, irrigation and recreation, and the ecological health of native plants and animals.
1.2 Requirements of State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (the SEPP) is a legal instrument that sets out obligations relating to development matters, including the planning and regulation of new development in the drinking water catchment.

Under the SEPP, proposed developments that require consent, including rural residential subdivisions, must demonstrate a neutral or beneficial effect (NorBE) on water quality and should incorporate current recommended practices and performance standards endorsed or published by the SCA that relate to the protection of water quality.

Neutral or beneficial effect on water quality

In the ‘Neutral or Beneficial Effect on Water Quality (NorBE) Assessment Guideline 2011’ (SCA, 2011), the SCA has defined a ‘neutral or beneficial effect on water quality’ as development that:

(a) has no identifiable potential impact on water quality, or
(b) 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
(c) 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 water quality treatment will be of the required standard).

The NorBE Assessment Guideline provides a clear direction as to what is meant by a neutral or beneficial effect, how to demonstrate it, and how to assess an application against the NorBE test. This Design Guide provides the mechanism to design rural residential subdivisions that are more likely to meet the NorBE requirements.

Two key aspects relating to NorBE for proposed developments that need to be understood are:

- NorBE must be met at all times, particularly during wet weather
- NorBE must be sustainable over the longer term.

It is a statutory requirement for all rural subdivisions to demonstrate compliance with NorBE, which is assessed by councils and the SCA using the NorBE test when considering subdivision development applications. Consent cannot be granted by council, nor concurrence given by the SCA (if required), for development applications which do not meet the NorBE requirements.

Current recommended practices and performance standards

Current recommended practices (CRPs) and performance standards provide solutions to manage the water quality impacts of a range of developments and activities, including agriculture, industrial developments, stormwater and wastewater management. The SEPP in essence states that:
Any development or activity should incorporate any current recommended practices and performance standards endorsed or published by the SCA that relate to the protection of water quality.

If any development or activity does not incorporate the SCA’s current recommended practices and standards, then it should demonstrate how the practices and performance standards proposed to be adopted are equivalent.

A list of the CRPs and standards is available on the SCA’s website, and a copy of each CRP and standard is available for public inspection at the SCA offices.

This Design Guide is an endorsed CRP developed by experts and practitioners, and peer reviewed by individuals with particular expertise in rural residential subdivision or water sensitive design. Other relevant CRPs endorsed by the SCA and used for the design of rural residential subdivision are referred to in the relevant sections throughout this Design Guide. The list is available on the SCA’s website www.sca.nsw.gov.au.

1.3 Rural residential subdivision

Significant land-use change is occurring across the drinking water catchment, particularly in relation to the subdivision of large grazing or farming properties into ‘hobby’ farms and rural residential lots. The creation of such farms and lots in a number of cases is undertaken with little regard to water quality, landscape or biophysical issues, or existing land management activities or works. This often results in adverse impacts on water quality and creates future difficulties for managing the impacts of the development on water quality, including the future uses on the created lots.

New owners of the subdivided lots often unreasonably and unknowingly inherit water quality management problems and responsibilities generated from other areas of the site. These problems could have often been avoided if the subdivision had been better designed in relation to existing site constraints, or if properly considered and designed rectification actions were carried out as part of the subdivision.

Managers or developers of larger properties intended for subdivision are generally better equipped to undertake works for managing water quality and environmental issues, than owners of small already subdivided land parcels. Therefore it is important that water quality issues are addressed at the subdivision design stage.

1.4 Water sensitive subdivision design elements

This Design Guide aims to promote water sensitive design elements for rural residential subdivisions in order to prevent detrimental impacts on water quality in the drinking water catchment, as well as addressing any existing poor management practices.

In order to achieve good design solutions for rural residential subdivisions, water sensitive design elements should be incorporated into the subdivision design process, which is structured around a number of design objectives including:

- integrated design
- accommodating existing soil and water management (including erosion control) measures
- controlling gully and watercourse erosion and sedimentation on the site
• controlling stormwater and wastewater pollution
• enhancing biodiversity
• ensuring the long-term effectiveness of management measures.

1.4.1 Integrated design

All issues that affect the water cycle should be managed in an integrated manner which allows them to be reconciled with other site planning issues such as biodiversity conservation, scenic and landscape quality, access ways and roads, development sites, and on-site wastewater and stormwater management. To do this requires a thorough understanding of the site. This will enable the subdivision designer to avoid adverse impacts and to utilise measures that achieve multiple objectives.

Issues affecting the water cycle that need to be assessed include, but are not limited to, existing soil and water management structures and measures, vegetation (both its retention or clearing), soil characteristics, salinity, flooding, watercourse protection, watercourse flow, water supply, sewage management, stormwater management, water quality, groundwater characteristics, seasonal variations, and land use and management practices.

Objectives

• To fully consider the site’s features, constraints, opportunities and local context at the earliest stages in the subdivision design process.
• To integrate planning issues in the subdivision design process to achieve multiple benefits.
• To achieve good rural residential subdivision design that is likely to satisfy NorBE.

1.4.2 Accommodate existing soil and water management measures

Rural residential subdivision will generally result in the modification of natural land and water features. However, it is possible to design a subdivision in a manner which recognises the site constraints, protects natural features and embraces opportunities to address existing land and water degradation. It is critical that the subdivision design recognises existing soil and water management measures that may have been introduced on the site including erosion control works such as contour banks, flumes, sediment dams, revegetation, watercourse modifications and stock exclusion areas.

Addressing existing land degradation and incorporating existing soil and water management measures into subdivision design provides many benefits including reducing risks from natural hazards, the maintenance of biodiversity, aesthetic benefits as well as the protection of water quality.

Objectives

• To incorporate existing soil and water management measures into the subdivision design and to maintain their integrity.
• To retain, protect and where practical restore, natural landforms, watercourses, native vegetation and other natural landscape features.
To minimise disruption to land surfaces, natural drainage patterns, groundwater recharge and discharge areas and native vegetation.

1.4.3 Control gully and watercourse erosion

The modification of soils and vegetation cover through the construction of roads, buildings and other impermeable surfaces for rural residential subdivision can cause significant changes to the behaviour of water in the landscape. During moderate and high rainfall events, highly erosive water flows may be created leading to sheet and rill erosion, gully erosion, increased bank and channel erosion, sediment deposition, loss of natural pool and riffle sequences within watercourses and degradation of aquatic habitats.

To counteract these impacts subdivision design should endeavour to minimise the likelihood of erosive stormwater flows from the subdivision, especially in areas prone to erosion.

Objectives

- To ensure that rural residential subdivision does not increase stormwater flow rates during moderate or high rainfall events during and after construction.
- To avoid increased gully and watercourse erosion due to highly erosive flows.

1.4.4 Control erosion and sedimentation on the site

Rural residential subdivision has the potential to increase erosion and sedimentation both on and off the site during construction. This occurs through disruption to land surfaces, removal of vegetation, concentrated flows discharging onto poorly vegetated soils, and through the importation and stockpiling of materials for construction of roads, building and other impervious surfaces. Subdivision design should take into consideration erosion risks and avoid disturbance in high risk areas which include steep slopes, erosive soils, and areas in close proximity to drainage depressions and watercourses. A conceptual soil and water management plan (SWMP), erosion and sediment control plan (ESCP) (see Landcom, 2004) or primary and progressive sediment control plans (see DECC 2008, Volumes 2C and 2D) for the subdivision should be included in the development application documents.

Objectives

- To ensure that rural residential subdivision does not increase erosion and sedimentation.
- To ensure that best management practices are incorporated in the subdivision design to control on-site soil erosion and minimise water pollution during construction.

1.4.5 Control stormwater pollution

The subdivision of land for rural residential purposes has the potential to introduce greater quantities and a broader variety of pollutants to the site. In addition, the replacement of natural ground surfaces and vegetation cover with roads, buildings and other more impermeable surfaces may increase the volume and rate of runoff from the site and the
potential for pollutants to be transported into watercourses and off site during rainfall events.

Stormwater generated by these rainfall events can be managed by a variety of measures. These measures should be incorporated into the subdivision design.

**Objectives**

- To treat stormwater flows on-site.
- To identify opportunities for the use of treated stormwater on-site.

### 1.4.6 Control wastewater pollution

Wastewater management is a potential major source of pollution associated with rural residential subdivision. As there is normally no sewerage infrastructure in place where most rural residential subdivisions are proposed, wastewater management will generally be provided through on-site wastewater management systems. The type of system, location within the site, site features (soils and landscape features) and ongoing management are important considerations in the subdivision design.

Where the lots are constrained, it is possible they may also have a public positive covenant placed on them under Section 88E of the *Conveyancing Act 1919* that enforces a certain type or location of treatment or disposal system.

When designing a wastewater management system for a rural residential subdivision, reference should be made to:

- the Department of Local Government’s ‘Environment and Health Protection Guidelines – On-Site Sewage Management for Single Households’ (the ‘Silver Book’)
- AS/NZS 1547:2000 ‘On-site Domestic Wastewater Management’
- the SCA’s list of information requirements (available on the SCA’s website)
- the SCA’s ‘Designing and Installing On-Site Wastewater Systems’.

**Objectives**

- To ensure that all wastewater generated within the rural residential subdivision is managed on-site, does not impact on water quality, and does not interact with stormwater management systems.
- To provide an opportunity for developers and subsequent landholders to understand and be made aware of their obligation to manage on-site wastewater management systems.

### 1.4.7 Maintain or enhance biodiversity

Rural residential subdivision has the potential to degrade site biodiversity through the removal or fragmentation of vegetation and disturbance of habitat if the design does not identify and allow for the site constraints. Subdivision design should seek to maintain or
enhance biodiversity through the protection of vegetated areas and enhancement of core habitat areas on site.

Objectives

- To ensure that rural residential subdivision protects and enhances the biodiversity on the site by avoiding natural features and vegetated areas and where practically feasible, restoring previously degraded habitat areas.

1.4.8 Ensure long-term effectiveness of management measures

On-site soil and water management measures, whether they are designed to be temporary or more permanent, serve not only the immediate site, but also provide benefits to the downstream catchment. Failure of these measures through choice of inappropriate design, lack of maintenance, or accidental or deliberate action can lead to significant water quality problems. The subdivision design process should ensure that the design integrity and effectiveness of on-site measures is sustainable over the longer term.

Objectives

- To ensure that permanent water and soil management measures are not removed, and will continue to operate in accordance with specified design criteria into the future.
- To ensure that subsequent landholders understand and are made aware of the purpose of the on-site soil and water management measures and of their obligation to undertake regular maintenance.

1.5 Rural residential subdivision design process

The process described in this Design Guide focuses on achieving a detailed and accurate analysis of the site to identify the site constraints and water quality management opportunities. Once the site is accurately considered in its context, a suitable subdivision design can be created.

An overview of the rural residential subdivision design process is illustrated in Figure 1-2. Note: this process assumes that the minimum lot size and maximum potential lot yield has been determined by reference to the appropriate local environmental plan (LEP).

The two design steps that are instrumental in preparing a rural subdivision design that is likely to have a neutral or beneficial effect on water quality are outlined below:

Step 1: Site Analysis (Chapter 2 of this Design Guide)

- Desktop review and constraint mapping - Collate existing information to form a basis for assessing the constraints and water quality management opportunities for the site. Map parameters that represent constraints to subdivision and overlaying these constraints on one image using a tool such as the SCA’s Site Analysis and Design Tool.
- Site inspection - Verify information gathered in the desktop review and constraint mapping, and identify any other site issues.
Step 2: Subdivision Design (Chapter 3 of this Design Guide)

- Locate potential building sites and effluent disposal areas - Choose the least constrained sites for potential building sites and effluent disposal areas. Note: the maximum lot yield allowable under the relevant LEP may not be achievable due to site constraints (see Example of Large Lot Subdivision in this Design Guide).

- Design vehicular access and lot layout - Simultaneously configure vehicular access and lot layout to building sites.

- Locate and design stormwater treatment measures – To maintain water quality at the required standard.

- Identify erosion and sedimentation control measures – Prepare a conceptual SWMP, ESCP or Primary ESCP.

- Identify areas to be protected and rehabilitation and other offset opportunities - Consider restoring degraded areas within the proposed subdivision.
Rural Residential Subdivision Design Process

**STEP 1**
- **Site Analysis**
  - Desktop review
  - Site inspection
  - Constraint mapping
  - Slope analysis

**STEP 2**
- **Subdivision Design**
  - Determine potential building sites
  - Determine effluent disposal areas
  - Design lot layout and vehicular access
  - Stormwater management
  - Erosion and sedimentation controls
  - Offset opportunities

**Site Analysis Checklist**
- Site analysis satisfactorily completed?
  - No
  - Yes

**Subdivision Design Checklist**
- Subdivision and water sensitive design reflects site constraints?
  - No
  - Yes

**SCA concurrence required for all unsewered subdivisions - SCA NorBE Assessment**
- NorBE achieved?
  - No
  - Yes

- SCA concurrence withheld and consent authority refuses consent on water quality grounds.
- SCA concurrence granted and consent authority grants consent on water quality grounds.

Figure 1-2  Rural residential subdivision design and assessment process
2 SITE ANALYSIS

2.1 Introduction

Good subdivision design is driven by the character and condition of the land. Detailed information on the land proposed to be subdivided is critical to the design process, to ensure constraints and opportunities are addressed. A site analysis, including desktop review and site inspections, will determine the opportunities and constraints for the site in relation to water quality impacts.

The priority of this Design Guide is the protection of water quality, and as such this section is restricted to information needed to design water sensitive rural residential subdivision. In addition to this, councils may require other site information to be included with the submission of a development application. Specific requirements should be obtained from the relevant council for incorporation into the site analysis.

The hypothetical case study used in the following sections to demonstrate the process of the site analysis is a small lot rural residential subdivision. The case study examines a proposal to subdivide the property known as Lot 1, which is 43 hectares in size. The minimum lot size allowed in this part of the local government area is 10 hectares according to the LEP, which would nominally allow for subdivision into four lots, not allowing for site constraints. An example of a large lot subdivision is also included in Section 3.6.

2.2 Desktop review and constraint mapping

2.2.1 Data sources

The first stage of the site analysis is the desktop review. This involves collecting and collating existing information about the site to form a basis for assessing the constraints and opportunities for the site. Data can be obtained from a number of sources, including those listed in Table 2-1.

Table 2-1 Possible data sources

<table>
<thead>
<tr>
<th>Possible data source</th>
<th>Desktop review considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land zoning</strong></td>
<td>Local council</td>
</tr>
<tr>
<td><strong>Property boundaries</strong></td>
<td>Landowner Land and Property Information (Department of Finance and Services) Local council</td>
</tr>
<tr>
<td>Possible data source</td>
<td>Desktop review considerations</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td><strong>Existing road reserves (formed or unformed)</strong></td>
<td>Status of the road reserve needs to be confirmed (ie Council controlled, private, Crown, Reserved, etc) to determine if road can be used. Council may have requirements for the design standards for local roads.</td>
</tr>
<tr>
<td>Local council</td>
<td></td>
</tr>
<tr>
<td>Department of Primary Industries Crown Land Division (including the former Land and Property Management Authority, LPMA)</td>
<td></td>
</tr>
<tr>
<td><strong>Land use and management practices</strong></td>
<td>Identify and distinguish areas of agricultural land use (grazing, cropping), urban areas, previous intensive uses on the land eg orchards or vineyards. Identify and distinguish areas of existing erosion control or management measures funded under the Catchment Protection Scheme or other grants schemes.</td>
</tr>
<tr>
<td>Landowner</td>
<td></td>
</tr>
<tr>
<td>SCA list of endorsed CRPs</td>
<td></td>
</tr>
<tr>
<td>Local council</td>
<td></td>
</tr>
<tr>
<td>Livestock Health and Pest Authorities (former Rural Lands Protection Boards)</td>
<td></td>
</tr>
<tr>
<td>Department of Primary Industries Soil Conservation Service Division (including the former LPMA)</td>
<td></td>
</tr>
<tr>
<td>Local Catchment Management Authority (CMA)</td>
<td></td>
</tr>
<tr>
<td><strong>Development</strong></td>
<td>Identify specific guidelines for certain types of development – refer to Development Control Plans.</td>
</tr>
<tr>
<td>Local council</td>
<td></td>
</tr>
<tr>
<td><strong>Aerial photographs</strong></td>
<td>Broad identification of vegetation, infrastructure (including dams and access) and any land degradation such as salinity, gully erosion or potential contaminated sites. Requirements of Native Vegetation Act 2003.</td>
</tr>
<tr>
<td>Land and Property Information (Spatial Information Exchange (SIX) on L&amp;PI website)</td>
<td></td>
</tr>
<tr>
<td><strong>Waterways and drainage</strong></td>
<td>Identify location of watercourses and buffer distances for effluent management areas. Identify any water rights beyond riparian rights. Identify existing approved and constructed soil management measures. Controlled activity approvals required under the Water Management Act 2000.</td>
</tr>
<tr>
<td>SCA Site Analysis and Design Tool (waterways and buffers)</td>
<td></td>
</tr>
<tr>
<td>Land and Property Information (SIX on L&amp;PI website)</td>
<td></td>
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<tr>
<td>Topographic maps</td>
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<tr>
<td>Office of Environment and Heritage (OEH, includes the former Department of Environment, Climate Change and Water) Regional Office</td>
<td></td>
</tr>
<tr>
<td><strong>Bores</strong></td>
<td>Groundwater vulnerability. Identify the presence and location of bores and their application. Bores for domestic water supply will affect the location of on-site wastewater disposal infrastructure.</td>
</tr>
<tr>
<td>OEH Regional Office</td>
<td></td>
</tr>
<tr>
<td>Landowner</td>
<td></td>
</tr>
<tr>
<td><strong>Water supply</strong></td>
<td>Identify location of existing water supply infrastructure.</td>
</tr>
<tr>
<td>Local council and/or local water utility</td>
<td></td>
</tr>
<tr>
<td><strong>Sewage disposal</strong></td>
<td>Identify location and capacity of existing sewerage infrastructure.</td>
</tr>
<tr>
<td>Local council and/or local water utility</td>
<td></td>
</tr>
<tr>
<td><strong>Springs or high water tables</strong></td>
<td>Identify the presence and location of springs or high water tables and any current use of the springs.</td>
</tr>
<tr>
<td>Groundwater vulnerability / availability mapping</td>
<td></td>
</tr>
<tr>
<td>Possible data source</td>
<td>Desktop review considerations</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Landowner</td>
<td>Location of high water tables and springs will affect the location of building sites, effluent management areas, roads and vegetation clearing.</td>
</tr>
<tr>
<td>Landowner, Local council, OEH (includes the former Environment Protection Authority), Department of Primary Industries, Department of Planning Site Contamination Manual</td>
<td>Identify the presence of any contaminated sites such as land fill, rubbish tips and dip sites (complements aerial photography interpretation – see Section 2.2.2 below). EPA notices issued or licences revoked.</td>
</tr>
<tr>
<td>Meteorological</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td></td>
<td>Information regarding rainfall, temperature, seasonal variations, etc.</td>
</tr>
<tr>
<td>Bushfire prone land</td>
<td>Local council, Rural Fire Service</td>
</tr>
<tr>
<td></td>
<td>Identify if property is bushfire prone and determine requirements for asset protection zones – refer to ‘Planning for Bushfire Protection 2006’ (RFS, 2006).</td>
</tr>
<tr>
<td>Topography</td>
<td>SCA Site Analysis and Design Tool, Topographic maps</td>
</tr>
<tr>
<td></td>
<td>Identify areas of sloping land that may result in erosion of disturbed soil. The steeper the slope, the greater the possibility and extent of soil erosion. Identify areas of State Protected Land – refer to the Native Vegetation Act 2003.</td>
</tr>
<tr>
<td>Dispersive soil</td>
<td>SCA Site Analysis and Design Tool, The former Department of Land and Water Conservation (DLWC)/SCA soils database</td>
</tr>
<tr>
<td></td>
<td>Identify if dispersive soils are located on the property. Dispersive soils play an important factor in the sighting of effluent management areas, as well as sediment and erosion control measures.</td>
</tr>
<tr>
<td>Salinity</td>
<td>SCA Site Analysis and Design Tool, DLWC/SCA soils database</td>
</tr>
<tr>
<td></td>
<td>Damage to the environment and infrastructure.</td>
</tr>
<tr>
<td>Soil permeability</td>
<td>SCA Site Analysis and Design Tool, DLWC/SCA soils database</td>
</tr>
<tr>
<td></td>
<td>Important to identify areas of high and low permeability for effluent management areas.</td>
</tr>
<tr>
<td>Soil phosphorus sorption</td>
<td>SCA Site Analysis and Design Tool, DLWC/SCA soils database</td>
</tr>
<tr>
<td></td>
<td>Determine if site has high or low phosphorus sorption for effluent management areas.</td>
</tr>
<tr>
<td>Soil depth</td>
<td>SCA Site Analysis and Design Tool, DLWC/SCA soils database</td>
</tr>
<tr>
<td></td>
<td>Determine if shallow soils exist on the site.</td>
</tr>
<tr>
<td>Flood levels</td>
<td>Local council</td>
</tr>
<tr>
<td></td>
<td>Identify flood liable land and determine council development requirements.</td>
</tr>
<tr>
<td>Vegetation (including clearing)</td>
<td>Local CMA, OEH</td>
</tr>
<tr>
<td></td>
<td>Requirements of Native Vegetation Act 2003.</td>
</tr>
</tbody>
</table>
2.2.2 Aerial photography

Figure 2-1 introduces a hypothetical case study of a 43 hectare property that is to be subdivided for rural residential purposes. The relevant local environmental plan allows for lots with a minimum size of 10 hectares. For this property, the maximum potential lot yield is therefore four lots, including the two existing residences.

Aerial photographs, such as in Figure 2-1, may be used in conjunction with a site inspection to identify many features of the site that may constrain the design of the subdivision, such as large areas of salinity, erosion or potentially contaminated lands, that may be caused by poor land management practices in the past, droughts or failed erosion and sediment control structures. Areas of remnant vegetation that should be retained may also be identified. On large properties it is particularly useful to use aerial photography to identify land degradation prior to site inspection and subdivision design, so that these areas can be targeted for rehabilitation as part of the development application and implementation process. Aerial photography can be sourced from the Land and Property Information’s Spatial Information Exchange (SIX) or Google Earth. Users should note that if there is an extended period between the date of the aerial photography and the date of subdivision design, verification of any changes to vegetation cover, access tracks, etc through a site inspection should be undertaken.

Contaminated land

Land uses that indicate potential for contamination include sheep/cattle dips, fertiliser dumps, rural rubbish tips in gullies, and orchards and other intensive agriculture. In some areas these may also include old mining sites and tailings dams, and former industrial or commercial sites, and may involve a range of contaminants including oils, pesticides and hydrocarbons. Contaminated lands are a constraint for development, and may require special treatment. The proponent / consultant should seek guidance from the Office of Environment and Heritage and Council. Under the Contaminated Land Management Act 1997, contaminated lands can be an ongoing liability for the person causing the contamination, even after the land is sold.
Watercourses and Waterbodies
The aerial photograph provided in Figure 2-1 shows that a watercourse runs along the property boundary to the north and west, and a watercourse is also located within the property (see also Section 2.3.1).

Existing Infrastructure
The property currently contains one access road, a watercourse crossing, and two existing dwellings and outbuildings. The location of these will need to be considered in the subdivision design.

Vegetation
Aerial photography shows that the site is heavily vegetated in the north-west corner. The subdivision design will need to aim to minimise vegetation clearing (see also Section 2.3.4).

Site History
The history of land use at the property has been investigated through enquiries with the current landowner, Council and LPI. The property has primarily been used for rural residential purposes, with some horse grazing, and includes a dressage area.
Flood Liable Land

The land is not identified as flood affected on councils flood prone lands maps.

Bushfire Prone Land

The site is mapped as bushfire prone Category 1 by council.

2.2.3 The Site Analysis and Design Tool

Once the relevant subdivision information has been collated through the desktop review, the site constraints can be identified on a map using the Site Analysis and Design Tool (SADT; an ArcReader tool supplied on CD with this Design Guide, later to be made available on DPI’s SIX Viewer). This tool is used to show the type and spatial extent of the site’s constraints affecting potential subdivision design.

The SADT contains a number of natural resource spatial data layers which include predetermined constraint thresholds; if these thresholds are exceeded, any proposed development may have difficulty achieving NorBE.

It is important to note that the information contained in the SADT is broad-scale information that only identifies possible constraints and problems, which then must be verified with a site inspection. In the absence of any other information, an assessor will assume that any constraint indicated by the SADT exists and it is therefore up to the proponent to either prove otherwise or design for the constraint. If the site inspection or testing does not confirm the potential constraints identified by the SADT this should be noted. Similarly where issues not identified in the desktop analysis are found, these site issues should be noted and taken into account in the subdivision design and layout.

The SADT will allow the user to search for a site using the Lot number and DP and then select the following datasets to identify the possible site constraints and inform the subdivision design. The datasets include:

- Site location – Lot and DP
- Watercourse buffers
- Soil depth
- Slope constraints
- Soil dispersiveness
- Soil permeability
- Soil salinity
- Soil phosphorus sorption
- Vegetation cover
- Mean annual rainfall (>1,500 mm).

It is important to note that the SADT only contains datasets for a defined set of constraints listed above; information regarding other constraints may need to be incorporated into the final analysis if relevant.

A step by step guide for using the SADT can be found in Appendix 1. The constraints and their potential impacts on subdivision design are included in Table 2-2. Examples of how the constraints may appear during the mapping exercise are illustrated in Figures 2-2 to 2-8 in Section 2.2.4.
Table 2-2 Site Analysis and Design Tool constraint mapping layers

<table>
<thead>
<tr>
<th>Constraint to assess</th>
<th>Methodology for assessment</th>
<th>Parameters of the assessment</th>
<th>Potential impact on subdivision design</th>
<th>Thresholds and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of drainage depressions, watercourses and waterbodies (Figure 2-2)</td>
<td>SADT, aerial photos plus site inspection</td>
<td>Assess potential house site buffers to drainage features.</td>
<td>Affects the siting of EMAs.</td>
<td>40 m from drainage depressions and waterbodies&lt;br&gt;100 m from watercourses (intermittent or perennial)&lt;br&gt;150 m from named rivers and water supply reservoirs (Named rivers include the Wingecarribee River, Wollondilly River, Nattai River, Nepean River, Cox’s River, Shoalhaven River, Kangaroo River, Mongarlowe River, Tarlo River for the full length of each river as defined on topographic maps, and the Mulwaree River upstream as far as the Braidwood Road crossing). Constraints such as drainage depressions or farm dams will need to be identified during the site inspection as they are not identified using the SADT. Site inspections are also critical for confirming that watercourses identified using the SADT are not actually drainage depressions.</td>
</tr>
<tr>
<td>Road and access crossings.</td>
<td></td>
<td>Affects road and access placement and crossings: Aim to minimise the number of crossings. Avoid eroded or gullied areas for crossings (may be able to rehabilitate). Minimise impacts on riparian corridor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing erosion (gullyng).</td>
<td></td>
<td>Potential rehabilitation or stabilisation opportunity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riparian corridors.</td>
<td></td>
<td>Existing riparian vegetation should be preserved. Identify potential opportunities for planting riparian vegetation and/or fencing riparian corridors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope (Figure 2-3)</td>
<td>SADT plus site inspection</td>
<td>Site confirmation required – areas that can be easily developed, road and access location, dwelling sites, effluent management area (EMA) sites.</td>
<td>Influences the location and design of the development; special stormwater management measures may be required; type of wastewater effluent management system.</td>
<td>&lt;15% (8.5°; shown as white)&lt;br&gt;15 - 20% (8.5°-11.4°; shown as pale yellow)&lt;br&gt;20% (&gt;11.4°; shown as dark yellow)</td>
</tr>
<tr>
<td>Constraint to assess</td>
<td>Methodology for assessment</td>
<td>Parameters of the assessment</td>
<td>Potential impact on subdivision design</td>
<td>Thresholds and comments</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------</td>
<td>-----------------------------</td>
<td>----------------------------------------</td>
<td>-------------------------</td>
</tr>
</tbody>
</table>
| Soil depth (Figure 2-4) | SADT plus site inspection | Assess each house site. Determine depth to rock, medium or heavy clay, or to a limiting layer (eg hardpan). | Influences the selection of wastewater management system and effluent management area. Refer to the ‘Silver Book’ and section 2.3.3 for further information. | >0.9 m (shown as white)  
0.75-0.9 m (shown as dark green)  
0.4-0.75 m (shown as olive green)  
0.25-0.4 m (shown as fluorescent green)  
<0.25 m (shown as pale green) | Low constraint  
Low – moderate constraint  
Moderate constraint  
Moderate to high constraint  
High constraint |
<p>|                      |                           | Assess soil depth at potential locations for water cycle management measures (eg infiltration pits, swales or bioretention systems). | Shallow soils or clayey soils might not permit installation and/or effective operation of effluent management systems that rely on infiltration. | |
|                      |                           | Installation of underground services. | Extensive rock outcrop or shallow soils might affect the cost or viability of installing underground services. | |
| Dispersive soils (Figure 2-5) | SADT plus site inspection | Assess potential sites where construction may occur. In areas where the soils are dispersive, that part of the site is said to be highly constrained and development should be avoided. | Dispersive soils may be considered to be a constraint during their exposure and subsequent management, such as during construction works, as they become an issue for erosion and sediment control (may require the preparation of a Soil and Water Management Plan (SWMP)). The presence of dispersive soils highlights the need for Type D | |</p>
<table>
<thead>
<tr>
<th>Constraint to assess</th>
<th>Methodology for assessment</th>
<th>Parameters of the assessment</th>
<th>Potential impact on subdivision design</th>
<th>Thresholds and comments</th>
</tr>
</thead>
</table>
| Permeability (Figure 2-6) | SADT plus site inspection | Assess all sites during site inspection for permeable soils, especially to confirm permeability when it is shown to be mapped on site via the SADT. | Influences the location and type of wastewater EMAs. | <100 mm/day (shown as pink)  
>2500 mm/day (shown as red)  
High constraint area (for location of EMAs).  
High constraint area (for location of EMAs). |
| Phosphorus (P) sorption (Figure 2-7) | SADT plus site inspection | Assess all sites during site inspection for soils with low phosphorus sorption capacity eg sandy, granitic, etc, especially to confirm when it is shown to be mapped on the site via the SADT. | Influences the location and type of wastewater EMAs as soils with low phosphorus sorption have a reduced ability to remove phosphorus. | >100 mg/kg (shown as white)  
<100 mg/kg (shown as pale blue)  
Low constraint area (for location of EMAs).  
High constraint area (for location of EMAs). |
| Salinity (Figure 2-7) | SADT, aerial photos plus site inspection | Assess all sites during site inspection for saline soils, especially to confirm salinity when it is shown to be mapped on site via the SADT. | Saline soils kill or inhibit the growth of vegetation, resulting in exposed soil susceptible to erosion. | No salinity (shown as white)  
Widespread salinity (shown as purple)  
Low constraint area  
High constraint area |
<table>
<thead>
<tr>
<th>Constraint to assess</th>
<th>Methodology for assessment</th>
<th>Parameters of the assessment</th>
<th>Potential impact on subdivision design</th>
<th>Thresholds and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation (Figure 2-8)</td>
<td>SADT, aerial photos plus site inspection</td>
<td>Assess all sites during site inspection for vegetation, especially to confirm remnant vegetation when it is shown to be mapped on site via the SADT.</td>
<td>The clearing of vegetation should be minimised to avoid exposing soils that may be susceptible to erosion. Clearing of vegetation should also be avoided on steep slopes and areas that could be groundwater recharge areas, such as rocky hilltops and ridge lines. Vegetated areas may have to be fenced off to ensure that the vegetation is protected from livestock.</td>
<td>Remnant vegetation 85-100% (shown as dark green) Semi-cleared 35-85% (shown as yellow-green) Essentially cleared 0-35% (shown as white)</td>
</tr>
</tbody>
</table>
2.2.4 Examples of mapped constraints using the Site Analysis and Design Tool

Watercourses and drainage depressions

The aerial photograph in Figure 2-1 already identified watercourses bounding and within the property. Figure 2-2 maps these watercourses, their tributaries and the required buffers. Although a 150 m buffer is included in the data layer, it does not appear on the watercourse constraint map for this case study, as no named rivers occur in or near the property. A field inspection is required to clarify the location of all watercourses and drainage depressions.

![Site Analysis and Design Tool](image)

Figure 2-2  Watercourse constraint mapping for proposed subdivision – drainage depressions and farm dams need to be identified through a site inspection.
Slope

Overlaying contours on the aerial photograph (Figure 2-1) reveals that parts of the property have a slope of more than 20%. This is confirmed by mapping the slope layer in the SADT (Figure 2-3). Steep slopes represent a constraint to development as they require more cut and fill which increases erosion risk. Effluent plumes may also travel further on steeper slopes. Slopes over 18° (32%) may also be State Protected Lands.

Figure 2-3  Site location and slope constraints of 15-20% (pale yellow) and greater than 20% (dark yellow).
Soil Characteristics

a. Soil Depth

Data obtained from the SADT (Figure 2-4) shows that the site may have areas of shallow soil (0.25-0.4 m) – these areas may be unsuitable for on-site wastewater management systems, or at least influence the type of wastewater management system that can be used.

Figure 2-4  Soil depth constraint mapping for proposed subdivision – darker green represents deeper soils.
b. Dispersive soil

Data obtained from the SADT (Figure 2-5) shows that the site may have areas of dispersive soil. The presence of dispersive soils should be confirmed through a site inspection and professional soil testing to determine if the area is able to be safely incorporated into the subdivision design. When dispersive soils become wet, the clay particles are forced apart; dispersive soils have a high susceptibility to erosion and typically have low permeability.

Figure 2-5 Dispersive soils constraint mapping.
c. Soil permeability

Data obtained from the SADT (Figure 2-6) shows that the property may have areas of high soil permeability ($K_{sat} > 2,500$ mm/day). These areas may be unsuitable for on-site wastewater management systems, and influence the location of effluent management areas (EMA).

Figure 2-6  Permeability – red represents possible areas of high permeability, and pink represents areas of low permeability. Low permeability soils are not indicated on this site.
d. Soil phosphorus sorption and salinity

Data obtained from the SADT (Figure 2-7) shows that there is no known risk of phosphorus sorption or salinity on the property. Mean annual rainfall (>1,500 millimetres) has also been indicated on this figure.

Figure 2-7 Phosphorus sorption and salinity - these constraints were not evident at this site.
Vegetation Cover

Data from the SADT (Figure 2-8) shows that there are areas of vegetation cover between 85 and 100%, which represents a high constraint for development due to the amount of clearing that would be required. Areas of 35-85% vegetation cover represent a moderate constraint.

2.2.5 Constraint overlay map

A constraint overlay map involves mapping all constraints and overlaying these constraints on one image, to illustrate areas on the site that are least constrained. These ‘white’ areas become potential building sites and locations for roads and driveways in the design stage, which can be confirmed during the site inspection. It should be noted, however, poor land management practices can lead to adverse water quality impacts, even on relatively unconstrained potential building sites.

A sieve analysis was undertaken by overlaying constraint maps onto one image (Figure 2-9) to identify areas on the site with minimal constraints. The analysis shows that the majority of the site is constrained necessitating care in the design of the subdivision. Special construction and water sensitive design measures would need to be implemented.
Using the SADT (or other similar tools) allows various layers to be turned on or off to gain a comprehensive understanding of the overall site constraints. This information, coupled with data gathered during the desktop review and site inspection, will provide direction as to the subdivision design and layout. If the site is overly constrained it may be unsuitable for development.

2.3 Site Inspection

The purpose of the site inspection is to verify the information gathered in the desktop review, constraint mapping exercise and any other sources (eg soil landscape mapping), as well as to identify any additional issues existing on the site that may not have been identified using the ArcReader tool. Any additional site characteristics and features identified during the site inspection should be noted and taken into account in the design. **Applicants are not to rely on desktop review only and must demonstrate a detailed site inspection and investigation has been undertaken.**

It should be noted that assessment of a proposal will be carried out using the information in the database unless it has been demonstrated through a site inspection and/or testing (eg soil depth) that the conditions on the site are different than indicated by the SADT.
2.3.1 Identification of watercourses, drainage depressions and waterbodies

Visually inspecting the site will verify the existence of watercourses, drainage depressions and waterbodies. To assist with identification, the following definitions are given in the ‘Neutral or Beneficial Effect on Water Quality Assessment Guideline 2011’.

**Drainage depression**: A low point that carries water during rainfall events, but dries out quickly once rainfall has ceased. Note that once it becomes incised or contains a gully it is considered to constitute a watercourse.

**Watercourse**: means any river, creek, stream or chain of ponds, whether artificially modified or not, in which water usually flows, either continuously or intermittently, in a defined bed or channel, but does not include a waterbody (artificial).

**Waterbody (artificial)**: An artificial body of water, including any constructed waterway, canal, inlet, bay, channel, dam, pond, lake or artificial wetland, but does not include a dry detention basin or other stormwater management construction that is only intended to hold water intermittently.

**Waterbody (natural)**: A natural body of water, whether perennial or intermittent, fresh, brackish or saline, the course of which may have been artificially modified or diverted onto a new course, and includes a river, creek, stream, lake, lagoon, natural wetland, estuary, bay, inlet or tidal waters (including the sea).

While some drainage depressions and watercourses are easy to identify, others may be more difficult and may only be determined by assessment of the nature of the surrounding landform (Figures 2-10 to 2-13). For example, the larger the catchment the more likely the drainage feature should be considered as a watercourse rather than a drainage depression. Advice from the SCA may be necessary to correctly classify the drainage feature.
Figure 2-10 Drainage depression

Figure 2-11 Drainage depression
Figure 2-12  A watercourse with a defined channel - an eroding watercourse can contribute large amounts of sediment to the waterway and degrade water quality

Figure 2-13  A dry incised watercourse with no active erosion
2.3.2 Slope

The site inspection should confirm the desktop analysis, especially for areas with slopes over 15%. If it is confirmed that these areas do have slopes in excess of 15% then construction should be avoided if possible. If construction (eg roads and house sites) must occur in areas of slopes over 15%, then the methods to be used to prevent erosion occurring in the short and long term should be described. Methods to ensure sustainable effluent management should also be detailed. Note: slopes over 32% may be State Protected Lands.

2.3.3 Soils

Where the desktop review has indicated that shallow, dispersive, low or high permeability soils, low phosphorus sorption soils or salinity (Figure 2-14) may exist on the site, field investigations should be conducted to verify this information. This will involve on-site soil depth testing as well as laboratory testing to verify the nature of the soil chemistry for later input into detailed design parameters. Outcomes from this assessment should inform the soil and water management plan, on-site effluent management and water sensitive design.

Figure 2-14  Saline scald – scalds such as this one develop when the drainage is impeded by the track around its perimeter, forcing a rise in the groundwater and the salt to come to the surface.

Soil depth will also be a critical element. Grass and vegetation cover may give the appearance of good deep soils and grass cover can often mask shallow rock outcrops, which may make the site not suitable for on-site effluent disposal (Figures 2-15 and 2-16).
Figure 2-15  Shallow soils with basement rock outcropping – this area in the foreground is not suitable for effluent disposal

Figure 2-16  Karst outcropping – this area is not suitable for effluent disposal
2.3.4 Vegetation

The assessment of vegetation requires a comprehensive analysis of all vegetation on the site, including grasses and shrubs, not just the presence of trees. This is to ensure that the water quality benefits of various vegetation types, including swamps, bushes and grasslands are considered. From a water quality perspective, the type of vegetation and the amount of groundcover is the most significant factor. It is generally accepted that groundcover of less than 70% will result in significantly increased susceptibility to sheet erosion and potential water quality impacts (Costin, 1980 and DPI, 2005). It is therefore recommended to retain at least 70% groundcover across a site. Vegetation should also be protected in areas that may be groundwater recharge areas, such as rocky hilltops and ridge lines.

It should be noted that the SCA does not support:
- the clearing of vegetation on steep land or other environmentally sensitive locations such as eroding areas or swamps for the purposes of boundary fencing, or
- the clearing of vegetation in saline aquifer recharge areas.

Subdivisions should be designed so as to minimise clearing of native vegetation, with building sites located in areas that are already cleared wherever possible. Where building sites are proposed in areas of native vegetation, note the requirements of council, the Native Vegetation Conservation Act 2003, the Threatened Species Conservation Act 1995, the Environment Protection and Biodiversity Conservation Act 1999, the Environmental Planning and Assessment Act 1979 and ‘Planning for Bushfire Protection 2006’ (RFS, 2006).

An Assessment of Significance under the Environmental Planning and Assessment Act 1979 (for threatened flora and fauna species) may be required as part of the development application where there is a potential for a scheduled species and/or endangered ecological communities to occur on the site and be impacted by the proposed development. This is normally included in a broad flora and fauna assessment at the DA stage. This Assessment can also be used during the site inspection to ground-truth the vegetation detected from aerial photographs.

It is also likely that a bushfire risk assessment will need to be undertaken for all land to be subdivided (out to a distance of 140 m from the boundaries of the property) that has bushland on or adjoining the area of the proposed development. While this is not a water quality issue, the management (through clearing) of the vegetation for bushfire protection can have a significant effect on water quality. As such, it is imperative that a comprehensive approach to the assessment of vegetation is undertaken, to ensure all legislation is considered.

2.3.5 Existing Degradation

Any large areas of land degradation detected in aerial photos should be inspected on-site to determine the actual type, extent and severity (Figure 2-17). The remainder of the site should also be examined for any other instances of land degradation not identified using aerial photography, and any constraints this places on the subdivision should be mapped.

Information on the extent of the degradation through delineation on the constraints map should be provided with the site analysis. If possible, the extent to which there are
pollutants generated by the degraded land should be determined for use later in the NorBE test.

Areas of land degradation (eg Figure 2-18) should be rehabilitated as part of the subdivision to prevent sediments from reaching watercourses, and to prevent further land degradation. The requirement for rehabilitation may constrain lot layout and road placement, as well as building sites and effluent management areas, because any activity that may exacerbate land degradation, including erosion, should be avoided.

Any areas requiring rehabilitation or remediation can provide an opportunity to offset any water quality impacts of the development, thereby helping to achieve a neutral or beneficial effect on water quality.

Applicants and developers are advised that the intentional degradation of land (assessed on a case-by-case basis), prior to the lodgement of a development application, may be a breach of one or more Acts, which may expose the applicant or developer to prosecution for a civil and/or criminal offence.

Figure 2-17   Badly eroded gully areas such as this may be detected on aerial photographs and confirmed via site inspection. Degraded areas present an opportunity for rehabilitation or stabilisation. Roads should not cross such degraded areas and stormwater should not be directed into degraded areas.

Where the site, or areas of the site, has been denuded of pasture or vegetation due to overstocking, drought, etc, these areas should be identified. Consideration should be given to means of rehabilitating these areas to minimise the increased erosion hazard.
Figure 2-18  Site analysis issues identified by the site inspection, including opportunities for rehabilitation.
2.3.6 Existing Infrastructure

The location of any existing infrastructure, including, but not limited to dwellings, farm buildings, access to the site, roads and tracks on the site, existing erosion control features or works, existing waste management measures, and the condition of each should be determined. These may influence the subdivision layout in the design stage.

Existing infrastructure may also be incorporated into a design as a feature of the development (Figure 2-19).

![Figure 2-19](image)

Figure 2-19 This existing access-way would be an asset to a subdivision because of its satisfactory cross fall and grassed drainage swale.

2.4 Checklist

At the conclusion of the desktop review, constraint mapping and site inspection, it is advisable to complete the checklist to ensure all relevant constraints, opportunities and issues have been identified. Table 2-3 below shows a completed checklist for the hypothetical case study.
### Table 2-3 Checklist

<table>
<thead>
<tr>
<th>Issue</th>
<th>Checked (Y/N)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desk top review complete</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Watercourses</td>
<td>Y</td>
<td>Present</td>
</tr>
<tr>
<td>Contours</td>
<td>Y</td>
<td>Indicate possibility of steep slopes</td>
</tr>
<tr>
<td>Slope class</td>
<td>Y</td>
<td>15-20% and &gt;20%</td>
</tr>
<tr>
<td>Rainfall erosivity</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Dispersive soil</td>
<td>Y</td>
<td>Present</td>
</tr>
<tr>
<td>Salinity</td>
<td>Y</td>
<td>None present</td>
</tr>
<tr>
<td>Soil permeability</td>
<td>Y</td>
<td>High permeability indicated</td>
</tr>
<tr>
<td>Soil phosphorus sorption</td>
<td>Y</td>
<td>None indicated</td>
</tr>
<tr>
<td>Soil depth</td>
<td>Y</td>
<td>Shallow soils &gt;0.25 m indicated</td>
</tr>
<tr>
<td>Aerial photography</td>
<td>Y</td>
<td>Available</td>
</tr>
<tr>
<td>Flood levels</td>
<td>Y</td>
<td>N/A</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Y</td>
<td>Heavily vegetated in some areas</td>
</tr>
<tr>
<td>Bushfire prone land</td>
<td>Y</td>
<td>Category 1</td>
</tr>
<tr>
<td>Potential degradation</td>
<td>Y</td>
<td>None</td>
</tr>
<tr>
<td>Access points</td>
<td>Y</td>
<td>Existing</td>
</tr>
<tr>
<td>Bores</td>
<td>Y</td>
<td>None</td>
</tr>
<tr>
<td>Contaminated land</td>
<td>Y</td>
<td>None</td>
</tr>
<tr>
<td>Other issues?</td>
<td>Y</td>
<td>None</td>
</tr>
</tbody>
</table>

### Site inspection completed

**Date:** 15/7/2010

- Watercourses
  - Drainage depressions: Y, None present
  - Watercourse: Y, Present as mapped in desktop review
- Contours: Y
- Slope class confirmed: Y
- Rainfall erosivity: Y
- Dispersive soil: Y, Present
- Salinity: Y, None present
- Soil permeability: Y, High permeability indicated
- Soil phosphorus sorption: Y, None found
- Soil depth: Y, Shallow soils found
- Vegetation
  - 7-Part test undertaken: Y
- Bushfire risk assessment: Y
- Existing degradation (GPS identification of area): Y, None found, as per desktop review
- Existing infrastructure: Y
- Preferred access points: Y, Noted
- Bores: Y, None
- Contaminated land: Y, None
- Other identified: Y, Nothing

**All constraints mapped** Y
CHAPTER 3

SUBDIVISION DESIGN
3 SUBDIVISION DESIGN

3.1 Introduction

This section explains how to use the information gathered in the site analysis to inform the design of the subdivision, including possible/preferred building locations, location of effluent management areas, lot layout and configuration, and road and dwelling access placement.

A number of key principles are introduced in this section which will assist in the design, assessment and approval of a subdivision. Firstly, the design must reflect the site conditions and constraints. It is not acceptable to design a subdivision and then justify the design through a site analysis and statement of environmental effects. There must be a clear and concise relationship between the two.

A good subdivision design will:

1. locate potential dwelling sites with appropriate wastewater management areas in the most suitable locations
2. provide vehicular access which minimises watercourse and drainage depression crossings, cut and fill and vegetation removal
3. provide complying lot sizes with boundaries in locations appropriate to the site constraints (such as watercourse, slope and vegetation)
4. achieve a proposed design that has a neutral or beneficial effect on existing water quality

By its very nature, subdivision design is complex and involves a feedback process of assessing constraints, design options and potential impacts which may become constraints. Reference should be made to Appendix 2 of this Design Guide to gain an understanding of how a council and the SCA will be assessing the application. A clear understanding of the development assessment process should also inform the decision making steps in a subdivision design.

Particular emphasis is given to how the design responds to identified site constraints including (but not limited to) watercourses and watercourse crossings, steep slopes, vegetation and groundcover, stormwater management, existing erosion control works, nearby sensitive environments and soil conditions.

The design will also need to respond to other issues and constraints that are not directly related to the protection of water quality, including the presence of Aboriginal and European heritage, adjacent land uses, bushfire hazards, etc.

3.2 Identify potential building sites

Identification of building sites is the first step in the design process, with the road layout and subdivision pattern following. The number of permissible building sites is determined by the relevant local environmental plan and checking with council. Potential building sites are identified using the mapped constraints from the site analysis. Potential building sites should be large enough to accommodate a dwelling plus a nominal effluent management area of approximately 1,600 square metres (based on the maximum area requirements for larger five to six bedroom dwellings where soils are poor with regard to depth,
permeability or phosphorus sorption capacity. Very few residential dwellings have required larger areas and most dwellings require less but it ensures that the SCA does not have to put restrictions on the size of dwellings when land is subdivided. A number of councils require a similar area for on-site wastewater management).

It is preferable to identify building sites on areas that exclude constraints as much as possible ie the 'white' areas on the sieve analysis (Figure 3-1). This will usually result in a lower risk and a more straightforward design, assessment and approval process. If it is not possible to achieve building sites on land that is minimally constrained, then more constrained sites may need to be used. This will require more stringent design and construction measures, and may result in a more complicated approval process. If a potential lot is so constrained that there is only one building site available, then the depiction of a building envelope at this location may be required on the plan of subdivision.

It should be noted that some constraints are more critical than others and may limit the potential to build, even in the absence of other constraints. For example, a site may have no other constraints identified other than a soil depth of less than 0.25 m, which would severely limit the type of effluent management system that could be used.

Buildings should be sited to:

- retain and where practical, restore natural landforms, watercourses, native vegetation and other natural landscape features
- ensure that rural residential subdivision protects the biodiversity on the site by avoiding natural features and vegetated areas and where appropriate restores previously degraded habitat areas
- minimise disruption to land surfaces, natural drainage patterns and native vegetation
- incorporate existing soil and water management measures into the subdivision design.

Another important consideration is the orientation of allotments. North facing slopes are better for effluent disposal because the solar access maximises evapo-transpiration, as well as providing solar access for the dwelling. The direction of the prevailing wind should also be considered, as wind increases evaporation.

The requirement to provide asset protection zones (APZs) between buildings and a bushfire hazard is potentially in conflict with the need to preserve vegetation for water quality benefits, as well as ecological reasons. The best way to avoid this is to place building sites in areas that are already cleared, and that will not need further clearing for APZ purposes.

This can be achieved by undertaking a preliminary bushfire assessment for the property. The vegetation for 140 m in all directions from the boundaries of the site should be examined in accordance with ‘Planning for Bushfire Protection 2006’ (RFS, 2006).

**Case Study**

The hypothetical case study continues from Chapter 2 using the property and constraint mapping in Figure 2-9. Note that the SADT only includes the constraint mapping discussed in Chapter 2, and does not include any tool for adding potential or existing building sites or lot boundaries.
The maximum potential lot yield for this 43 hectare property under the relevant LEP is four lots, including the two existing residences. Figure 3-1 shows three new potential building sites in minimally constrained areas – one potential building site will need to be removed when the vehicular access and lot boundaries are designed (see Sections 3.4 and 3.5 below).

![Figure 3-1](image)

**Figure 3-1** Identify possible minimally constrained building sites (note: the rectangles to the south identify the existing dwellings, the squares identify potential building sites). Note the requirement for a 100m buffer from the watercourses.

### 3.3 Determine wastewater management system and location

Due to the relatively remote location of many subdivisions wastewater management will generally be provided through on-site wastewater management systems. The type of system, location within the site and ongoing management are all important considerations in the subdivision design.

Once potential building sites have been identified, the next step is to determine whether adjacent areas are suitable for effluent disposal. At the subdivision design stage, a determination of wastewater management systems that are unsuitable due to site and soil constraints should be made. These constraints could include lack of an appropriately sized area for effluent disposal, insufficient distance from waterways, steep gradient, unsuitable soil type and insufficient soil depth. A wastewater report is necessary to establish the suitability of the wastewater disposal area, determine the area needed for disposal and the most suitable management system to use.
General objectives

- Ensure that all wastewater generated within the rural residential subdivision is managed on-site and does not contribute to water quality pollution by allocating suitable areas for wastewater (including greywater) management.

- Consider soil and landscape constraints when determining whether a site is suitable for on-site wastewater disposal, including permeability constraints, phosphorus sorption capacity, salinity, dispersive soils, sodicity, slope constraints, land degradation, soil depth and watercourse buffers (see Table 3-1).

- On constrained sites, an effluent management envelope of 1,600 square metres may be required to be defined on the plan of subdivision and a restrictive covenant placed on the Title for the lot (on larger and less constrained lots, it is assumed that a specific effluent management area (EMA) can be determined at the subsequent dwelling application stage). Small or heavily constrained lots may require covenants specifying a small ‘footprint’ EMA, and specific location. The aim is to ensure that each proposed lot has a suitable and adequate area for on-site effluent management for the soil conditions.

- Every lot will require an individual soil assessment and sample unless the location of any adjacent EMA is within 100 m. If the soil sample indicates that certain on-site management methods are not suitable, this should be identified in the water cycle management study.

- The wastewater effluent model (WEM) is used by the SCA to assess whether a neutral or beneficial effect on water quality has been achieved from a wastewater management perspective. The WEM is a GIS-based, effluent plume generation modelling tool designed to support the design of on-site wastewater systems. The WEM assessment considers such constraints as slope, permeability, phosphorus sorption, rainfall, soil depth and proposed area for wastewater effluent management. More information can be found in the NorBE Assessment Guideline (SCA, 2011a).

- If the potential building envelope is assessed to be unsuitable for any on-site wastewater disposal, then that particular site should no longer be considered as a building envelope.

The SCA generally requires an EMA of 1,600 square metres to be identified on each lot. In addition, a building envelope of notionally 45 m x 45 m is required reflecting a typical curtilage area around a rural dwelling (excluding the EMA).

All potential building sites and associated EMAs have been located outside the appropriate buffer distance from watercourses and drainage depressions, the locations of which were confirmed during the site inspection.

Relevant current recommended practices and other references

The CRPs endorsed by the SCA that should be incorporated into the design planning, design, construction and maintenance of on-site wastewater management systems may include:

Application to rural residential subdivisions design

The site constraints presented in Table 3-1 need to be considered and the suggested conditions adopted. If they are not to be adopted the proposal should be referred to the SCA for site specific discussions before lodgement of the development application. The listed constraints are utilised in the NorBE Assessment Tool used by councils during assessment of the proposal (see also SCA, 2011a).

Figure 3-3 presents an illustration of sustainable wastewater management on a rural residential lot.

Table 3-1 Site constraints and considerations for on-site wastewater management

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope of EMA is greater than five percent (more cut and fill is required, which may expose unsuitable soil profiles for absorption areas around mound systems, increasing the risk of failure).</td>
<td>Some mound systems may be suitable, however amended soil mounds are generally not suitable unless specifically designed for the site, and an alternative system may need to be used for effluent disposal.</td>
</tr>
<tr>
<td>Slopes of EMA greater than 20% (11.4°; excess cut and fill is required and the effluent plume would travel greater distances).</td>
<td>Relocate EMAs to avoid this site constraint.</td>
</tr>
<tr>
<td>The soil permeability (Ksat) for the EMAs on any of the lots is less than 100 or greater than 2500 mm/d (causes excessive runoff or waterlogging and percolation).</td>
<td>Relocate EMAs to avoid this site constraint.</td>
</tr>
<tr>
<td>The phosphorus sorption (Psorp) of the soil for the EMAs on any of the lots is less than 100 mg/kg (renders the soil unable to immobilise any excess phosphorus).</td>
<td>Relocate EMAs to avoid this site constraint, or consider an amended soil mound.</td>
</tr>
<tr>
<td>There are any sodicity, salinity or dispersion characteristics of the soil as identified in the ‘Silver Book’ that pose constraints for effluent disposal on any of the lots (inhibits plant growth, may cause structural degradation).</td>
<td>Relocate EMAs to avoid this site constraint.</td>
</tr>
<tr>
<td>The soil depth for the EMAs on any of the lots is less than 0.25 m (reduced capacity to filter nutrients and pathogens, restricts plant growth).</td>
<td>Relocate EMAs to avoid this site constraint – specific design considerations eg the use of mounds, may be required if relocation is not possible.</td>
</tr>
<tr>
<td>The soil depth is between 0.4 and 0.9 m or the soil type is medium or heavy clay within that depth range for any of the lots (reduced capacity to filter nutrients and pathogens, waterlogging, excessive runoff).</td>
<td>Absorption systems (trenches or beds) are not suitable for this location and an alternate system may need to be used for effluent disposal.</td>
</tr>
<tr>
<td>Constraint</td>
<td>Condition</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>The soil depth is between 0.4 and 0.75 m or the soil type is sand or sandy</td>
<td>ETA systems are not suitable for that location and an alternate system may</td>
</tr>
<tr>
<td>loam within that depth range for any of the lots.</td>
<td>need to be used for effluent disposal.</td>
</tr>
<tr>
<td>Drinking water bores within 100 m of the EMA (groundwater becomes</td>
<td>Ensure EMA does not overlay the bore drawdown zone for the bore.</td>
</tr>
<tr>
<td>vulnerable to contamination).</td>
<td></td>
</tr>
<tr>
<td>The proposed EMA for any lot is within 40 m of a drainage depression or</td>
<td>Relocate EMAs to avoid this site constraint.</td>
</tr>
<tr>
<td>waterbody (including farm dams) or wet areas (swamps, groundwater</td>
<td></td>
</tr>
<tr>
<td>discharge) – to prevent effluent entering the waterbody or wet area.</td>
<td></td>
</tr>
<tr>
<td>The proposed EMA for any lot is within 100 metres* of a watercourse, and/</td>
<td>Relocate EMAs to avoid this site constraint.</td>
</tr>
<tr>
<td>or located on river flats and/or located on a 1:100 flood zone or those</td>
<td></td>
</tr>
<tr>
<td>associated with watercourses and drainage easements (to prevent effluent</td>
<td></td>
</tr>
<tr>
<td>entering a watercourse).</td>
<td></td>
</tr>
<tr>
<td>The proposed EMA for any lot is within 150 metres* of the bank of a named</td>
<td>Relocate EMAs to avoid this site constraint.</td>
</tr>
<tr>
<td>river or water supply reservoir (to prevent effluent entering a named</td>
<td></td>
</tr>
<tr>
<td>river).</td>
<td></td>
</tr>
<tr>
<td>Other site characteristics that may pose constraints for the EMAs for any</td>
<td>Relocate EMAs to avoid this site constraint.</td>
</tr>
<tr>
<td>of the lots – eg vegetation, aspect, current use, infrastructure (</td>
<td></td>
</tr>
<tr>
<td>proposed or existing, including roads, soil conservation works), etc (uses</td>
<td></td>
</tr>
<tr>
<td>not compatible with disposal of effluent).</td>
<td></td>
</tr>
<tr>
<td>Availability of electricity.</td>
<td>Can affect the choice of system and disposal method.</td>
</tr>
</tbody>
</table>

* Note: the SCA’s buffer distance requirements are more stringent than those in the ‘Silver Book’.
Effluent Management Area – Absorption Trench

The soil profile, slope and sewerage system criteria are all factors that will influence the size and implementation of the EMA. These are to be installed strictly in accordance with the supplier’s recommendation specific to the site conditions.

Principles

- Install diversion drain and bund to upper slope to control and redirect overland flow.
- Fence the EMA and where practical integrate with boundary fences.
- Good solar access to assist evaporation.
- Bury the effluent distribution pipe from the tank to the EMA at a minimum depth of 300 mm in a manner that provides protection against mechanical damage or deformation.
3.4 Locate roads and access ways

Once suitable building sites and EMAs have been determined, the subdivision configuration can be determined, including lot layout and access.

This Design Guide is specifically applicable to low volume roads associated with rural residential subdivisions, expected to experience average daily traffic of approximately 60 vehicle movements (based on seven vehicle movements per lot per day on a nine lot rural subdivision (RTA, 2002). As internal access roads, they will have to incorporate lower design speeds to accommodate in-road drainage structures such as dips, crests, construction in cross slopes and cross drains.

Rural roads with average daily traffic higher than 60 vehicle movements per day and arterial rural roads should be designed according to local council specifications and the ‘Blue Book’ Vol.2C ‘Unsealed Roads’ (DECC, 2008). However, some of the environmental oriented principles and design guidance from this Design Guide can be adopted provided that the other road design guidelines are met such as safety, road gradient, design speed and driving needs.

There is considerable scope for planning roads within rural residential subdivisions that have a low impact on the water quality and the environment by suitably locating and designing them as low formation roads with minimal disruption to the natural surface hydrology of the site. Low formation roads have the reduced level of the road surface typically a maximum of 300 mm above the natural surface level, while high or standard formations have a reduced level of the road surface of up to one metre or more above the natural surface level. Access ways should be constructed using compacted road base.

Lot access and roads should be designed to have a minimal impact on watercourses, including the maintenance of natural environmental and hydrological regimes, existing surface and groundwater flows and natural flood regimes, as well as mimicking natural drainage pathways and flow concentrations.

To avoid undue disturbance to soil and landscape, roads and access ways should also be located so as to minimise cut and fill, vegetation clearing, and length. Duplicating access ways adjacent to each other, as illustrated in Figure 3-3, causes unnecessary disturbance and a single access way should be planned at the design stage. There are, however, a number of issues and council requirements to be considered if combining access to a number of properties over a single access using a ‘right of way’ (or similar), such as maintenance and management, as such arrangements can cause conflict between users.
Existing well-designed roads and access tracks should be used where possible in order to minimise potential impacts on water quality, ecological integrity and other values resulting from clearing. Occasionally it may be necessary to construct new roads or tracks, or to realign or extend existing access ways, although a new road may cause more disturbances to the soil during construction. Sometimes an existing road may not be well placed in terms of other constraints or access to proposed development sites.

Other considerations regarding the location of roads and access ways include:

- Areas of very high and extreme soil erodibility should be avoided.
- The number of watercourse crossings should be minimised (if not eliminated) and adequate design principles incorporated.
- Roads constructed on ridges and spurs (Figure 3-4) are generally preferred as they require minimal earthmoving, are simple to drain and have less run-off. Where roads follow ridges, energy dissipaters must be used to reduce the velocity of water flowing down gutters and swales, depending on slope.
- Roads should not be located immediately adjacent to natural watercourses and waterbodies, such as in Figure 3-5 (note buffer thresholds). Sufficient vegetation, especially grasses, should exist between the road and watercourses to act as a sediment filter.
- Natural drainage paths should not be used as roadways.
- Avoid flat areas that could be subject to water logging or ponding of water.
This ridge-line road required little cut and fill, and frequent turnout drains (two in the space of 30 m) divert stormwater to prevent erosion (NB: it is too steep for swales).

Construction of this road required large amounts of cut and fill, and is too close to the waterway.
Grades

Roads and access ways with gentler gradients will result in a reduced run-off velocity. Roads with grades exceeding 21% (12°) should be avoided, as effective erosion control becomes increasingly difficult on steep slopes. New alignments should be sought, on an acceptable grade, if the road provides an integral link in the road network.

Areas of steep side or cross slopes should be avoided. Specialist engineering advice is generally required over 21% (12°) to ensure that there is adequate stabilisation of the road and batters.

Armouring of road drainage will be required for:
- grades over eight percent (4.6°) on dispersible soils,
- 10% (5.7°) on non-dispersible soils.

Gravelling and sophisticated drainage measures are required for:
- grades greater than 27% (15°) on low erodibility soils
- grades greater than 21% (12°) on moderately erodible soils.

Unsealed roads should not be built on slopes exceeding 18% (10°) on highly erodible soils (the ‘Blue Book, Vol 2C, DECC, 2008).

Drainage

Any design of roads and access ways must allow for adequate right-of-way and road widths. Road widths should be capable of including road pavement and all associated drainage works. Where drainage measures and structures such as turn outs, mitres, culverts and erosion control structures are located within a private property, an easement or under covenant, controls should apply to ensure ongoing maintenance and protection of these measures and structures.

The location of turn out or mitre drains to dispose of stormwater from the surface of the road should be done with care. These structures should discharge stormwater as sheet flow onto stable discharge points and not onto bare soil or areas subject to erosion. The spacing between mitre drains should be sufficient to ensure that surface flow in the table drain or edge of road does not build up sufficient energy to cause erosion (Figure 3-6).
The maximum spacing of mitre drains is given in Table 3-2, and a reasonable approach to determine the spacing is:

$$300 \div \text{slope (expressed as a percentage)}$$

For example, a 20% slope would require $300 \div 20 = 15m$, resulting in a mitre drain every 15 m (SCA, 2008).

Table 3-2  Recommended maximum spacing for off-road drainage structures (DECC, 2008)

<table>
<thead>
<tr>
<th>Road grade</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 8°</td>
<td>70 to 90m</td>
<td>60 to 70m</td>
<td>20 to 30m</td>
</tr>
<tr>
<td>8°– 12°</td>
<td>60 to 70m</td>
<td>60 to 50m</td>
<td>*</td>
</tr>
<tr>
<td>12°– 16°</td>
<td>40 to 60m</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>16°– 18°</td>
<td>40 to 30m</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

* Indicates that tracks of the grade specified should not normally be constructed on these soil types. Cross-banks, combined with limiting or discouraging traffic access may, however, be the best available means of erosion control on existing roads of these grades. Where tracks are constructed on slopes exceeding 12°, only light and infrequent traffic should normally be permitted.

Avoid the concentration of runoff flows onto adjoining land. Where necessary, place rocks, sandbags, spreader swales/banks or other protective surface to dissipate energy or disperse flow and encourage growth of vegetation at the point of water outflow from...
culverts and drains. Erosion and sediment control measures must be designed and implemented before work starts on the project (see Section 3.9).

Drainage works should be located to avoid the need to remove natural vegetation. Locate borrow pits, sediment ponds and stockpile sites such that native vegetation will be subjected to no or minimal impact (including siting of access routes).

Subdivisions should be designed so as not to impede the flow of groundwater in areas prone to salinity. For example, any roads traversing potentially saline areas must not impede groundwater flow and may also require special or specific engineering considerations (see DIPNR, 2003 and Austroads, 2004).

For constrained sites (steep slopes greater than 20%, dispersive soils and very high erosion hazards based on soil loss classes, as defined in the ‘Blue Book’ (Landcom, 2004)), a range of linings can be considered for the drain to improve erosion resistance and/or reduce flow velocity. Dense stoloniferous grasses can act to increase the surface roughness, decrease the flow rate, increase the infiltration rate, and increase the surface strength of the table drain. Where grass cover cannot be maintained or is undesirable, crushed rock can be used in selected locations where scour could be a problem. If resistance to greater flows is required rock may be grouted together (Austroads, 2001).

Figure 3-7 illustrates a water sensitive rural road drainage design.

**Watercourse and drainage depression crossings**

As roads approach a watercourse or drainage depression crossing, proper road drainage is critical to avoid sedimentation in watercourses. Watercourse crossings must be designed, constructed and maintained to safely handle expected vehicle loads and minimize disturbance of watercourse banks, channels and, ultimately, aquatic organisms. Poorly located or constructed watercourse crossings may cause erosion to watercourse banks and beds. When planning crossings, factors such as the watercourse bed material, size, storm frequency, flow rates, intensity of use (permanent or temporary), and the passage of fish should all be considered.

Preferred crossing types for fish passage (NSW Fisheries, 1999) include (in order) bridges and tunnels, arch culverts, box culverts, low level crossings such as fords and causeways, and pipe culverts and pipe causeways (Figures 3-8 and 3-9).

OEH’s requirements under the *Water Management Act 2000* should also be taken into account when planning and designing watercourse crossings, especially with respect to the requirement for a Controlled Activity Approval for works within 40 m of a watercourse. More information regarding Controlled Activity Approvals can be found in Section 2.2.1 and Appendix 2 of this Design Guide. When designing watercourse crossings, the following should be considered:

- Road location design should try to minimise the number of creek crossings, since each crossing site has some impact on the environment.

- Soil stabilization practices should be used on exposed soil at watercourse crossings. Seed and mulch should be used, along with the installation of temporary sediment control structures, such as straw bales or silt fences, immediately following construction to minimise sediment entering the watercourse. These practices should be maintained until the soil is permanently stabilised. In some instances turfing may be appropriate or the application of non-erodible materials such as concrete, bricks or gabions.
Install watercourse crossing structures at right angles to the watercourse channel.

Limit construction activity in the water to periods of low or normal flow. Keep use of equipment in the watercourse to a minimum.

Construct a bridge or place fill directly over a culvert higher than the road approach to prevent surface runoff from draining onto the crossing structure and into the watercourse.

Divert road drainage into undisturbed vegetation, so that minimal stormwater drainage from the road directly enters the watercourse. This can be achieved by constructing turnout drains between 30 to 60 m from the watercourse, allowing the natural vegetation to filter out the sediment. If it is not possible to avoid road drainage directly entering a watercourse it is critical that where the drain crosses the bank of the watercourse appropriate stabilisation (including armouring) must be applied to prevent scouring.

Design the road so that low points are 30 to 60 m away from the watercourse, so that sediment laden stormwater is not discharged directly into the watercourse.

Stabilise approaches to bridge, culvert and ford crossings with aggregate or other suitable material to reduce sediment entering the watercourse.

All watercourse crossing structures should be sized to wholly contain peak flow from a 1 in 5 year ARI storm event and to withstand the peak flow from a 1 in 10 year ARI storm event.

Relevant current recommended practices

The CRPs endorsed by the SCA that should be incorporated into the design of roads and access ways, and associated drainage measures and watercourse crossings, include:

- ‘Road Runoff and Drainage: Environmental Impacts and Management Options: AP-R180’ (Austroads, 2001).
- ‘Guidelines for Treatment of Road Runoff from Road Infrastructure AP-R232/03’ (Austroads, 2003).

Additional references also include:

- ‘Environmental Best Practice for Outback Roads’ (ARRB, 2000).
Figure 3-7 Illustrations of rural subdivision vehicular access drainage designs
Figure 3-8  Water sensitive watercourse crossing designs
3.5 Determine lot layout and boundaries

Roads, watercourses and/or other constraints identified in the site analysis must be taken into account when simultaneously designing the lot layout and vehicular access around the potential building sites. The lot boundaries should be located to minimise the impact on sensitive areas (such as steep land or highly erosive soils) and existing vegetation by running boundaries through cleared areas, and taking the shortest distance through vegetated areas. Areas that require specific management measures (including structures) should, as much as possible be contained within one lot.

Proposed lot boundaries may need to be amended once it has been determined whether the wastewater generated will be able to be retained on each lot.

Case Study

(continued from Section 3.2)

Figures 3-10 and 3-11 show the proposed lot layout and placement of access ways using the existing roads on the property. In order to maintain a minimum allotment size of 10 hectares and minimise disturbance for vehicular access, it was necessary to reduce the number of potential new building sites from three to two by removing one of the potential building sites from the concept lot layout and move another.
Figure 3-10  Desktop analysis – potential lot and access layout over constraint mapping.

Figure 3-11  Desktop analysis – potential lot and access layout over aerial photograph.
When watercourses and drainage depressions exist on the site, the following design guidelines should be considered:

- A watercourse bank should not form the boundary between two allotments, as this can create conflict over who is responsible for watercourse maintenance.

- If possible, a lot should not be bisected by a watercourse so as to create large useable areas on each side of the watercourse. This creates a barrier for movement from one side of the property to another (requiring a crossing), especially if the watercourse has been fenced off for rehabilitation. A designated crossing point may have to be constructed.

- A possible solution is to design the lots that are adjacent to a watercourse to each include a buffer of 10 m or more to the watercourse while incorporating the watercourse into the other lots (Figure 3-21). If required, water for the stock on lots to the north can be provided through offline watering infrastructure and a suitable easement to ensure water supply. Consideration of buffers must be taken into account.

The purpose of this is to enable appropriate management of the watercourse without a boundary (i.e., fence) located in the middle of the watercourse, or 'give and take' fencing with numerous watercourse crossings. As a result the boundary will be easier to fence off, it is less likely that the fence will be washed away, and consistent management of the watercourse can be achieved. Fences should be located clear of the bed and banks of a watercourse. Such an approach will also reduce land management conflicts between both sides.

![Figure 3-21](image)

**Figure 3-21** Example of how to design a subdivision along a watercourse
3.6 Example of a large lot rural residential subdivision

The following section demonstrates the same process followed as for the 4 lot subdivision above, but applied to a more complex site in the drinking water catchment with a greater number of constraints.

Figure 3-12 shows an aerial photograph of the site identifying the property boundaries and topographic features. Watercourses bound the property to the north and west and a watercourse is also located within the property.

The property currently contains a number of access roads, watercourse crossings and an existing dwelling and outbuildings (Figures 3-13 and 3-14). The location of these will need to be considered in the subdivision design. The aerial photograph also reveals a potential area of land degradation (possibly a quarry), the extent of which should be confirmed with a site inspection.

The site is heavily vegetated in some areas, particularly on the hills away from the river flats. The subdivision design will need to aim to minimise vegetation clearing. The property has primarily been used for cattle grazing plus an orchard to the north-west of the existing dwellings. There are no cattle dips on site.

Figure 3-12  Aerial photograph showing the property boundaries and topographic features.
Figure 3-13  Aerial photograph showing the property’s northern access features.

Figure 3-14  Aerial photograph showing the property’s southern features.
Constraint mapping of the property (Figure 3-15) indicates that parts of the site have a slope of more than 20%, areas of shallow soil, areas of dispersive and high permeability soils, as well as areas of low phosphorus sorption. It also identifies a named river bounding the property to the north requiring a 150 m buffer.

In this example, the relevant local environmental plan allows for lots with a minimum size of 40 hectares. This property is 420 hectares; the maximum potential lot yield is therefore 10 lots, as illustrated in Figure 3-16 below. Note the larger rectangle near the western boundary identifies the existing dwelling and outbuildings, the smaller squares identify potential building sites.

Figures 3-17 and 3-18 show the proposed lot layout and placement of access ways using the existing roads on the property. In order to maintain a minimum allotment size of 40 hectares it was necessary to reduce the number of lots from 10 to 9 (including the existing dwelling), by removing one of the potential building sites to the south-east of the site from the concept lot layout.

![Constraint overlay map showing all constraints for this site.](image)

**Wastewater disposal**

There is one area on this site that is ‘minimally’ constrained with two potential building sites, located in the south-west quadrant of the lot. For the remaining potential building sites, the constraints that do exist can be addressed by the careful choice of wastewater disposal system. For example, the potential building site in Lot 7 in Figure 3-17 is in an area which the SADT indicates is constrained by soil depths between 0.4 and 0.75 m deep. This constraint, if confirmed by site inspection, means that evapotranspiration absorption beds cannot be used, especially if the soil is found to be sandy or a sandy loam, and another system will need to be chosen for wastewater effluent disposal.
Figure 3-16 Identify possible minimally constrained building sites.

All the building sites and associated effluent management areas have been located outside the appropriate buffer distance from named rivers, watercourses and drainage depressions, the locations of which were confirmed during the site inspection.

**Access**

Although it is not ideal that the existing road to the north is situated so close to the river, the construction of a new road would cause unnecessary soil disturbance. Using the existing road minimises cut and fill, and makes use of existing watercourse crossings. However, the existing watercourse crossings will need to be modified to minimise the localised erosion that is occurring. The existing road and crossings may also have to be upgraded to meet council requirements. This may mean that the existing locations are not suitable.

The main access road entering the site on the south-east boundary will need to be sealed to outside the property boundary as well as for its extent within the site.
Figure 3-17   Potential lot layout and access over constraint mapping.

Figure 3-18   Potential lot layout and access over aerial photography.
3.7 Poor subdivision design

Figures 3-19 and 3-20 illustrate an example of poor subdivision design for the same block of land used in the large lot rural subdivision example in Section 3.6 above. The subdivision has been designed with only maximum lot yield in mind (i.e. minimum lot size of 40 hectares according to the LEP; 10 lots for a 420 hectare site). In this case:

- the building sites for Lots 1, 3, 4, 5, 7, 8 and 10 are too close to a watercourse and may result in movement of effluent to the watercourse
- the building sites for Lots 3, 6 and 8 will require the construction of new watercourse crossings, causing soil disturbance and opportunity for erosion
- the building sites for Lots 3, 6, 7, 8, 9 and 10 are on land that is too steep (greater than 20% slope), and will require excess soil disturbance for development
- the building sites on Lots 4, 6, 8 and 9 are located where clearing will be necessary to allow development
- all building sites are on shallow soil (0.75 m or less) that poses a potential constraint to effluent disposal
- the building sites for Lots 2, 3, 6, 7, 8 and 10 are located on soil that is dispersive (coloured orange) that poses an erosion and sedimentation threat
- the building sites for Lots 1, 3, 4, 5 and 9 are located on soil that has limited phosphorus sorption capability (coloured pale blue) that poses a potential constraint to effluent disposal
- the building sites for Lots 1, 3, 4 and 5 are located on soil with poor permeability (coloured red) that pose a potential constraint to effluent disposal.

![Proposed subdivision designed for maximum lot yield.](image-url)
3.8 Locate stormwater management measures

Greater quantities and a broader variety of pollutants are generated through the replacement of vegetated ground by buildings, roads and other impervious surfaces during the process of rural residential subdivision (and the subsequent use of the land). Stormwater must be managed on-site to prevent these pollutants being washed into waterbodies and watercourses. This involves a number of management practices, including:

- responsive building siting, lot layout and vehicular access, which minimises disturbance or disruption to the natural landforms, watercourses, drainage patterns and native vegetation
- minimising and controlling erosion and sedimentation impacts from the proposed subdivision during the construction stage of the development. This is discussed in greater detail in Section 3.8
- remediation and/or protection of degraded environments within the subdivision site such as gully erosion, native vegetation, riparian zones, salinity affected areas and stock dip sites (see Section 3.10)
- adopting stormwater treatment measures to control and trap pollution in runoff before discharging outside the subdivision site. These include a number of measures such as grassed swales, constructed wetlands and ponds, rainwater tanks, filtration devices and others.
Any existing soil and water management measures on the site such as contour banks, flumes and sediment dams should be protected or restored to function as part of the stormwater management of the new subdivision.

Table 3-3 outlines the stormwater management measures that may be applicable for use in the design of a rural residential subdivision. Detailed guidance for planning, design, construction and maintenance of these stormwater management measures are provided in the CRPs listed against each management measure. The table also notes any design criteria that are specific to the use of the management measure in the drinking water catchment.

Information from the stormwater management measures design is to be incorporated into any required stormwater modelling. As a requirement for the assessment of a neutral or beneficial effect on water quality, MUSIC (Model for Urban Stormwater Improvement Conceptualisation) modelling data must be provided for all residential subdivision applications involving any of the following:

- four or more lots or
- where the impervious area exceeds 2,500 square metres or
- special cases (eg heavily constrained sites) or
- where more than 70% of the lot becomes impervious.

Figure 3-22 presents an illustration of water sensitive stormwater management in a rural residential subdivision.

### Table 3-3  Stormwater management measures for rural residential subdivision

<table>
<thead>
<tr>
<th>Water management measure</th>
<th>Relative applicability for rural residential subdivisions</th>
<th>Current recommended practice</th>
<th>Specific design criteria for use in the drinking water catchment</th>
</tr>
</thead>
<tbody>
<tr>
<td>(see Figure 3-23)</td>
<td></td>
<td>DLWC, 1998.</td>
<td>Site ponds to receive as much runoff as possible from developed areas (ie roads and house sites).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NSW EPA, 1997.</td>
<td>Note that a buffer of 40 m applies for siting EMAs near ponds.</td>
</tr>
<tr>
<td>Upgrading existing farm dams or new dams</td>
<td>High</td>
<td>Melbourne Water, 2005.</td>
<td>Locate dams to receive as much runoff as possible from developed areas (ie roads and house sites).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DLWC, 1998.</td>
<td>Note that a buffer of 40 m applies for siting EMAs near dams.</td>
</tr>
<tr>
<td>Grassed swales</td>
<td>High</td>
<td>Melbourne Water, 2005.</td>
<td>Integrate their location into the subdivision design – use along roads.</td>
</tr>
<tr>
<td>Water management measure</td>
<td>Relative applicability for rural residential subdivisions</td>
<td>Current recommended practice</td>
<td>Specific design criteria for use in the drinking water catchment</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------------------------------------</td>
<td>-------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Bioretention systems/rain gardens</td>
<td>High – would generally be constructed with dwelling unless lot was so constrained that there was only one dwelling site</td>
<td>Melbourne Water, 2005. NSW EPA, 1997. FAWB.</td>
<td>Located so as to capture excess roof runoff and runoff from developed areas</td>
</tr>
<tr>
<td>Sand filters</td>
<td>Low</td>
<td>N/A – generally only used in heavily urbanised and built-up areas. Not ideal for rural residential subdivisions.</td>
<td></td>
</tr>
<tr>
<td>Porous paving</td>
<td>Low</td>
<td>N/A – tangible benefit only where significant impervious surfaces occur (ie ‘high urban’). Not relevant for rural residential subdivisions.</td>
<td></td>
</tr>
</tbody>
</table>

**Additional references**
Figure 3-22 Water sensitive rural stormwater management in a rural residential subdivision

Box Culvert Drain
A prefabricated concrete culvert used to optimise water flow under roads.

Outlet Culvert
A pipe and head well associated with roads, cross drains and civil works to provide controlled drainage of water in low flow applications.

Grassed Swale
Used as conveyance and treatment systems for road runoff.

Constructed water quality ponds and wetlands
Good wetland design involves:
- having length to width ratio > 3:1
- locating the inlet & outlet at opposite ends
- using island and planting reeds along flow path
- incorporating variety of functional zones to optimise stormwater treatment

Figure 3-23  Good design principles for constructed wetland design
3.9 Identify erosion and sedimentation control measures

General

Construction and other land disturbance can lead to significant environmental harm when soil exposed by access and clearing is eroded and washed away. Valuable topsoil can be lost, reducing the potential for regeneration of vegetation. The movement of eroded material off the site can lead to pollution of downstream watercourses by sedimentation, increased turbidity and release of nutrients attached to the eroded soil particles. Degradation of water quality from the construction site can also occur due to poor management of stockpiles, waste storage areas and the construction site’s machinery.

Erosion and sediment control is also a key issue in the environmental management of rural roads, particularly when dealing with unsealed roads, as they represent a substantial area of unprotected soil by vegetation and are thus very susceptible to erosion.

Relevant current recommended practices and other references

All erosion and sediment control measures for rural residential subdivision should be designed according to the design guidance provided by the CRP ‘Managing Urban Stormwater: Soils and Construction Vol 1 4th ed.’ by Landcom, 2004 (the ‘Blue Book’).


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In a rural subdivision context, the majority of erosion and sedimentation impacts are associated with road works and building site construction.

- A conceptual erosion and sediment control plan (ESCP) should be included in the water cycle management study, with the aim of demonstrating that construction can take place without sediment leaving the site. A conceptual ESCP identifies the constraints regarding the control of soil erosion and pollution from sediments, outlines standard measures to be used during the construction stage and gives consideration as to whether a sediment basin is required.

- General erosion and sediment control documentation is required if the total disturbed area is calculated to be less than 2,500 square metres.

- Site constraints should be assessed at the concept design stage of the project and should drive the design solutions included in the conceptual Primary and Progressive ESCPs. Design development should be managed to integrate the engineering and soil and water management planning. Once engineering plans are finalised, integration can be very difficult to achieve.

- Where the proposed works are located in constrained areas of the site as determined in the Site Analysis stage of the rural residential design process, the following information should be presented as part of the conceptual Primary and Progressive ESCPs using a map at a scale of 1:10,000 or larger:
- Contours (two metre interval or closer on steep sites), site boundary, main roads, water courses and other significant features.
- Lithology or regolith features.
- Slope - a minimum of three classes between 0 and 30% gradient and meeting Soil Loss Class requirements.
- Landform element from Table 2.1 of the ‘Blue Book’.
- Soil type.
- Groundwater resources and aquifer recharge areas.
- The R- and K- factors from the RUSLE, Soil Loss Class and Soil Hydrologic Group (refer to the ‘Blue Book’).
- Identification of appropriate vegetation types for rehabilitation.
- Location of dispersive soils.

3.10 Identify rehabilitation opportunities

The SCA considers that if a site contains degraded areas that are affecting water quality, then they should be identified for rehabilitation as part of the subdivision application. In some cases it will be necessary to rehabilitate the degraded areas in order to achieve a neutral or beneficial effect on water quality. Table 3-4 lists the types of degraded areas where rehabilitation opportunities may exist as well as actions to address the issues.

<table>
<thead>
<tr>
<th>Degradation type</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet erosion</td>
<td>The removal of a fairly uniform layer of soil from the land surface by raindrop splash and/or runoff. No perceptible channels are formed.</td>
<td>Vegetation with suitable species, maintain vegetation cover, and prevent compaction by fencing area off from stock.</td>
</tr>
</tbody>
</table>
| Rill erosion (halfway between sheet and gully erosion) | The removal of soil by runoff from the land surface whereby numerous small channels, generally up to 30 cm deep, are formed. Typically occurs on recently disturbed soils. | Decrease flow velocity by
  • decreasing slope length, and/or
  • increasing roughness of surface.
Increase stability of surface by compaction, or use of paving or riprap. |
| Gully erosion          | A complex series of processes whereby the removal of soil is characterised by large incised channels in the landscape. Such channels are generally more than 30 cm in depth. The severity of gully erosion may be recorded as minor, moderate, severe or very severe. | Depending on the severity of the erosion there are a number of options –
Direct means:
  • fencing off the gully to prevent stock access
  • fencing off the gully and revegetating the full extent of the gully
  • reshaping the gully and surrounds to a more stable profile for gullies less than two metres deep, or
  • reshaping the gully and surrounds to a more stable profile (two to five metre gully and may require permanent structures like flumes), revegetating for the full extent and fencing off. |

Table 3-4 Types of degraded area and actions to address the issue
<table>
<thead>
<tr>
<th>Degradation type</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect means:</td>
<td></td>
<td>- Catchment works such as contour banks and revegetation.</td>
</tr>
<tr>
<td>Watercourse bank / bed erosion</td>
<td>The removal of soil by the direct action of water flow, and/or wind/wave action. Typically occurs during periods of high flow.</td>
<td>Determine the cause – it is better to address the cause of the problem than to repair an isolated section of channel bed or bank. There are a range of measures available, including revegetation, stabilisation and reforming ‘natural’ watercourse profile (pools and riffles). Hydraulic aspects of the watercourse need to be considered.</td>
</tr>
<tr>
<td>Mass movement</td>
<td>A general term encompassing erosion processes in which gravity is the primary force acting to dislodge and transport land surface materials.</td>
<td>Evidence of prior mass movement is the best indicator that it could happen again. Due to the amalgamation of a number of factors, determine cause or likely causes (eg overgrazing, removal of vegetation, subsoil). The best solution will depend on the causes.</td>
</tr>
<tr>
<td>Overgrazed paddocks</td>
<td></td>
<td>Obtain an agronomist’s report to determine stock carrying capacity.</td>
</tr>
<tr>
<td>Saline / salt scalds</td>
<td>A bare area produced by the removal of the surface soil by wind and/or water erosion, and the subsequent exposure of the more clayey subsoil that is, or becomes, relatively impermeable to water.</td>
<td>Salinity is due to either rising groundwater or impedance of subsoil groundwater flow. Determine the cause as this will affect the possible rectification actions.</td>
</tr>
<tr>
<td>Rubbish tips</td>
<td></td>
<td>Remove rubbish and dispose of it at a licensed or council waste management facility.</td>
</tr>
<tr>
<td>Stock dip sites and other contaminated sites</td>
<td></td>
<td>Undertake Phase 1 Contamination Assessment to determine the scale of contamination and appropriate further actions.</td>
</tr>
</tbody>
</table>

If the site inspection reveals areas denuded of vegetation, a report from an agronomist may be required to give a methodology to rehabilitate those areas. Also, if there is limited area available for cropping or grazing due to factors such as native vegetation or slope, an agronomist’s report on the suitability of these areas for such uses may be required, as well as the stock carrying capacity of the proposed lot(s). These documents are to be made available to lot purchasers.

Degraded watercourses and other existing land degradation such as sheet erosion, gully erosion and salt scalds should be rehabilitated as part of the subdivision process. This requirement will be included in conditions of consent. If degraded areas are found, direct consultation with the SCA should be undertaken to determine appropriate rehabilitation actions for inclusion in the water cycle management study.
In cases where there is obvious significant existing degradation such as the gully erosion shown in Figure 3-24, the rehabilitation of the degraded environment should be considered early in site analysis and subdivision design. Other rehabilitation opportunities include remediation or protection of native vegetation and riparian zones, protection of groundwater recharge and discharge areas by fencing and rehabilitation of salinity affected areas and stock dip sites.

**General objectives**

The general objective for rehabilitation measures design is to rectify existing situations impacting on water quality.

**Relevant current recommended practices and other references**

The CRPs endorsed by the SCA that should be incorporated into the design of rehabilitation opportunity measures include:

- ‘Guidelines for Using Compost in Land Rehabilitation and Catchment Management’
  Department of Environment & Climate Change NSW 2007

Other references

- ‘Dryland Salinity – the Farmer’s Guide’ (NSW Agriculture, 2001)
- ‘Riparian Management Guidelines for the Wollondilly and Wingecarribee Rivers’
  (Wollondilly Catchment Management Committee, 2002)

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Recommendations for:

- stabilisation of gully erosion
- managing existing or potential salinity
- protection of groundwater recharge and discharge areas by fencing to preserve vegetation from stock
- rehabilitating contaminated sites
- targeted tree planting (eg on steep lands and / or along waterways
- fencing off farm dams and providing trough water for stock
- repairing farm dams if they have degraded spillways or walls, or are choked with aquatic weeds.
This gully is an example of a rehabilitation opportunity that may become a requirement as part of the development consent.

3.11 NorBE assessment

The consent authority and the SCA require subdivision applications to include documentation that demonstrates how the proposal will have a neutral or beneficial effect on water quality (NorBE).

The level of assessment required matches the level of risk of the development: developments with the greatest potential risk to water quality, such as proposed subdivisions on heavily constrained sites, will require the most thorough assessment.

In those instances where the subdivision will result in four or more lots, greater than 2,500 square metres of impervious area, special cases (eg heavily constrained sites), or where the subdivision will result in greater than 70% of the lots becoming impervious, MUSIC (stormwater) modelling will be required to justify a NorBE outcome.

Good project design leading to source management and control, and retention of natural features of waterways, is preferable to structural and "end of pipe" solutions. All measures must be taken to contain on-site any potential water quality impacts resulting from a proposed development.

More information can be found in the ‘Neutral or Beneficial Effect on Water Quality Assessment Guideline 2011’ (SCA, 2011a).
### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANZECC</td>
<td>Australian and New Zealand Environment and Conservation Council</td>
</tr>
<tr>
<td>ARMCANZ</td>
<td>Agriculture and Resource Management Council of Australia and New Zealand</td>
</tr>
<tr>
<td>APZ</td>
<td>Asset protection zone</td>
</tr>
<tr>
<td>BASIX</td>
<td>Building sustainability index</td>
</tr>
<tr>
<td>CMA</td>
<td>Catchment management authority</td>
</tr>
<tr>
<td>CRP</td>
<td>Current recommended practice</td>
</tr>
<tr>
<td>DA</td>
<td>Development application</td>
</tr>
<tr>
<td>DPI</td>
<td>Department of Primary Industries (including the Office of Water and LPMA)</td>
</tr>
<tr>
<td>EMA</td>
<td>Effluent management area</td>
</tr>
<tr>
<td>EP&amp;A Act</td>
<td><em>Environmental Planning &amp; Assessment Act 1979</em></td>
</tr>
<tr>
<td>ESCP</td>
<td>Erosion and sediment control plan</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic information systems</td>
</tr>
<tr>
<td>LPI</td>
<td>Land and Property Information (including the former Land and Property</td>
</tr>
<tr>
<td></td>
<td>Management Authority, LPMA)</td>
</tr>
<tr>
<td>LEP</td>
<td>Local environmental plans</td>
</tr>
<tr>
<td>MUSIC</td>
<td>Model for Urban Stormwater Improvement Conceptualisation</td>
</tr>
<tr>
<td>NorBE</td>
<td>Neutral or beneficial effect on water quality</td>
</tr>
<tr>
<td>OEH</td>
<td>Office of Environment and Heritage (including the former Department of</td>
</tr>
<tr>
<td></td>
<td>Environment, Climate Change and Water, DECCW)</td>
</tr>
<tr>
<td>RUSLE</td>
<td>Revised Universal Soil Loss Equation</td>
</tr>
<tr>
<td>SCA</td>
<td>Sydney Catchment Authority</td>
</tr>
<tr>
<td>SEPP</td>
<td>State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011</td>
</tr>
<tr>
<td>SLWCA</td>
<td>Strategic land and water capability assessment</td>
</tr>
<tr>
<td>STP</td>
<td>Sewage treatment plant</td>
</tr>
<tr>
<td>SWMP</td>
<td>Soil and water management plan</td>
</tr>
<tr>
<td>WCMS</td>
<td>Water cycle management study</td>
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<tr>
<td>WEM</td>
<td>Wastewater effluent model</td>
</tr>
<tr>
<td>WSD</td>
<td>Water sensitive design</td>
</tr>
</tbody>
</table>
Glossary

activity

In Part 5 of the EP& A Act means:

(a) the use of land, and
(b) the subdivision of land, and
(c) the erection of a building, and
(d) the carrying out of a work, and
(e) the demolition of a building or work, and
(f) any other act, matter or thing referred to in section 26 that is prescribed by the regulations for the purposes of this definition, but does not include:

(g) any act, matter or thing for which development consent under Part 4 is required or has been obtained, or
(h) any act matter or thing that is prohibited under an environmental planning instrument, or
(i) exempt development, or
(j) development carried out in compliance with an order under Division 2A of Part 6, or
(k) any development of a class or description that is prescribed by the regulations for the purposes of this definition.

carrying out of the proposed development

The proposed development is any development requiring consent under Part 4 or any activity under Part 5 of the Environmental Planning and Assessment Act, 1979. Development requiring consent is specified in environmental planning instruments such as council local environmental plans.

The carrying out of the proposed development refers to the life cycle of the proposal including construction, operation and decommissioning.

clearing native vegetation

Has the same meaning as in the Native Vegetation Act 2003.

Note: the term is defined as follows:

Clearing native vegetation means any one or more of the following:

(a) cutting down, felling, thinning, logging or removing native vegetation,
(b) killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation.

(See Division 3 of Part 3 of the Native Vegetation Act 2003 for the exclusion of routine agricultural management and other farming activities from constituting the clearing of native vegetation if the landholder can establish that any clearing was carried out for the purpose of those activities).

concurrence

Agreement by the Chief Executive of the SCA with the consent authority in granting consent to the development proposal.

consent authority

In relation to a development application or an application for a complying development certificate, means:

(a) the council having the function to determine the application, or
(b) if a provision of this Act, the regulations or an environmental planning instrument specifies a Minister or public authority (other than a council) as having the function to determine the application – that Minister or public authority, as the case may be.
development (a) the use of land, and  
(b) the subdivision of land, and  
(c) the erection of a building, and  
(d) the carrying out of a work, and  
(e) the demolition of a building or work, and  
(f) any other act, matter or thing referred to in section 26 that is controlled by an environmental planning instrument,  
but does not include any development of a class or description prescribed by the regulations for the purposes of this definition (EP&A Act).

development application An application for consent under Part 4 of the Environmental Planning and Assessment Act 1979 to carry out development but does not include an application for a complying development certificate.

dispersive soil Soil that is susceptible to structural breakdown into individual particles and has the ability to pass rapidly into suspension in water. Dispersible soils greatly limit water movement through the soil resulting in poor drainage and water logging.

drainage depression A low point that carries water during rainfall events, but dries out quickly once rainfall has ceased. A gully or incised drainage depression is considered to constitute a watercourse.

fill The depositing of soil, rock or other similar extractive material obtained from the same or another site, but does not include:

(a) the depositing of topsoil or feature rock imported to the site that is intended for use in garden landscaping, turf or garden bed establishment or top dressing of lawns and that does significantly alter the shape, natural form or drainage of the land, or  
(b) a waste disposal landfill operation.

gully erosion A form of erosion involving the formation of deep sided channels or gullies usually due to the removal of riparian vegetation.

intermittent watercourse Having banks and beds or ponds or remaining wet for considerable periods between rainfall events and which may be characterised by supporting moisture tolerant vegetation.

named rivers Wingecarribee River, Wollondilly River, Nattai River, Nepean River, Cox’s River, Shoalhaven River, Kangaroo River, Mongarlowe River, Tarlo River for the full length of each river as defined on topographic maps, and the Mulwaree River upstream as far as the Braidwood Road crossing.

permeability The permeability of a material is the speed of the water that travels through it. To be permeable, a material has to meet three conditions:

- it has to be porous,  
- its openings must be large enough to let water pass through them, and  
- its openings must be well interconnected.

phosphorus sorption The ability of soil to adsorb phosphorus.

potential bedroom Generally a room with a closable door, at least one window and a minimum of 8 square metres. A room in a separate building such as a studio could be considered if it has a toilet and washing facilities or close access to same. A room that could reasonably be used as a bedroom.

rainfall erosivity The potential for soil to wash off disturbed, devegetated earth into waterways during storms.
saline soil  Soil that contains sufficient soluble salt to adversely affect plant growth and/or land use.

section 88  The imposition of a restriction or public positive covenant by a prescribed authority on land under the *Conveyancing Act 1919*.

significant (cut and fill)  Three metres cut and fill to be used as the upper limit.

site  The site of a proposed development means the area of land described in the development application or the Part 5 assessment.

site area  The area of any land on which development is carried out, or is proposed. The land may include the whole or part of one lot, or more than one lot, if they are contiguous to each other.

soil depth  The vertical depth of soil from the soil surface to parent rock material.

steep  Slopes greater than 20% (11.4°) (for watercourses and gullies).

waterbody  A waterbody (artificial) or waterbody (natural).

waterbody (artificial)  An artificial body of water, including any constructed waterway, canal, inlet, bay, channel, dam, pond, lake or artificial wetland, but does not include a dry detention basin or other stormwater management construction that is only intended to hold water intermittently.

waterbody (natural)  A natural body of water, whether perennial or intermittent, fresh, brackish or saline, the course of which may have been artificially modified or diverted onto a new course, and includes a river, creek, stream, lake, lagoon, natural wetland, estuary, bay, inlet or tidal waters (including the sea).

watercourse  Means any river, creek, stream or chain of ponds, whether artificially modified or not, in which water usually flows, either continuously or intermittently, in a defined bed or channel, but does not include a waterbody (artificial).

waterway  The whole or any part of a watercourse, wetland, waterbody (artificial) or waterbody (natural).

wetland  Means:

(a) natural wetland, including marshes, mangroves, backwaters, billabongs, swamps, sedgelands, wet meadows or wet heathlands that form a shallow waterbody (up to two metres in depth) when inundated cyclically, intermittently or permanently with fresh, brackish or saline water, and where the inundation determines the type and productivity of the soils and the plant and animal communities, or

(b) artificial wetland, including marshes, swamps, wet meadows, sedgelands or wet heathlands that form a shallow water body (up to two metres in depth) when inundated cyclically, intermittently or permanently with water, and are constructed and vegetated with wetland plant communities.

WCMS  Water cycle management study. Components of the WCMS include:

- a conceptual SWMP or ESCP for the construction phase
- an on-site effluent management plan if unserved
- water sensitive design features, and
- a determination of pre- and post- development loads.
References


Appendix 1

ArcReader
Site Analysis and Design Tool
Appendix 1. ArcReader Site Analysis and Design Tool

Introduction

ArcReader is used by the Sydney Catchment Authority (SCA) to provide an easy to use mapping platform allowing users to interact with geographical information. Geographical datasets can be queried, areas of interest can be zoomed into, features of interest can be searched upon and maps can be quickly created.

This User Guide will give you guidance for the installation of ArcReader, an overview of ArcReader, the features it offers and the tools and functions that it can perform.
1. Getting Started

1.1 Installing the ArcReader Software


2. Once the CD has loaded, double click the ArcReader software folder:

3. Double click the ArcReader setup.exe file and the installation will start automatically. Follow the steps within the ArcReader wizard, choosing ‘Complete’ for Installation Type, to complete the installation.
Select Installation Type
Select the desired installation type.

- Typical
  - The most common application features will be installed. This option is recommended for most users.

- Complete
  - All application features will be installed.

- Custom
  - Use this option to choose which application features you want installed and where they will be installed. Recommended for advanced users.

Destination Folder
Select a folder where the application will be installed.

The Setup will install the files for ArcGIS ArcReader in the following folder. To install into a different folder, click the Browse button and select another folder.

Destination Folder
C:\Program Files\ArcGIS\ ArcReader

You can choose not to install ArcGIS ArcReader by clicking Cancel to exit the Setup Program.
4. Next, double click the ArcReader931.msp file and follow the wizard steps to complete the installation.

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation</td>
<td>65.569 KB</td>
<td>Folder</td>
</tr>
<tr>
<td>ArcReader931.msp</td>
<td>2,526 KB</td>
<td>Windows Installer Patch</td>
</tr>
<tr>
<td>instmsi3.exe</td>
<td>196,371 KB</td>
<td>Cabinet File</td>
</tr>
<tr>
<td>setup1.cab</td>
<td>145 KB</td>
<td>Compiled HTML Help file</td>
</tr>
<tr>
<td>Setup.chm</td>
<td>63 KB</td>
<td>Application</td>
</tr>
<tr>
<td>setup.exe</td>
<td>1 KB</td>
<td>Configuration Settings</td>
</tr>
<tr>
<td>setup.ini</td>
<td>9,709 KB</td>
<td>Windows Installer Package</td>
</tr>
</tbody>
</table>
1.2 Accessing the site analysis and design tool maps

1. On the CD folder list, double click the Local Government Area folder, for example:

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArcReader</td>
<td></td>
<td>Folder</td>
</tr>
<tr>
<td>Wingecarribee</td>
<td></td>
<td>Folder</td>
</tr>
</tbody>
</table>

2. Two folders are shown. The pmf folder contains the published map file that was published by the SCA using ArcGIS 9.3.1 for each LGA. The data folder contains all the data that is incorporated into the published map file in a locked file geodatabase. Users will not need to access the data within this folder.

3. Double click the pmf folder and then double click the relevant pmf file to load the map into ArcReader.
2. User Interface Overview

This section breaks down the user interface and describes the various operations and functions. The interface sections are shown in the diagram below. This guide is structured so that each of the interface sections, are dealt with individually.
2.1 The Table of Contents

The table of contents lists all the layers on the map and shows what the features in each layer represent. You can turn each layer on or off by checking and unchecking the check box next to the layer. When the layer is on, it appears on the map. Layers are drawn on the map in the order in which they are listed in the table of contents. Layers listed on top of other layers in the table of contents will be drawn on top of those layers on the map.

**Greyed tick**

A greyed tick next to a layers name indicates the layer is not shown at the scale that is currently being viewed. To view these layers, change the scale or zoom into an area of interest. The scale dependency of the layers has been set by the SCA to ensure the performance of the map document is optimised.

Note: The order of the layers in the table of contents, the colour and the names of the layers cannot be changed within the published map document.

2.2 Map Window

The map window is the area where the map layers are viewed. The map window also allows for navigation with the use of the tools around the map.
2.3 Map Title

The map title has been set by the SCA. The map title cannot be changed within the published map document.

2.4 Legend

The map legend shows the map layers that are represented in the published map document and indicates the colour key for each layer. The layer names and colours cannot be changed.

2.5 Toolbars

The ArcReader toolbars can be used to navigate around the main map window and also to query the features and data that is being displayed. Each of the tools will be discussed further below as they are used for navigation. The ArcReader Help is also available for explaining other tools that are not explained here.
2.6 Navigation Toolbar

The Navigation Toolbar contains the tools used to move around the Main Map window and also to query the features and data that is being displayed.

- **Zoom In** - Allows you to either
  1. Click over a location and zoom in by a magnification of two, or
  2. Define a rectangle to encompass the area where more detail is required.

- **Zoom Out** – Allows you to either
  1. Click over a location and zoom out by a magnification of two, or
  2. Define a rectangle to encompass the area where less detail is required.

- **Identify** – Allows you to display the attributes associated with features by clicking on the features and viewing the details on the Display tab.

- **Pan** – Allows you to click on any point in the Main Map window and drag the map in any direction.

- **Measure** – Allows you to take distance measurements from the Main Map window. The distance between the nominated points is displayed in the Location Information Window.

- **Full View** – Displays the map at the extent of the currently selected map service dimensions.
Previous View – This will take the Main Map window back one step so that the last extent you viewed will be displayed again.

Next View – Allows you to move forward through the views that have already been displayed. This button will only become active if you have changed the view and then used the previous button.

2.7 Map Properties

All spatial data that is supplied in the published map files are in the format of a Geographic Coordinate System (GCS) and Geocentric Datum of Australia 1994 (GDA94).

What is GDA94?

<table>
<thead>
<tr>
<th>GDA94</th>
<th>Geocentric Datum of Australia 1994. As the words imply, ‘geocentric datum’ has its origins at the centre of the earth. The key advantages of the GDA over Australia's current datum are that GDA is totally compatible with satellite-based navigation systems such as the Global Positioning System (GPS) and with major international geographic systems. For those using satellite positioning and/or operating nationally or internationally, the GDA will provide significant and substantial benefits.</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is a datum?</td>
<td>A ‘datum’ is a mathematical surface on which a mapping and coordinate system is based. A ‘geocentric datum’ is a datum which has its origin at the Earth’s centre of mass. The advantage of the geocentric datum is that it is directly compatible with satellite-based navigation systems. The GDA is also based on a model which is a best fit model for the whole Earth with the GDA’s centre being coincident with the Earth’s centre of mass.</td>
</tr>
<tr>
<td>Need more information?</td>
<td>Go to Geosciences GDA Home Page</td>
</tr>
</tbody>
</table>

The data has been sourced from the Sydney Catchment Authority corporate geodatabase, the Land & Property Information Division of the Department of Finance and Services and the Bureau of Meteorology.
2.8 Sydney Catchment Authority Disclaimer

The SCA map disclaimer is incorporated into the published map file. The SCA map disclaimer cannot be changed or manipulated. All printed maps will need to have the SCA map disclaimer as shown. The map disclaimer will be updated each year to reflect the copyright year.

3. Scale

The Scale area displays the current scale of the main map window. It is possible to select from a list of standard scales that are predefined. This enables the user to move quickly to a required scale. It is also possible to set a User Defined Scale (see Section 3.3 below).

3.1 Predefined Scales

To move to a defined scale simply click on the drop-down list and move the cursor over the desired map scale and click the mouse button to set the scale. The main map will automatically redraw to the new scale.

ArcReader published map files have been designed with scale dependant layers. These define when certain feature layers or element types within feature layers are displayed. For example, cadastral properties will only be displayed at a scale of 1:100,000. This is necessary to ensure that the main map is not congested with too much information.

Keep this in mind when you change a map scale. Layers that were visible at the previous scale may not be displayed at the new scale.
3.2 Scale Dependent Layers

The following is a summary of the scale ranges of the layers that are published in the map files.

<table>
<thead>
<tr>
<th>LAYER NAME</th>
<th>MINIMUM SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Government Areas</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Cadastral properties</td>
<td>1:250,000</td>
</tr>
<tr>
<td>Contours – 10m intervals</td>
<td>1:50,000</td>
</tr>
<tr>
<td>Waterbodies</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Watercourses</td>
<td>1:250,000</td>
</tr>
<tr>
<td>Named river 150 m buffer</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Watercourse 100 m buffer</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Watercourse 40 m buffer</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Permeability</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Phosphorous sorption</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Salinity</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Dispersive soils</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Slope</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Soil depth</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Mean annual rainfall</td>
<td>Visible at all scales</td>
</tr>
<tr>
<td>Low constraint area</td>
<td>1:250,000</td>
</tr>
</tbody>
</table>

3.3 User Defined Scales

As well as having predefined scales there is an option for the user to define the scale that they wish to use on their map. Instead of clicking on the drop-down menu, click in the white area of the scale menu and type the required scale.

Below is a guide of minimum and maximum scales for different types of maps. These are a guide only and should be used when trying to determine an appropriate scale for the map being produced.
4. Basic user tools

4.1 Searching for a known Deposition Plan Number

Step 1: Click on Find Tool on the search and measure toolbar

Step 2: Ensure the Features tab is selected in the Find window
Step 3: Type in the known Deposition Plan number into the text box next to Find (DP1012603). Select the Cadastral Lot layer in the In layer drop down menu to base the search. Click Find.

Step 4: Once the find command has been run, a list of features matching the number entered will be displayed. The Zoom to Feature tool will enable you to identify the selected lot in the Main Map window.
Step 5: The selected property will be shown in the map window and the site constraint analysis can be undertaken.

4.2 Measure Tool

The measure tool will enable the user to measure the distance between two or more points in the Main Map window. Measuring units are either metres or kilometres.

Step 1: Zoom to the area where the features you wish to measure are both seen in the Main Map window.

Step 2: Click on the Measure button.

Step 3: Click over a start point and move the mouse to the next point in the measurement. Click once on the point to read the distance in the nominated units.
Units of measurement can be changed by clicking on the dropdown menu and selecting the required units for distance and area.

Step 4: If you wish to continue the measurement with additional segments move the cursor to the next point and click once to see the cumulative distance in the measurement window.

Step 5: To finish the measurement, double click in the Main Map window.

5 Printing

Step 1: Open the Page Setup dialog box under the File menu and choose the appropriate printer setup, orientation, and layout settings based on the page size shown on the ArcReader status bar. These settings allow the printed map to fit on the desired page.

Step 2: Check Show Margins to see the printer margin in layout view if you are unsure about the chosen paper size and orientation settings.

Step 3: If the map you are working with has a page size that is too large for your printer, you can still print the map to the paper size of your choice by checking Scale to Fit Page. Click OK.

Step 4: Click the Print button.

6 Help

ArcReader provides a full range of offline and online help documentation. To activate the Help documents click on the Help button on the Standard menu.
Appendix 2

Development Assessment and Approvals
## Appendix 2. Development Assessment and Approvals

### 1.1 Planning and legislative context

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (the SEPP)</strong></td>
<td>Under the SEPP, proposed developments, including subdivisions, must demonstrate a neutral or beneficial effect (NorBE) on water quality and should incorporate any CRPs and performance standards endorsed or published by the Sydney Catchment Authority (SCA) that relate to the protection of water quality. Rural residential subdivisions are assessed by councils and the SCA using the NorBE test when considering subdivision development applications. Consent will not be granted by council, or concurrence by the SCA if required, for development applications which do not meet the NorBE requirements. This Design Guide explains how to design rural residential subdivisions that are more likely to meet the NorBE test.</td>
</tr>
<tr>
<td><strong>Neutral or Beneficial Effect (NorBE) on Water Quality Assessment Guideline 2011</strong></td>
<td>The NorBE Assessment Guideline (SCA, 2011a) aim to provide a clear direction as to what is meant by a neutral or beneficial effect, how to demonstrate it, and how to assess an application against the NorBE test.</td>
</tr>
<tr>
<td><strong>MUSIC Guidelines</strong></td>
<td>The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) is a conceptual design tool that estimates stormwater pollutant generation from proposed land development, and the performance of stormwater treatment devices. MUSIC estimates both the short and long term effects of a wide range of stormwater management actions on the volume and quality of runoff discharging to receiving waters. Two MUSIC guides for the Sydney drinking water catchment are being developed by the SCA. The first is the MUSIC Assessors Guide for use by both the SCA and councils, and is designed for those staff involved in assessing development applications that utilise MUSIC for stormwater modelling. The second is the MUSIC Users Guide for use by developers and their consultants (SCA, 2010).</td>
</tr>
<tr>
<td><strong>State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004</strong></td>
<td>BASIX ensures homes are designed to use less potable water and be responsible for fewer greenhouse gas emissions by setting energy and water reduction targets. All development applications for new dwellings, and alterations to dwellings, must be accompanied by a BASIX Certificate. A BASIX certificate is not required at the subdivision stage; however it is good practice to be aware of water cycle management requirements throughout the design stage, and to design a subdivision layout, which allows the subsequent design or location of energy-efficient dwellings.</td>
</tr>
<tr>
<td><strong>Water Management Act 2000</strong></td>
<td>Under Part 3 of the Water Management Act 2000, a controlled activity approval is required for controlled activities carried out in, on or under waterfront land (within 40 m of the bank). Such controlled activities include the erection of a building, the removal of vegetation, or any other activity that affects the quantity or flow of water in a water source.</td>
</tr>
</tbody>
</table>
**Native Vegetation Act 2003**

The clearing of native vegetation has been identified as an action that has the potential to impact on water quality. Vegetation clearing, including on State protected land, requires separate consent in defined circumstances under the *Native Vegetation Act 2003*. The Act states that native vegetation must not be cleared except in accordance with development consent or a property vegetation plan.

**Planning for Bushfire Protection 2006**

‘Planning for Bush Fire Protection 2006’ applies to all development applications on land that is classified as bush fire prone land on a council’s bush fire prone land map. The document aims to provide for the protection of human life and to minimise impacts on property from the threat of bush fire, while having due regard to development potential, on-site amenity and protection of the environment.

This influences the design of rural residential subdivision through the need for an Asset Protection Zone (APZ). An APZ is a buffer zone between a bush fire hazard and buildings, which is managed progressively to minimise fuel loads and reduce potential radiant heat levels, flame, ember and smoke attack. The requirement for APZs can potentially conflict with the need to retain vegetation for water quality protection.

### 1.2 Obtaining other approvals

Local government has the primary responsibility for granting development consent for rural residential subdivisions, therefore all development applications must be made to the relevant local council. The council will then review the application and refer it to other government agencies that may be required to provide input, or approvals as required by other Acts. All correspondence and communication should be directed through the local council.

Other approvals that may be required in addition to the development consent are summarised in the table below. This is not a definitive list of other approvals as these will be site dependent, but includes those most relevant to rural residential subdivision. Consultation should be undertaken with relevant approval bodies early in the design process.

**Table A2-1 Examples of other approvals that may be required**

<table>
<thead>
<tr>
<th>Approval</th>
<th>Approval body</th>
<th>When required (summary only)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local Government Act 1993</strong></td>
<td>Local council</td>
<td>Installation or construction of a waste treatment device; operation of an on-site waste management system.</td>
</tr>
<tr>
<td><strong>Water Management Act 2000</strong></td>
<td>NSW Office of Water (DPI)</td>
<td>Excavation or earthworks or vegetation clearing within 40 m of the bank of a watercourse or waterbody.</td>
</tr>
<tr>
<td><strong>Rural Fires Act 1997 &amp; Planning for Bush Fire Protection 2006</strong></td>
<td>NSW Rural Fire Service</td>
<td>Applies to all development applications on land that is classified as bush fire prone land on a council’s bush fire prone land map.</td>
</tr>
<tr>
<td><strong>Roads Act 1993</strong></td>
<td>Relevant road authority</td>
<td>Approval should be obtained for any works within a public road reserve.</td>
</tr>
<tr>
<td><strong>Native Vegetation Act 2003</strong></td>
<td>Local CMA</td>
<td>Vegetation clearing, including on State Protected Land, requires separate consent in defined circumstances under the <em>Native Vegetation Act 2003</em>. The Act sets out that</td>
</tr>
</tbody>
</table>
native vegetation must not be cleared except in accordance with development consent or a property vegetation plan.

**Threatened Species Conservation Act 1995**
OEH
May require an assessment of significance to be prepared to consider ecological communities, key threatening processes and the terms of relevant recovery and threat abatement plans.

**Protection of the Environment Operations Act 1997**
OEH
Non-scheduled activities for the purposes of regulating water pollution.

**Crown Lands Act 1989**
DPI
Proposed opening and or construction of Crown roads.

**Water Act 1912**
NSW Office of Water (DPI)
Extraction and use of water sourced from rivers and aquifers.

### 1.3 Providing Information

The following is a summary of information to be submitted with development applications (DA). This list is not exhaustive, as other reports and studies may be required depending on the specific characteristics of the site and the requirements of the council.

<table>
<thead>
<tr>
<th>Submission</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed DA including sub-catchment location</td>
<td>A completed DA is required for all rural subdivision proposals. The DA should include the sub-catchment location for the proposed subdivision.</td>
</tr>
<tr>
<td>Owner’s contact details</td>
<td>Owner’s contact details must be provided for all rural residential subdivision proposals.</td>
</tr>
<tr>
<td>Statement of environmental effects</td>
<td>A statement of environmental effects (SEE) must accompany each application. For matters to be included in a SEE, applicants or their representatives should refer to this document, and also to provisions of the Environmental Planning and Assessment Regulations 2000. The SEE should include all requirements of this guideline as appropriate.</td>
</tr>
<tr>
<td>Site analysis plan</td>
<td>A site analysis plan is required for all rural residential subdivisions. The plan should identify the main site constraints to be considered in the subdivision design. This plan is to address all of the requirements of the site analysis checklist.</td>
</tr>
<tr>
<td>Demonstrated link between site analysis and subdivision layout</td>
<td>DAs, preferably through detail in the SEE, must clearly demonstrate a link between the site analysis, constraints and opportunities of the site and the proposed subdivision layout. DAs that do not demonstrate this may be refused consent by council or concurrence by the SCA. Note this does not mean development cannot occur in constrained areas, but the DA must clearly demonstrate how the constraints are addressed.</td>
</tr>
<tr>
<td>Subdivision layout plan</td>
<td>A subdivision layout plan is required which shows the lot layout and vehicular access and shows building sites and effluent disposal areas.</td>
</tr>
<tr>
<td>On-site wastewater management report</td>
<td>An on-site wastewater management report is required for a rural residential subdivision. The report should consider factors such as soil profile, climate, terrain, aspect, maximum potential wastewater generation, the impact of any existing wastewater management system and the sizing of a sustainable effluent management area (EMA). As a general rule, one soil profile per lot is</td>
</tr>
</tbody>
</table>
Components of the WCMS include:
- a conceptual SWMP or ESCP for the construction phase
- an on-site effluent management report if unsewered
- MUSIC modelling outputs (including a determination of pre- and post-development loads)
- small-scale stormwater quality modelling outputs
- existing and proposed water sensitive design features, including erosion control works such as contour banks, flumes and revegetation, and
- an Operational Management Plan if communal WSD proposed.

A plan that specifies proposed erosion and sediment control measures for the subdivision is required for all rural residential subdivisions with a construction area less than 2,500 square metres.

Erosion and sediment control plans that relate to road construction. The Primary ESCP would contain standard procedures and drawings to be used on a site and is supplemented by Progressive ESCPs. Progressive ESCPs are prepared for specific locations, such as areas of high erosion hazard, and as required during the construction process eg clearing phase to construction phase.

A conceptual soil and water management plan is required for all rural residential subdivision with a construction or impervious area greater than 2,500 square metres which specifies the soil and water management measures being incorporated on site.

MUSIC modelling data must be provided for all residential subdivision applications involving either 4 or more lots or where the impervious area exceeds 2,500 square metres or special cases (eg heavily constrained sites) or where more than 70% of the lot becomes impervious.

1.4 Rural residential design guide requirements

As discussed previously, this Design Guide has been prepared to assist developers to prepare subdivisions to meet the requirements of the NorBE test. Councils should assess how developers have applied this Design Guide in developing their rural residential subdivision proposal as this will help inform their NorBE assessment process. In order to assist councils in this process, a series of checklists have been provided (Tables A2-3 to A2-5). Note: if the development proposal is referred to the SCA for concurrence, copies of the completed checklists should be provided with the DA documentation.

**Has the required information been provided?**

The assessment of rural residential subdivision is dependent on the provision of appropriate information (Table A2-3). Councils should ensure that this information has been provided with the development application prior to further assessment.

**Has the site analysis been undertaken in accordance with the design guide?**

Site Analysis is a critical element of good subdivision design. The site analysis will determine the opportunities and constraints for the site in relation to water quality impacts. Councils should assess whether the developer has adequately completed the site analysis (Table A2-4). Councils should refer to the site analysis data provided in the development application and ensure that it is consistent with council data.
**Has the subdivision design considered the site constraints?**

The subdivision design should respond to the site analysis. Councils should ensure that all issues have been addressed and that the design reflects the site analysis (Table A2-5).

**Table A2-3 Information Checklist**

<table>
<thead>
<tr>
<th>Information required</th>
<th>Information supplied (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed DA including sub-catchment location</td>
<td></td>
</tr>
<tr>
<td>Owner’s contact details</td>
<td></td>
</tr>
<tr>
<td>Subdivision layout plan</td>
<td></td>
</tr>
<tr>
<td>Water cycle management study, including (as required):</td>
<td></td>
</tr>
<tr>
<td>- on-site wastewater management report</td>
<td></td>
</tr>
<tr>
<td>- a conceptual SWMP or ESCP for the construction phase</td>
<td></td>
</tr>
<tr>
<td>- an on-site effluent management report if unsewered</td>
<td></td>
</tr>
<tr>
<td>- MUSIC modelling outputs (including a determination of pre- and post-development loads)</td>
<td></td>
</tr>
<tr>
<td>- small-scale stormwater quality modelling outputs</td>
<td></td>
</tr>
<tr>
<td>- existing and proposed water sensitive design features, including erosion control works such as contour banks, flumes and revegetation, and</td>
<td></td>
</tr>
<tr>
<td>- an Operational Management Plan if communal WSD proposed.</td>
<td></td>
</tr>
<tr>
<td>Erosion and sedimentation control plan (ESCP) OR</td>
<td></td>
</tr>
<tr>
<td>Conceptual soil and water management plan (SWMP)</td>
<td></td>
</tr>
<tr>
<td>MUSIC stormwater modelling (including electronic data) OR</td>
<td></td>
</tr>
<tr>
<td>modelling (small-scale)</td>
<td></td>
</tr>
</tbody>
</table>

**Table A2-4 Site analysis checklist**

<table>
<thead>
<tr>
<th>Site Analysis Desktop Review</th>
<th>Yes</th>
<th>No</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have the constraints been mapped using the Site Analysis and Design Tool?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Inspection</td>
<td></td>
<td></td>
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<tr>
<td>Has a site inspection confirmed mapped constraints?</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### Table A2-5 Subdivision Design Checklist

<table>
<thead>
<tr>
<th>Issue</th>
<th>Yes</th>
<th>No</th>
<th>If no, why not?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Justification for outcomes included</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determine potential building sites</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Determine effluent disposal sites</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Design vehicular access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimise cut &amp; fill</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Minimise watercourse crossings</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Locate property boundaries to minimise impact from clearing fencing lines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water sensitive design measures</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>