13 Human amenity

This chapter outlines the potential impacts of the Project on:

- Traffic, transportation and access.
- Waste generation and management.
- Air quality.
- Noise and vibration.
- Hazards and risk.
- Visual amenity.

13.1 Traffic, transportation and access

Traffic and Transport – the EA shall include an assessment of impacts to the local and regional road network and intersections, including direct impacts from any traffic rerouting and any access restrictions to property. This assessment must include details on the nature/mode of traffic generated from the construction and operation of the project, transport routes and traffic volumes. Consideration must also be given to the impact of the project in the context of any other major construction traffic likely to be utilising the same roads during the construction of the project.

This section outlines the potential impacts of the Project on traffic, as assessed by TTM Consulting (Appendix H). The assessment investigates traffic generation during construction and operation, and the impact of this traffic generation on surrounding road networks.

The finding of this assessment is that there would be no significant traffic impacts during either construction or operation, and that impacts would be further reduced through the implementation of the mitigation and management measures described in this section.

It is expected that the traffic generated in the later stages of the Project would be less intensive, as works associated with Stage 1 of the Project comprise the majority of the total works required for the Project as a whole. In addition, as the value management and design have progressed, elements of the water cycle project have reduced in scale in the early stages. Hence, actual traffic numbers for Stage 1 of the Project (as presented in this section) may be lower as detailed design progresses.

13.1.1 Scope of the traffic impact assessment

This assessment focuses on traffic associated with project approval. It is difficult to evaluate traffic impacts at concept level, as the traffic environment would be different for subsequent stages of the Project as residential commuters and new road networks would need to be further considered.

Future assessments under the EP&A Act, potentially under Part 3A project application(s) or Part 4 development applications, would need to be undertaken for elements of the concept plan that are not part of Stage 1 of the Project. In terms of potential traffic assessments, approvals would need to consider the traffic conditions that are existing at the time of assessment, not conditions that are currently there.

13.1.2 Traffic impact assessment methodology

The existing environment was identified, including relevant intersections and traffic flows in the vicinity of the study area. A SIDRA analysis was conducted on the identified intersections and roads to obtain the existing Level of Service (LoS). SIDRA is a computer program that is used by all Australian road authorities.

The LoS is a qualitative measure derived that describes the operational conditions within a traffic stream or at an intersection. The LoS is classified into six levels ranging from A–F. Table 13.1 summarises these six levels with LoS-A presenting virtually free flow, and LoS-F representing forced flow where capacity limits are exceeded by approaching traffic flows.

Table 13.1 Level of service classification summary

Level of service	Average delay (seconds per vehicle)	Traffic signals, roundabout	Give way and stop signs
A	Less than 14	Good operation.	Good operation.
B	15 to 28	Good with acceptable delays and spare capacity.	Acceptable delays and spare capacity.
C	29 to 42	Satisfactory.	Satisfactory, but accident study required.
D	43 to 56	Operating near capacity.	Near capacity and accident study required.
E	57 to 70	At capacity. At signals, incidents will cause excessive delays. Roundabouts require other control mode.	At capacity; requires other control mode.
F	Greater than 71	Unsatisfactory with excessive queuing.	Unsatisfactory with excessive queuing; requires other control mode.

Source: Guide to Traffic Generating Developments version 2.2 (RTA, 2002).

The nature and quantity of traffic that would be generated from the construction and operation was calculated in traffic movements. A traffic movement is defined as a vehicle making one trip (either to or from the site). For example, if a construction activity requires one truck to attend the site daily, this would be equivalent to two truck movements per day (ie there and back). Additional traffic generation arising from other projects that have the potential to occur concurrently with construction of Stage 1 of the Project were also identified and calculated in traffic movements.

An assessment was conducted to determine the impacts of traffic generated from the construction of Stage 1 of the Project and operation after this first stage is completed, taking into consideration traffic generated from other projects running in concurrence to the construction of the Stage 1 of the Project. The assessment included a SIDRA analysis on the key intersections to determine the LoS arising during construction and operation.

13.1.3 Existing environment

Figure 13.1 shows the main intersection associated with the site and Figure 13.2 illustrates the existing local road network in relation to the study area.

Main roads and traffic flow

The two main roads servicing the study area are Old Cooma Road and Googong Dam Road; they are shown in Figure 13.2.

Old Cooma Road is a two-lane sealed road that predominantly carries rural residential commuter traffic to and from Queanbeyan and provides a connection between Monaro Highway near Royalla and Queanbeyan. The posted speed limits in the area are 100 kilometres per hour on Old Cooma Road and 60 kilometres per hour on Googong Dam Road.

Googong Dam Road is a two-lane sealed road that connects Old Cooma Road to Googong Dam. The road provides access to the Googong Foreshores for recreational activities, the Googong water treatment plant, a Ranger's Station and an Information Centre.

There are no public transport services in the area, except for a weekday school bus service along Old Cooma Road. Table 13.2 outlines existing traffic flows on these two main roads. Old Cooma Road has been divided into two parts (north and south of Googong Dam Road) in relation to traffic flow statistics.

Table 13.2 Existing traffic flows in the vicinity of the study area

Road	Date	Average weekday traffic (total vehicles)	Peak two-way traffic flow (vehicles/hr)	Percentage of heavy vehicles
Old Cooma Rd (south of Googong Dam Rd)	May 2005	2,120	244	5.7%
Old Cooma Rd (north of Googong Dam Rd)	December 2006	2,537	265	5.7%
Googong Dam Rd	August 2004	260	29	9.5%

Source: QCC, 2008.

Intersections

The intersection at Old Cooma Road and Googong Dam Road is the only significant intersection in relation to the study area and is represented in Figure 13.2 and Figure 13.1 below. The intersection is constructed and line marked as a typical AustRoads 'CHR' intersection.

SIDRA analysis has been conducted on this intersection to determine the existing LoS. Results indicate that both the AM peak hour and PM peak hour are classified as LoS A and B, respectively. Therefore, the volumes at this specific intersection are extremely low in relation to the capacity of the intersection.

Properties

There are three properties within the study area that have been considered in relation to access restrictions:

- The 'Beltana' property – this is owned by CIC and the tenants will leave the property prior to the commencement of construction of NH1A.
- The 'Talpa' property – this is located immediately north of Googong Dam Road.
- The Gorman property – this is located immediately west of the water recycling plant (WRP) site.

13.1.4 Other concurrent projects of relevance

Projects that have the potential to run in concurrence with Stage 1 of the Project have been considered in relation to the additional traffic generation they may produce.

Googong Dam Spillway Remediation Works Project (Spillway Project)

The Spillway Project is currently under construction and likely to extend over a period of about 18 months, leading up to late 2010. It is possible that there would be some interaction with construction traffic associated with the Spillway Project and traffic associated with Stage 1 of the Project, as the proposed starting date for Stage 1 of the Project is July 2011. However, it is expected that virtually all heavy haulage associated with the Spillway Project would be complete before the commencement of Stage 1 of the Project.

Table 13.3 sets out the Spillway Project traffic estimates applicable to the period when both the Spillway Project and Stage 1 of the Project would be under construction or operation. The table shows both the project's traffic movements during peak hours as well as the total daily traffic movements.

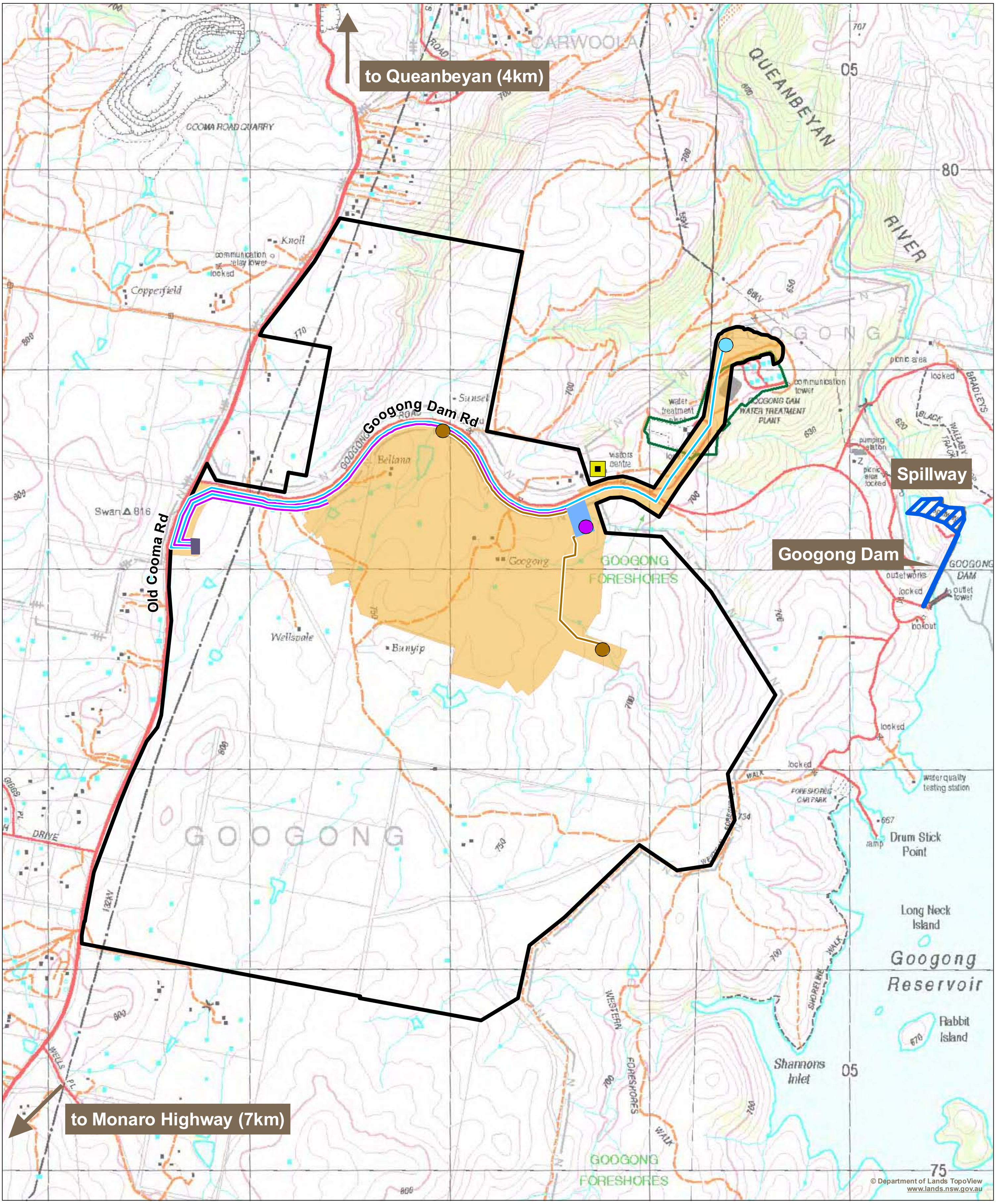
Table 13.3 Googong Dam Spillway Project – daily movements and peak-hour movements

Traffic sources	Daily movements	AM peak hour		PM peak hour	
		In	Out	In	Out
Concrete trucks	100	8	2	2	8
Other trucks	12	1	1	1	1
Employee traffic (light vehicle)	100	30*	5*	5*	30*

Source: Cited in Appendix H.

** GHD estimated 10 per cent of total daily traffic during peak hours, with 80 per cent in the peak direction. This EA considers that that peak period proportion is likely to be exceeded in the case of employee traffic, which is reflected in the estimates in Table 13.3.*

Figure 13.1 Intersection at Old Cooma Road and Googong Dam Road



Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig13-2

Source Brown Consulting, NSW LPMA

- Bulk water pumping station
- Recycled water pumping station
- Sewage pumping station
- Potable water mains
- Recycled water mains
- Sewage mains
- Visitor centre/ranger station
- Interim reservoir area
- Existing ACTEW Googong water treatment plant site
- Water recycling plant
- Subject site
- Study area

1:25,000

0 200 400 600 800m

Figure 13.2 Existing road network

Maunsell Roberts

Googong Neighbourhood 1A development and early use

The first subdivision, Neighbourhood 1A (Stage 1) would be under construction from July 2010 and completed around August 2011 (ie during the period of construction of the Project).

Table 13.4 outlines the traffic estimates for the period during which the development and early use of Neighbourhood 1A would coincide with construction of water cycle infrastructure.

Table 13.4 Development of Googong Neighbourhood 1A – daily movements and peak-hour movements

Traffic source	Daily movements	AM peak hour		PM peak hour	
		In	Out	In	Out
Civil works					
Semi-trailer movements	40	3	3	3	3
Employee (light) vehicles	60	20	5	5	30
House building					
Trucks	40	3	3	3	3
Light vehicles	60	20	5	5	20

Upgrade to Old Cooma Road

Old Cooma Road would be upgraded between Googong and Edwin Land Parkway as part of the Googong Voluntary Planning Agreement. Improvements would include the road being straightened at the Quarries, as well as the widening and/or duplication of the carriageway where required. Subject to approvals, works for the upgrade would commence in September 2010.

13.1.5 Construction impacts

Traffic generation associated with construction of the Project

Estimated traffic generation associated with the construction of the Project is outlined below with the focus on traffic generation related to Stage 1 of the Project. Trucks and other vehicles would generally use Old Cooma Road north of the site and Googong Dam Road to access construction work sites at the designated construction access points shown in Figure 5.16. These roads are suitable for heavy vehicle use.

- WRP – This would be the major site works component of the Project and would require about 310 trucks (620 truck movements) to deliver plant and equipment. This number of truck movements would be phased throughout the construction period. During Stage 1 of the Project, daily truck movements related to the water recycling plant would involve the following components:
  - Road pavement construction – This would generate the highest daily rate of WRP traffic. It is estimated that 40 truck movements daily may attend the site to deliver crushed rock, equipment and incidental materials.
  - Concrete construction of the WRP – Trucks would be required to deliver or remove formwork and other materials.
  - Employee transport – Light vehicles would be required daily to transport employees; it is estimated that this would involve 40 vehicle movements per day.

- Bulk water pumping station – It is estimated that construction of the bulk water pumping station would generate a total of 230 trucks (460 truck movements) for excavation, concrete works and delivering plant and equipment. It is estimated that 32 truck movements and 16 employee light vehicle movements per day are required.
- Reservoir works – It is estimated that reservoir works would require a total of 660 trucks (1,320 truck movements). Traffic associated with Stage 1 of the Project is estimated to require 32 truck movements daily as well as maximum of 20 employee light vehicle movements per day.
- SPS1 and SPS2 – It is estimated that construction of all sewage pumping stations for the Project would require a total of 440 trucks (880 truck movements). Stage 1 of the Project would involve the construction of SPS1 and SPS2, which is estimated to require 64 truck movements and 20 employee light vehicle movements per day.
- Pipe works – It is estimated that pipe works for the Project would require a total of 600 trucks (1,200 truck movements). Pipe works relating to Stage 1 of the Project would require an estimated 54 truck movements and 20 employee light vehicle movements daily.

Table 13.5 provides a summary of the above traffic generation associated with Stage 1 of the Project, it also provides details on estimated daily peak-hour movements. Table 13.5 includes total vehicle movements for each traffic source associated with Stage 1 (see the last column of the table).

Table 13.5 Daily vehicle movements (including peak-hour movements) for Stage 1 of the Project

Traffic source	WRP	BWPS	Reservoir works	SPS1 and SPS2	Pipe works	Totals
Trucks (peak daily movements)	40	32	32	64	54	**222**
Light vehicles (peak daily movements)	40	16	20	20	20	**116**
Daily AM peak hour						
Trucks in	3	2	4	4	4	**17**
Trucks out	3	2	4	4	2	**15**
Light vehicles in	12	5	6	6	6	**35**
Light vehicles out	4	1	2	2	2	**11**
Daily PM peak hour						
Trucks in	3	2	4	4	2	**15**
Trucks out	3	2	4	4	4	**17**
Light vehicles in	4	1	2	2	2	**11**
Light vehicles out	12	5	6	6	6	**35**

Table 13.6 takes the totals calculated in Table 13.5, as well as the totals calculated for traffic sources from other concurrent projects of relevance (totals can be located in Table 13.3 and Table 13.4). These totals have been combined and the expected traffic impact from Stage 1 of the Project and concurrent projects has been calculated and listed in bold in the last column. These totals have then been used to determine the LoS at key intersections during construction and operation.

Table 13.6 Potential traffic generation for Stage 1 of the Project and concurrent projects

Traffic source	Stage 1 of the Project	Googong NH1A dev. and early use	Spillway project	Totals
Trucks (peak daily movements)	222	80	112	**414**
Light vehicles (peak daily movements)	116	120	100	**336**
Daily AM peak hour				
Trucks in	17	6	9	**32**
Trucks Out	15	6	3	**24**
Light vehicles in	35	40	30	**105**
Light vehicles out	11	10	5	**26**
Daily PM peak hour				
Trucks in	15	6	3	**24**
Trucks out	17	6	9	**32**
Light vehicles in	11	10	5	**26**
Light vehicles out	35	40	30	**105**

Potential impacts on main intersections – Old Cooma Road and Googong Dam Road

The total number of daily truck movements and light vehicle movements by employees (222 and 116, respectively), as well as the daily vehicle movements from the concurrent projects, have been added to the existing volumes at the intersection at Old Cooma Road and Googong Dam Road. A SIDRA analysis provided the following LoS assessments (the results of the SIDRA analysis are found in Appendix H):

- AM peak hour LoS ranges from A–C.
- PM peak hour LoS ranges from A–B.

A LoS-E during peak hours is generally regarded by road authorities as acceptable. The levels of service that have been calculated by the SIDRA analysis for this intersection, are therefore well within the acceptable threshold. It has therefore been determined that no significant change to the LoS would result from the construction of Stage 1 of the Project, taking into consideration additional projects running concurrently at that time.

Potential impacts on main roads

At Old Cooma Road, north of Googong Dam Road, taking into account the traffic generated during the construction of Stage 1 of the Project and concurrent projects, the daily traffic along this road is likely to be increased by up to 698 vehicles, including 294 heavy vehicles. This would take the volume to 3,235 vehicles per day, which includes around 17 per cent heavy vehicles. These conditions would equate to a LoS-C, which is considered acceptable. Therefore, no significant traffic impact is likely along Old Cooma Road, north of Googong Dam Road.

At Old Cooma Road, south of Googong Dam Road, it is estimated that traffic associated with reservoir works and pipe works would use the southern section of Old Cooma Road. A LoS-A classification would remain along Old Cooma Road, south of Googong Dam Road. It is therefore likely that additional traffic would have no significant impact on the LoS.

At Googong Dam Road, taking into account the traffic generation during construction and concurrent projects, the daily traffic along this road is likely to be at a LoS A. These conditions are considered acceptable. Therefore, no significant traffic impact is likely along Googong Dam Road.

Potential impacts on access to properties

It has been determined that access to properties within the study area would be maintained during construction, so no significant impact is likely. Consultation with relevant landholders would also be maintained and would include the notification of any traffic alterations.

Management and mitigation measures during construction

Proposed management and mitigation measures to be implemented during construction would include:

- Planning the use of vehicles to maximise efficiency and reduce vehicle trips. This would include the encouragement of car-pooling by construction workers.
- Educating construction workers in relation to local traffic arrangements and conditions (such as the intersection of Googong Dam Road and Old Cooma Road).
- Preparing a traffic management plan to detail traffic arrangements and take into consideration any works running concurrently (eg the upgrade to Old Cooma Road).
- Engaging a traffic control contractor to implement traffic management (such as partial road closures).
- Installing traffic management devices in compliance with Australian Standard 1742.3 and any RTA requirements.
- Transporting any oversized loads in accordance with RTA guidelines.
- Informing councils, property owners and local community members of any potential loss of or disruption to access to properties, roads and/or pathways. Appropriate temporary measures – to either provide alternative access or to reinstate access at the end of each workday – would be negotiated with relevant parties.
- Managing traffic, transportation and access in consultation with relevant stakeholders, including Council and the RTA; this would include impact mitigation and management measures to address partial road closures, access to properties and provisions for temporary access and reinstatement.

13.1.6 Operation impacts

No significant traffic impacts are likely during the operation of the Project. This is because the Project would not generate a large number of traffic movements.

The WRP would not be fully operational until about 195 dwellings are occupied. Prior to full operation (about six months into the development), trucks would cart sewage to an off-site treatment plant. Prior to full operation of the plant, it is estimated that one semi-trailer attending the site daily would be initially adequate, and an additional daily load would be necessary when around 50 houses are occupied. Those truck movements would only occur on Googong Dam Road and Old Cooma Road.

Other operational activities such as routine inspections and plant and grounds maintenance are expected to generate fewer than 10 light vehicle trips daily.

In addition, about six truck movements a week would be required for biosolid removal and chemical delivery.

Management and mitigation measures during operation

Proposed management and mitigation measures to be implemented during operation include the preparation of an operational environmental management plan (OEMP) and traffic management plan, which would detail management measures such as timing of truck movements, parking arrangements and access to existing properties.

13.1.7 Conclusion

During construction, the Project would not cause significant traffic impacts, even when considering the total of Project-generated traffic and any traffic arising from concurrent projects.

During operation, the Project would not cause significant traffic impacts.

Mitigation and management measures are reinforced in the statement of commitments (T1–T5) in Chapter 18.

13.2 Waste generation and management

Waste Generation and Management – the EA shall detail the likely waste quantities and qualities generated during the construction (including spoil generation) and operation of the project. Specific focus must be placed on potential contamination of soils, and on sludges, solids and aqueous wastes produced through the operation of the project. Details of appropriate waste management and disposal options for those materials must be provided. The assessment must take into consideration the DECC's *Waste Classification Guidelines* (2008).

This section details the potential quantities and qualities of waste that would be generated during the construction and operation of the Project.

The assessment finds that, in general, waste generated from the Project would be typical of such installations and could be managed through the implementation of industry standard measures and procedures.

13.2.1 Scope of waste generation and management impact assessment

Waste generation and management have been assessed at concept level for the operation of the Project and at project approval level for the construction and operation of Stage 1 of the Project.

13.2.2 Existing environment

Legislation

The *Protection of the Environment Operations Act 1997* (PoEO Act) primarily comes into force when an activity has been identified as a 'Scheduled Activity' as listed in Schedule 1 to the PoEO Act. Sewage treatment works are noted as a scheduled activity when these works have a capacity that exceeds 2,500 equivalent persons or 750kL/day (clause 36). As such, a licence under the PoEO Act would be required for the WRP.

The *Waste Avoidance and Recovery Act 2001* (WARR Act) has been established, to assist in the achievement of the objectives of the PoEO Act. Under the WARR Act, the NSW Government has established the following waste management hierarchy, with the most preferable approach listed first:

- Avoidance.
- Reuse.
- Recycle (resource recovery).
- Disposal.

This project is consistent with the approach of the WARR Act. Water that would otherwise be disposed to the environment would be treated for reuse throughout the development. Waste products of the treatment process, such as biosolids, would be treated such that they can be re-used elsewhere.

The *Waste Classification Guidelines* (DECC, 2008) provide specific guidance on classification of wastes. A waste is considered to be any discarded, rejected, unwanted, surplus or abandoned substance and it is the responsibility of the waste generator to ensure that all wastes are classified properly.

The *Waste Classification Guidelines* outline a number of pre-classified wastes and provide guidance on classifying waste based on chemical analysis. Chemical composition of waste varies and therefore different waste types pose differing environmental risks. Appropriate management options, transportation and disposal facilities can be explored based on the waste classification.

Waste classification

Most activities associated with construction and operation of the project would generate waste. Based on origin and composition, each waste must be classified into one of six categories as outlined in the *Waste Classification Guidelines*. The six categories are:

- Special waste.
- Liquid waste.
- Hazardous waste.
- Restricted solid waste.
- General solid waste (putrescible).
- General solid waste (non-putrescible).

Waste materials arising from construction and operation of the project have been identified within five of these six waste classes. Where a waste is not pre-classified or suspected of contamination, chemical assessment would be undertaken to verify classification, including potentially classifying certain wastes as restricted solid waste.

13.2.3 Waste generation and potential impacts

Table 13.7 shows the types, quantities and classifications of waste that would be generated for the Project. It also shows the risk to the environment from potential contamination caused by leaks or spills. General management measures have been proposed for each type of waste in order to reduce the risk to acceptable levels.

A number of construction wastes would be produced for which exact quantities are unknown and expected to be low. These include general construction wastes and refuse, which would be classified and disposed of to licensed facilities in accordance with the *Waste Classification Guidelines*. The chemical compositions of waste products from the WRP are not shown, as assessments of the contamination potential of these wastes have been made elsewhere in this chapter. For wastes that still pose medium or higher risks, specific mitigation measures are presented in the following section.

Table 13.7 Waste types, classification and general management measures

Classification*	Type of waste	Source	Quantities	Potential impacts	Management measures	Risk to environment
Construction wastes						
Special waste	Waste tyres	Construction vehicles.	Expected to be low.	Resource use, and difficulties with disposal.	• Waste types must be tracked when transported interstate, but not when transported within NSW. • Waste to be transferred to an appropriately licensed facility.	Low
Liquid waste	Concrete slurries, drilling muds, and bentonite muds consisting of approved water based products or synthetic lubricants.	Boring for pipe installation.	Expected to be low.	Sedimentation of runoff water. Fine particulates when waste is dry.	• Bunding, swales, soil and water management procedures in accordance with the 'Blue Book'.	Low
	Liquid waste from human waste storage facilities or waste treatment, including pump-out waste and sewage.	Construction site offices and portable toilets.	Expected to be low.	Soil and water contamination from leaks or transportation.	• Sewage disposal during construction via truck by an approved contractor to a local sewage treatment plant.	Medium
	Fuels, oils, greases, engine coolant.	Vehicle maintenance and refuelling.	Expected to be low.	Soil and water contamination from leaks or spills.	• Bunding of storage and work areas. • Licensed facilities to receive waste.	Low
Hazardous waste	Adhesives, lubricants, cleaning agents, water treatment chemicals, other plastic material.	Maintenance during construction, and construction of WRP.	Expected to be low.	Soil and water contamination from leaks or spills.	• Bunding of storage areas. • Licensed facilities to receive waste.	Low
	Any other waste material that meets the criteria for dangerous goods under the *Australian Code for the Transport of Dangerous Goods by Road and Rail.*	Maintenance during construction, and construction of WRP.	Expected to be low.	Contamination or incidents during transportation.	• Storage and transportation in accordance with relevant codes and standards.	Low

Classification*	Type of waste	Source	Quantities	Potential impacts	Management measures	Risk to environment
General solid waste (putrescible)	Non-recyclable and other putrescible general solid waste.	Construction site offices and other activities.	Expected to be low.	Soil and water contamination, resource use, odour.	• Implement procurement policies to reduce waste during construction. • Appropriate disposal.	Low
General solid waste (non-putrescible)	Recyclables – glass, aluminium cans, PET plastic bottles, scrap metal and off-cuts, paper and cardboard.	Operation and decommissioning of temporary site offices, and general site maintenance during construction.	Expected to be low.	Resource use and recycling potential for waste.	• Segregation and recycling of wastes.	Low
	Concrete, metallic materials, brick, rubble, soils (topsoil, fill materials).	Construction of WRP, pipelines and other infrastructure; and trenching, grading and other earthworks.	Unknown at concept stage, expected to be in the hundreds of tonnes.	Increased resource use, dust, sedimentation of runoff, and dispersal of building rubbish.	• Segregation and recycling of wastes.	Low
	Vegetation (including grasses, established trees and shrubs).	Clearing for construction activities.	Expected to be in the tens of tonnes.	Loss of flora and fauna habitat, and reduction in biodiversity.	• Flora and fauna management plan. • Assessment concluded that all vegetation in areas to be cleared is of poor condition.	Low
	Spoil.	Trenching and excavations for construction.	Unknown at concept stage, but anticipated to be in the thousands of tonnes.	Sedimentation of runoff water, dust, visual impacts.	• In situ waste classification during geotechnical investigations for water infrastructure. • All spoil re-used elsewhere on site for landscaping. • Handling in accordance with the 'Blue Book'.	Medium
	Drained and crushed oil filters, and rags, oil absorbent materials that do not contain free liquids.	Maintenance during construction and operation.	Expected to be low.	Soil and water contamination.	• Segregation and appropriate disposal.	Low

Classification*	Type of waste	Source	Quantities	Potential impacts	Management measures	Risk to environment
Operational wastes						
Special waste	Waste tyres.	Operational and maintenance vehicles.	Expected to be low.	Resource use, and difficulties with disposal.	• Waste types must be tracked when transported interstate, but not when transported within NSW. • Waste to be transferred to an appropriately licensed facility.	Low
Liquid waste**	Pump-out waste and sewage.	Pump-out sewage prior to WRP commissioning.	Maximum 2 tankers/day until WRP commences operation, or 27kL/day.	Contamination of soil, water or groundwater from spills or leaks during storage and transportation.	• Licensed transport to a nominated STP (likely Queanbeyan or Fyshwick).	Medium
	Liquid wastes from WRP.	Discharge of treated effluent during commissioning and maintenance of the WRP.	Average of 227kL/day for Stage 1. Average of 1183kL/day at ultimate load.	Soil and water contamination from out of specification effluent. Effects on downstream habitats and biology.	• Operating conditions of WRP and capture and treatment mechanisms within the plant.	Medium
		Intermittent discharge of excess recycled water during operation.	227 kL/day for Stage 1.*** 1183 kL/day at ultimate load.	Soil and water contamination. Impacts on human health. Spills or leaks during transportation.	• Mitigation measures are provided in earlier sections. • Transportation of hazardous liquid wastes to be undertaken by licensed approved contractors.	Medium
General solid waste – putrescible	Dewatered grit and screenings from effluent treatment.	Operation of WRP (at ultimate loads).	Grit: $2m^3$/day Screenings: $2.6m^3$/day.	Contamination of soils, water or groundwater from transportation or storage.	• Bunding of storage, use of licensed contractors for transportation.	Low

Classification*	Type of waste	Source	Quantities	Potential impacts	Management measures	Risk to environment
General solid waste – non-putrescible	Biosolids categorised as unrestricted use or as restricted use 1, 2 or 3.	Operation of WRP (at ultimate loads).	$8m^3$/day	Contamination from spills or leaks of inadequately treated sludge during transport.	• Storage and transportation in accordance with the DECCW's Environmental Guidelines on the Use and Disposal of Biosolids Products.	Low
	Dewatered grit and screenings from the potable water system.	Operation of reservoirs and BWPS.	Expected to be low	Limited. Expected to be inert salts from the potable supply.	• Segregation at source and removal as necessary.	Low
	Drained and crushed oil filters, and rags, and oil-absorbent materials that do not contain free liquids.	Maintenance during operation.	Expected to be low	Soil and water contamination.	• Segregation and appropriate disposal.	Low

**Wastes classified in accordance with six steps of the Waste Classification Guidelines, Part 1: Classifying Waste, DECC NSW, April 2008.*

***Note: The composition of liquid wastes from the WRP and their potential for contamination of soils and groundwater is assessed separately in this chapter.*

****These figures assume that rainwater tanks would be installed on dwellings. Without rainwater tanks, recycled water discharge volumes would be much lower. Refer to Appendix C for further information.*

13.2.4 Construction impacts and mitigation measures

Potential impacts

The nature and volume of waste generated during the construction of the Project, if not managed appropriately, may potentially impact on:

- Visual amenity and aesthetic quality of the construction area.
- Water quality of local drainage lines and watercourses. This is particularly relevant for gross pollutants (litter) and accidental release of contaminated liquids.
- Health and safety of workers and visitors to the site.

Mitigation measures

In general, waste streams would need to be managed throughout the project to satisfy the following principles:

- Waste management strategies would be developed in accordance with the WARR Act and by adopting the resource management hierarchy principles (in order of priority) of avoidance, resource recovery and disposal.
- Waste to be disposed of off site would be disposed of to a waste facility that is licensed under the PoEO Act to receive wastes of that type.

These principles would be embodied in the construction environmental management plan (CEMP). The CEMP would be prepared prior to the initiation of construction activities and include:

- Procedures to classify all waste types in accordance with the *Waste Classification Guidelines* and NSW legislative requirements.
- Resource recovery and reuse strategies for each type of material where applicable.
- Details of how waste would be stored and treated on site.
- Procedures and disposal arrangements for all material according to waste classification.
- Reporting and recording requirements for all waste movements, allowing determination of recycling and reuse levels achieved (landfill diversion).

Table 13.7 outlines specific management measures that would be implemented for classified wastes, as defined in the *Waste Classification Guidelines*.

13.2.5 Operational impacts and mitigation measures

Potential impacts during operation

Potential impacts during operation would be associated with:

- Removal of sewage during the initial stages of development, prior to the wastewater flows becoming sufficient to adequately operate the plant. This would involve the pump-out of sewage from sewage pumping station SPS1 by truck to an appropriate treatment facility.
- Removal of effluent, biosolids and other materials during commissioning of the WRP and other infrastructure.
- Production of biosolids during the water recycling process.
- Waste such as litter generated from the operation of the WRP.

- Discharge of treated effluent during commissioning of the WRP. Note that the contamination potential of the treated effluent has been addressed in relation to soils in Chapter 9, water and groundwater in Chapter 7 and Chapter 10 respectively, and aquatic ecology in Section 11.2.
- Discharge of excess recycled water during operation of the WRP. The composition of the discharged recycled water is expected to be well within the ANZECC (2000) guidelines and as such would pose little risk to the surrounding environment.
- Storage and handling of fuels and chemicals that have the potential to contaminate soils, water and groundwater.

Mitigation measures

Mitigation measures proposed during operation include:

- Implementation of appropriate protocols and procedures, such as timing and truck routes, for the removal of wastewater from sewage pumping stations, prior to the WRP commencing operation.
- Collection and dewatering of grit and screenings from inlet works of the WRP and transportation off site for disposal at an appropriately licensed facility.
- Treatment of biosolids (activated sludge) to Grade B standard, suitable for use in such activities as agriculture, forestry, soil and site rehabilitation.
- Collection and dewatering of any solid matter removed through maintenance activities of the water cycle infrastructure and transportation offsite for disposal at an appropriately licensed facility.
- Implementation of waste management procedures for other putrescible and recyclable waste generated from the water recycling plant and other water cycle infrastructure.
- Implementation of management procedures and monitoring associated with discharge of treated effluent during commissioning and licence proving phases of the water recycling plant operation.
- Bunding of all chemical and fuel stores to 110 per cent of the capacity of the largest container. All chemicals and fuels would be stored on hardstand areas and in accordance with manufacturers' MSDS recommendations.
- Design of the WRP with a 'first flush' system to capture the first 10mm of stormwater during rain events and redirect it to the head of works. In this way, any incidental spills or minor contaminated runoff within the WRP would be contained and passed through the treatment train.

The Googong Integrated Water Cycle Management Strategy Water and Wastewater Concept Design (Appendix B) provides further details on the operational management of wastes produced from the WRP and other water cycle infrastructure.

13.2.6 Conclusion

Waste generated during construction and operation would be adequately managed through the implementation of mitigation measures and procedures, which would be detailed in construction and operation management plans (CEMP and OEMP).

Potential impacts would not be significant, provided these measures are adequately implemented.

Mitigation and management measures are reinforced in the statement of commitments (W1 and W2) in Chapter 18.

13.3 Air Quality

Air Quality – the EA shall include an assessment of the air quality impacts associated with the Project prepared in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005), *Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2001) and *Technical Notes: Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2001). This assessment must consider any potential impacts on nearby sensitive receptors, including future residential receptors associated with the Googong urban development area.

This section summarises the odour impact assessment by MWH (Appendix I). This assessment finds that:

- During construction, air quality impacts would relate primarily to dust, which would have a minimal impact, provided that standard management and mitigation measures are implemented.
- During operation, potential air quality impacts would relate primarily to odour. The water recycling plant would be the main potential odour source to nearby residences. However, it is anticipated that there would be no significant odour impacts during operation.

13.3.1 Scope of air quality impact assessment

The air quality assessment focuses on air quality impacts associated with Stage 1 of the Project (project approval), in particular:

- Odour modelling and controls for sewage pumping stations SPS1 and SPS2 and the WRP.
- Potential air quality impacts during construction (eg dust).

For concept approval, the assessment addresses:

- Air quality impacts associated with SPS3 and SPS4 at a concept level (as their precise location and detailed design has not yet been finalised).
- The odour control plan for the Googong township.

13.3.2 Existing environment

Study area

The Googong study area is located within a rural landscape characterised by large rural landholdings, State forests and small townships. The study area is predominantly surrounded by low-intensity grazing, bushland and rural residential land uses; no intensive agricultural activities are known to occur.

Climate

Climatic information is derived from Bureau of Meteorology data. Records from the nearest automated weather station are sourced from Canberra airport, about 12 kilometres north-east of the Googong township site.

Googong is located within a temperate climate, distinctively characterised by dry (and warm) summers and cold winters. Mean temperatures are within the range of 13–27 degrees during summer and 0.5–12 degrees in winter. Uniform rainfall is experienced throughout the year with an average of 615.5 millimetres received per annum.

Local air quality

The ambient air quality of the study area is affected by the predominantly agricultural use of the surrounding area, and is considered clean and fresh. (There are minimal odour impacts from the agricultural uses due to the low-intensity farming.) Quantitative analysis of the air quality has not been deemed necessary given the absence of prevailing factors that would alter the air quality from its relatively benign state.

External factors affecting local air quality

Various external factors occasionally have impacts on air quality in the study area. These include:

- Operations of the quarry located on Old Cooma Road. Blasting, crushing and other quarrying activities, vehicle movements on unsealed surfaces and windborne particles picked up from exposed surfaces, may generate dust pollution. The quarry's environmental management plan includes several measures intended to ensure properties surrounding the quarry are generally free of dust emissions, but potential impacts are to some extent variable and subject to weather conditions. Readymix Holdings conducts regular monitoring of dust levels at locations around the quarry's area of activity (Willana, 2007).
- Seasonal bushfires, burn-offs and hazard reduction burning, which produce smoke and ash.
- Extreme weather events combined with drought, which can cause dust or particulates from farming activities. The south-east and Monaro regions of NSW have been in drought since June 2008 (though above-average rainfall over the summer of 2009–10 has eased the impact). Drought has the effect of increasing dust effects during extreme weather events. The NSW Department of Industry and Investment indicates that it is impossible to predict rainfall with any certainty for periods longer than three months in the future. For this reason, no assessment can be made of the likelihood that the current dust-sensitive environment will or will not continue for the lifetime or stages of the Googong township development.

13.3.3 Odour assessment methodology

The odour impact assessment has been prepared in accordance with the requirements of the DECCW's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DECC, 2005 – The Methods), *Assessment and Management of Odour from Stationary Sources in NSW* (DECC, 2001) and *Technical Notes: Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW* (DECC, 2001). The assessment also considers the draft NSW Best Practice Odour Guidelines (NSW DoP, 2010).

Study objectives

The objectives of the odour impact assessment were to:

- Determine the predicted odour impacts from odour releases at the proposed initial sewage pumping stations (SPS1 and SPS2) and assess their compliance with DECCW odour impact criteria.
- Establish a baseline (no odour control) dispersion model for the proposed WRP at Stage 1 of development.
- Determine an odour control strategy (through dispersion modelling) for:
  - Stage 1 that demonstrates compliance with DECCW odour impact criteria (including determining the process units requiring odour control; the nature of any required odour control; and the appropriate odour discharge concentration limit).

- Ultimate development[1] that demonstrates compliance with DECCW odour impact criteria (including determining the process units requiring odour control; the nature of any required odour control; and the appropriate odour discharge concentration limit).

- Explore the types of appropriate land use surrounding the WRP based on the assessment results.

Assessment criteria

Models representing the WRP at Stage 1 and ultimate development have been produced using a dispersion model called AUSPLUME as an options-screening tool. A dispersion model referred to as CALPUFF was adopted for the odour impact assessment of the Stage 1 WRP and pumping stations, for baseline and final variations of odour control models (in accordance with the requirements of The Methods). The CALPUFF dispersion models included the following:

- Odour control models for sewage pumping stations at Stage 1.
- Baseline model for the WRP at Stage 1.
- Odour control model for the WRP at Stage 1.
- Odour control model for the WRP at ultimate development.

The Methods have two different conditions for the assessment of odour impacts, depending on the quality of input data used in the model. If site-specific odour emission and meteorological data is used, then less stringent criteria of the 99th percentile concentration can be used for the odour impact assessment. If non-site-specific data is used, then the 100th percentile or maximum concentration must be reported.

Odour emissions for the WRP were estimated using:

- MWH's odour emissions database, based upon olfactometry samples from similar sites with similar wastewater treatment processes and operating conditions.
- Hourly meteorological data from a CSIRO air pollution model (referred to as TAPM).

Although the TAPM-generated data could be considered to be representative of real site conditions, observational data from an on-site meteorological station is preferable, as are site-specific odour emission data. Considering the use of these non-site-specific data, and since the WRP is at concept (as opposed to detailed) design stage, both the 99th and 100th percentiles have been reported to show the degree of uncertainty associated with the dispersion modelling at this stage.

The DECC criteria uses a sliding scale of odour impact criteria based on the density of the population potentially affected, as shown in Table 13.8.

Table 13.8 Impact assessment criteria for Googong WRP

Population of affected community (persons per km^2)	Impact assessment criteria (odour units)
Urban areas (≥ ~ 2000) and/or schools and hospitals	**2.0**
~ 500	3.0
~ 125	4.0
~ 30	5.0
~ 10	6.0
Single residence (≥ ~ 2)	7.0

Source: DECC, 2005 in MWH, 2009.

[1] *MWH (2009) refers to the ultimate development scenarios as 'Stage 2'.*

The impact assessment criterion of two odour units (2 ou) has been used in the odour assessment of the Stage 1 and ultimate configurations for the WRP. This allows for the presence of residential, commercial and recreational areas planned for the Googong township, which is considered to represent a 'worst case' scenario for land use planning.

The dispersion modelling undertaken as part of the odour impact assessment would be validated at a later stage in the design. This is reinforced in the statement of commitments (AQ1) in Chapter 18.

13.3.4 Construction impacts

Dust

Construction would generate minor dust impacts. Principal dust and particulate matter emissions from construction activities would be associated with bulk earthworks. The extent of the impact would vary depending upon soil type, the prevailing wind conditions at a given location and wetness.

The following activities are those identified as a specific potential source of dust generation during construction:

- Vegetation clearing, trenching, backfilling and reinstatement.
- Wind erosion from stockpiling of excavated topsoil and trench spoil.
- Movement of vehicles and construction machinery, both within and in/out of the construction site.
- Drilling and blasting at hard rock areas.

Construction of the pipelines would involve only minimal surface disturbance at any one time as the excavation works and rehabilitation would happen progressively.

Odour

During construction, it is unlikely that there would be any odour impacts that would affect air quality, as odour sources are likely to only come from vehicle emissions and these would be well within the required guidelines.

13.3.5 Mitigation measures during construction

Dust

The following dust suppression measures would be implemented to minimise nuisance dust:

- Speed limits would be reduced during high dust/windy conditions.
- Clearing of vegetation and topsoil would be limited to the designated footprint required.
- Disturbed areas would be progressively reinstated with suitable stabilising agents or revegetation.
- Water trucks would be used to reduce dust in dry, windy conditions.
- Working practices would be modified during periods of high winds by limiting the use of some machinery – particularly when close to dwellings – and by reducing travel speeds.
- Blasting would be conducted at appropriate times, with consideration of site conditions and sensitive receivers.
- The burning of material on site would be prohibited, except under the instruction of fire services.

These dust suppression measures are based on standard construction industry measures based on the 'Blue Book' (Landcom, 2004) and would be sufficient to adequately manage dust during the construction phase. These measures would be contained in the construction environmental management plan (CEMP) and the air quality management plan.

There remains a potential for dust impacts during extreme weather events, but it is not expected that the Project would contribute nuisance dust above existing levels.

13.3.6 Operational impacts

Dust

During operation, it is unlikely that particulate matter (dust) would affect air quality within the study area. The site would be rehabilitated after construction, minimising the potential for dust generation. Dust issues arising from vehicle and equipment movement during maintenance operations are considered to be negligible and should not create any long-term or permanent impact on air quality in the region.

Odour

Table 13.9 outlines the odour dispersion modelling results for the Stage 1 pumping stations (SPS1 and SPS2), and for the Stage 1 and ultimate WRP (SPS3 and SPS4 have only been assessed at concept level as the precise locations and design requirements are not yet known).

Table 13.9 Summary of odour dispersion modelling results

Modelling scenario	**Odour control description**	**Compliance with DECC criterion outside of WRP site boundary**	
		2ou, 99th %ile	**2ou, 100th %ile**
SPS 1 Stage 1 odour control	Activated carbon odour control unit installed; no stack required; 500 odour units (ou) discharge	Yes	Yes
SPS 2 Stage 1 odour control	Activated carbon odour control unit installed; no stack required; 500ou discharge	Yes	Yes
WRP Stage 1 baseline	N/A (no odour control)	No	No
WRP Stage 1 odour control	Inlet works, bioreactor 1, rotary drum thickener, and aerobic digester covered; 8 m odour control stack at 500ou.	Yes	Yes
WRP Ultimate odour control	Inlet works, bioreactors 1–4, rotary drum thickener, and aerobic digester covered; 8 m odour control stack at 500ou.	Yes	No

Source: MWH (2009) – Appendix I

Results of the odour dispersion modelling for the WRP show that odour control measures are required for Stage 1 and the ultimate development so that the WRP can comply with DECCW odour impact criteria. The recommended odour control approaches for each system component and each stage of development are detailed in Table 13.9 above.

The DECCW assessment methods allow for the assessment level to be the 99th percentile where site representative or specific odour emission and meteorological data have been used. No site-specific odour or meteorological data were available to be used as part of the modelling conducted as part of the odour assessment (Chapters 3–5 of Appendix I). The models demonstrated full compliance with DECCW criteria (99th percentile and 100th percentile) for all odour mitigated scenarios, except for the ultimate WRP, which complies with the 99th percentile criterion only. The dispersion modelling resulted in a slight exceedance of the 100th percentile odour criterion for the ultimate WRP.

13.3.7 Mitigation measures during operation

Modelling

The odour monitoring proposed to be undertaken during the initial stages of WRP operation would provide the relevant site-specific odour emission and meteorological data to be used in further modelling to demonstrate adherence to the DECCW criteria and ensure that the odour modelling results comply with the 99th percentile at the boundary of the WRP site.

Buffer zone

Initially, it was proposed by the DECCW that a buffer of 400 metres would be required around the WRP. However, the modelling discussed above and subsequent urban design responses negate the need for a buffer zone. Urban design iterations that have been made in response to the odour assessment (Appendix I and Figure 13.3) were outlined in a meeting with DECCW representatives on 3 June 2009 and include:

- Amending the initial design to create larger lots of 1.5ha immediately west of the WRP.
- Planting between the boundaries of these larger lots and the WRP.

Approach to mitigation

The approach to odour management and mitigation during operation would involve:

- Implementing comprehensive odour control facilities at the WRP and pumping station, as detailed in Chapter 5 of Appendix I.
- Registering and investigating odour complaints. Engineering, operational or other odour reduction measures would be implemented where verified odour complaints are received as part of the OEMP.
- Reconsidering potential odour impacts associated with the WRP. This would include:
  - Collecting site-specific data.
    - Establishing a meteorological station on the WRP site to collect data, at least 12 months prior to commissioning.
    - Collecting odour data at the WRP during and following its commissioning, prior to the residential development of the area immediately adjacent to (and west of) the plant.
  - Conducting further odour dispersion modelling for Stage 1 and ultimate scenarios, incorporating site-specific data to measure compliance with DECCW odour criteria following commissioning of the WRP and to influence urban layout adjacent to the plant.

It would be possible to collect odour data following commissioning of the WRP because of the proposed staged development of the neighbourhoods, with subdivision construction commencing in the areas furthest away from the plant. Odour data would therefore be collected prior to development of areas adjacent to the plant. This would allow flexibility to amend the urban design to mitigate any additional potential odour impacts.

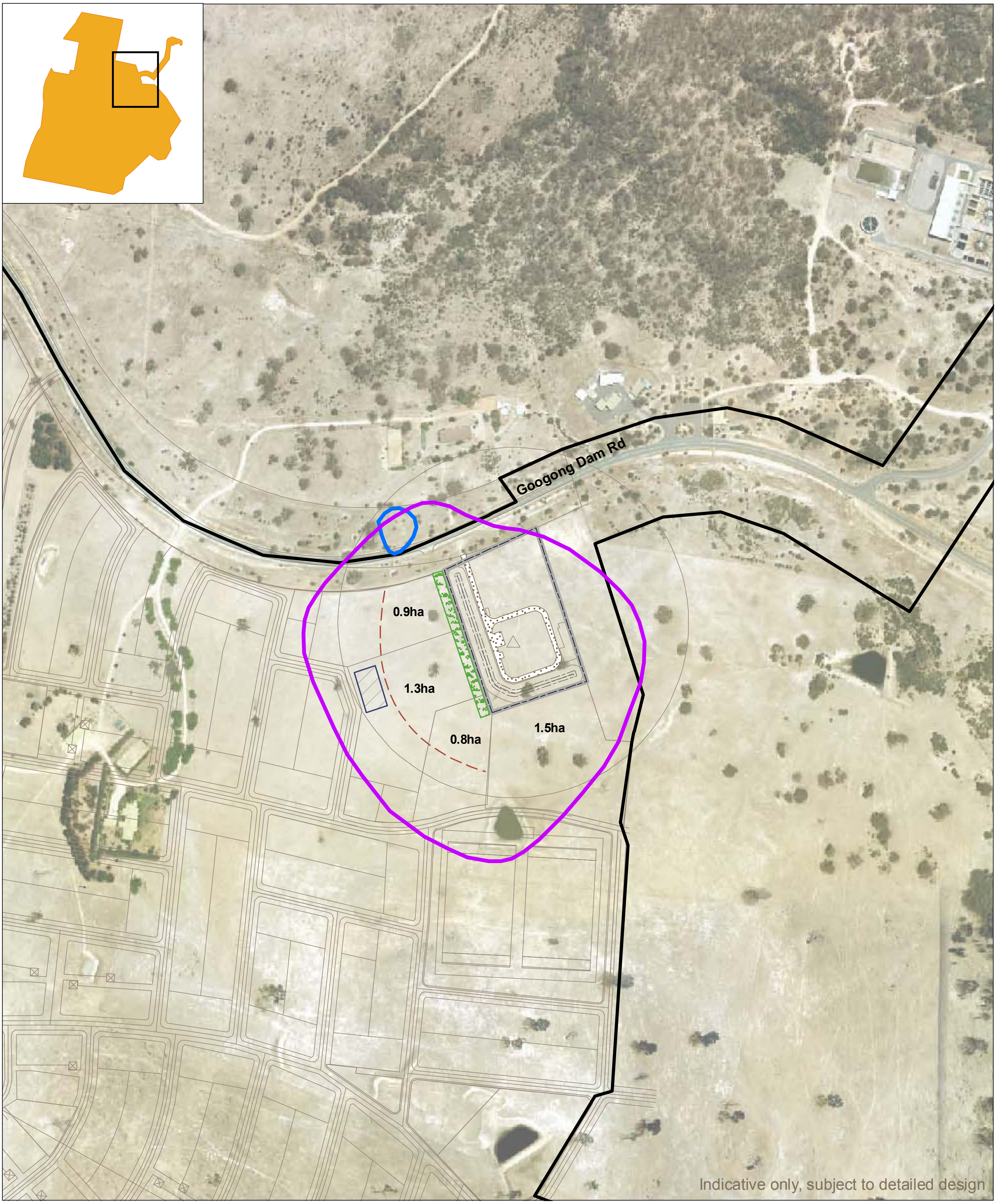
13.3.8 Conclusion

Air quality impacts associated with the Project would be as follows:

- During construction, impacts would relate to dust generation. However, there would be only a minimal impact provided the standard management and mitigation measures are implemented.
- During operation, potential air quality impacts would relate primarily to odour, with the water recycling plant being the main potential odour source for nearby residences. However, it is anticipated that there would be no significant odour impacts during operation.

Odour monitoring would be undertaken during the initial stages of the plant's operation to provide the relevant site-specific odour emission and meteorological data, which would be used in further modelling to demonstrate adherence to the DECCW criteria.

Mitigation and management measures are reinforced in the statement of commitments (AQ1–AQ8) in Chapter 18.



Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig13-3

Source Brown Consulting, MWH

- Stage 1 (no odour control) 2ou 100th percentile contour
- Ultimate stage (with odour control) 2ou 100th percentile contour
- Water recycling plant boundary
- Study area
- Proposed extent of built form
- Indicative building envelope
- Proposed planting (easement)

1:5,000

0 50 100 150 200m

Figure 13.3 Indicative odour contours - water recycling plant

Manidis Roberts

13.4 Noise and vibration

Noise and Vibration – the EA shall include an assessment of noise and vibration impacts during construction and operation and in a cumulative context with existing development. Construction traffic noise must also be addressed. The assessment must take into account the following guidelines, as relevant: *Environmental Noise Control Manual* (EPA, 1994), *Environmental Criteria for Road Traffic Noise* (EPA, 1999), *Industrial Noise Policy* (EPA, 2000) and *Assessing Vibration: A Technical Guideline* (DECC, 2006).

Heggies Pty Ltd (Appendix J) and Renzo Tonin and Associates (Appendix R) undertook noise impact assessments to determine the noise impacts of the Project and to assess compliance with the relevant DECCW guidelines for noise and vibration.

The assessments found that noise impacts from the Project would be effectively mitigated through the implementation of acoustic treatments.

13.4.1 Scope of noise and vibration assessment

Noise impacts associated with the Project have been assessed for all water cycle infrastructure components for the construction and operation phases. Noise impacts associated with the WRP, the bulk water pumping station and the reservoirs have been assessed at project level due to design of those infrastructure elements being sufficiently detailed at this time. For the sewage pumping stations, a noise assessment for project approval was conducted on SPS1 and SPS2, which would service Stage 1 of the Project.

Future assessments under the EP&A Act, potentially under Part 3A project application(s) or Part 4 development applications, would need to be undertaken for SPS3 and SPS4.

13.4.2 Existing environment

Nearby receivers

The study area largely comprises farming land both around and within its boundary. There are three sensitive residential receivers within the study area (this population would increase with the proposed subdivision and urban layout, the final details of which are yet to be determined[2]).

The proponent, CIC Australia, owns one of these receivers, the ‘Beltana’ property, and the tenants will leave the property prior to construction of the first subdivision (NH1A).

The other two receivers are likely to remain in their current location upon commencement of construction of the Project and may, therefore, be potentially affected by construction. These receivers, which are near the WRP site, are:

- The ‘Talpa’ property – located immediately north of Googong Dam Road.
- The Gorman property – located immediately west of the WRP site.

[2] *The subdivision of the study area is subject to approval under Part 4 of the EP&A Act. However, elements of the proposed layout are taken into account in this EA.*

Ambient background noise

Ambient background noise surveys were conducted (in February to March 2009) to characterise and quantify the acoustical environment in the area surrounding the Project.

Noise levels at the representative receiver sites were found to be low due to the predominantly rural nature of the study area, with identified sources being birds, distant vehicles, aircraft and livestock.

Bureau of Meteorology data from Canberra Airport weather station indicate that wind is not a significant contributor to background noise. There are no measurable industrial noise contributions within the study area.

Future ambient noise

The environment of, and surrounding, the study area will change throughout the life of the Project, as the development of the Googong township progresses to a largely urban landscape.

13.4.3 Assessment methodology

Noise guidelines

The noise assessment was prepared with reference to Australian Standard (AS) 1055:1997 *Description and Measurement of Environmental Noise*, Parts 1, 2 and 3 and in accordance with the DECC (formerly the EPA) *Industrial Noise Policy* (EPA, 2000 – the INP) and *Environmental Criteria for Road Traffic Noise* (EPA, 1999 – ECRTN). Where issues relating to noise are not addressed in the INP, such as sleep disturbance, reference was made to the *Environmental Noise Control Manual* (EPA, 1994 – ENCM).

For construction and operational vibration impact, the assessment was based on Assessing Vibration: A Technical Guideline (DECC, 2006).

Study objectives

The objective of the assessment by Heggies was to undertake a noise and vibration impacts assessment and recommend feasible mitigation strategies during construction and operation of the Project in order to:

- Outline impacts arising from construction activities for the water cycle infrastructure, including trenching, traffic movements, drilling and associated works.
- Understand potential noise impacts from the operation of the WRP and associated infrastructure, including pumping stations.
- Provide offset distances from the water infrastructure to residential homes that would satisfy the requirements of the documents and guidelines referred to in the Director General's Requirements.
- Provide the proponent with recommended mitigation measures that may be implemented during construction of the WRP and other infrastructure.

The objective of the additional study by Renzo Tonin was to provide an assessment of the revised layout of the WRP. This study also updated the assessment of construction noise, in accordance with new guidelines (*NSW Interim Construction Noise Guideline* (ICNG)).

Assessment criteria – construction noise

The aspects that were assessed, and the assessment criteria, are as follows:

- Intrusiveness – The assessment of intrusiveness impacts was based on noise criteria applicable to construction sites; the recommended maximum noise levels from construction for varying durations of activities are outlined in Table 13.10.
- Traffic – The assessment of traffic noise was based on criteria applicable to different road classifications as defined in the *Environmental Criteria for Road Traffic Noise* (EPA, 1999) and outlined in Table 13.11. The two roads that would be used to access the study area are Old Cooma Road and Googong Dam Road. Maximum peak noise levels have been used to assess traffic noise impacts, as there is generally so little traffic along Googong Dam Road that each vehicle driving past can be viewed as a separate event.
- Vibration – The construction activities expected to occur in the study area are likely to cause intermittent vibration at the nearest potentially affected facades. The assessment is based on various criteria in DECC (2006) for human and building response to vibration (maximum 115 dB linear for air blast overpressure and five millimetres per second (5mm/s) peak particle velocity caused by vibration).
- Blasting – The assessment of blasting impacts was based on ANZECC (1990) guidelines for assessing potential blast emissions impacts at residential and other noise and/or vibration sensitive receivers (as advocated by DECCW).

Table 13.10 Recommended noise levels for construction of varying durations

Duration of activity	Maximum LA10 noise levels
Up to 4 weeks	Background LA90 + 20dB
Between 4 and 26 weeks	Background LA90 + 10dB
More than 26 weeks	Background LA90 + 5dB

Table 13.11 Applicable criteria for different types of developments

Type of development/road	Criteria	
	Day (7am–10pm)	Night (10pm–7am)
Land use developments with potential to create additional traffic on existing freeways/arterials (Old Cooma Road)	LA_{eq}(15hr) 60	LA_{eq}(9hr) 55
Land use developments with potential to create additional traffic on collector roads (Googong Dam Road)	LA_{eq}(1hr) 60	LA_{eq}(1hr) 55

The above criteria were based on the assessment by Heggies (Appendix J). However, it should be noted that the criteria could have also been based on the *NSW Interim Construction Noise Guideline* (ICNG), as discussed by Renzo Tonin in Appendix R. Generally, the ICNG are less stringent than the previous guidelines in the *Environmental Noise Control Manual* (EPA). Thus, applying the precautionary principle, this assessment has been based on the more stringent EPA guidelines.

Assessment criteria – operational noise

The noise impact assessment involved considering the following noise characteristics, with the following criterion adopted:

- Intrusiveness – The assessment of intrusiveness is based on the criterion that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than five decibels above the measured background level (L_{A90}). This calculation is used to determine the project-specific noise level for intrusiveness, which for ultimate operation is 35 dBA.
- Amenity – The assessment of noise impacts on amenity is based on noise criteria specific to land use and associated activities for industrial-type noise. If the existing noise level from industry approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion. For rural residential amenity areas, the acceptable and maximum recommended $L_{Aeq(Period)}$ noise levels range from 40–50 dBA and 45–55 dBA from night to day, respectively. The range of criteria is used to determine the project specific noise level for amenity.
- Sleep disturbance – The assessment of noise impacts on sleep is based on the *Environmental Noise Control Manual* (EPA) recommendation that the $L_{A1(1minute)}$ noise level of the source under consideration should not exceed the background noise level (L_{A90}) by more than 15 dBA when measured outside the bedroom window of the receiver during the night-time hours. This assessment is also based on conclusions relating to sleep disturbance in the ECRTN.
- Vibration – The assessment of vibration is based on the various DECC (2006) criteria for human and building response to noise (see Chapter 4 of Appendix J).

13.4.4 Construction impacts

Potential noise impacts from construction (other than traffic noise)

Construction noise would occur for more than 26 weeks and would be above the DECCW guidelines. Table 13.12 shows the predicted noise impacts from construction activities (other than traffic noise).

Table 13.12 Construction noise impacts (calm weather conditions)

Activity	Construction noise goal (dBA) $L_{A10(15\ minute)}$	Predicted noise level (dBA) $L_{A10(15\ minute)}$
WRP earthworks and access road construction		
At 'Beltana' property	35	58
At Gorman property	35	51
At 'Talpa' property	35	62
WRP building works		
At 'Beltana' property	35	55
At Gorman property	35	48
At 'Talpa' property	35	59
Pipe laying		
At 250 m	35	56
At 550 m	35	45
At 750 m	35	40

Activity	Construction noise goal (dBA) $L_{A10(15\ minute)}$	Predicted noise level (dBA) $L_{A10(15\ minute)}$
BWPS construction		
At 'Beltana' property	40	50
At Gorman property	40	54
At 'Talpa' property	40	60
Reservoir construction		
At 'Beltana' property	40	38
At Gorman property	40	44
At 'Talpa' property	40	36

Potential noise impacts from construction traffic

For Stage 1 of the Project, maximum peak traffic noise is expected to exceed the construction noise criteria at the Gorman and Talpa properties. This would not be an issue for the Gorman property as they would both be sold and vacated by the time construction commences. A number of noise mitigation measures are provided below for the construction activities at the WRP site, which would reduce the noise impacts at the Talpa property.

At concept approval, future residents of the Googong township could potentially be exposed to some construction noise from the WRP during the final stages of commissioning. It is predicted that, at various times, noise from long-term construction activities at the WRP may exceed the DECCW guidelines at most locations around the project site. However, it is expected that localised construction noise from earthworks and building activities on the remainder of the site associated with subdivision works would be more significant.

Potential blasting and vibration impacts

The greatest potential for vibration impacts to occur would be from vibratory rollers and rock-breaking equipment during construction of the WRP and access roads. The Talpa residence would be about 200m from the nearest access road construction, and 120m from the WRP site. Measurements from similar developments (see Appendix J) indicate that the level of vibration with an offset distance of 200m would be below the level of human perception. If heavy rock-breaking equipment is used at the WRP site, vibration may be felt at Talpa, but would be within the DECCW vibration criterion (5mm/s).

In addition, preliminary geotechnical surveys have identified the presence of rock at the WRP site that may require blasting during construction. There is also a possibility that blasting may be required at the pumping station sites (SPS1 and SPS2) for the development of NH1A during Stage 1.

A detailed assessment of vibration from blasting or rock-breaking activities has not been made at this stage. This is due to the fact that detailed geotechnical studies have not been commissioned and, as such, the extent of rock that would require breaking is unknown. Also unknown at this stage is the construction methodology that would be used for rock-breaking activities.

Appendix J outlines a preliminary assessment for ground-borne and air pressure impacts resulting from blasting at the WRP site, based on typical values for explosive charges. It indicates that air blast overpressure levels at Talpa may be above the DECCW criteria, while vibration levels would be below. The assessment also indicates that heavy rock-breaking equipment would result in vibration levels below the DECCW criteria. Mitigation measures for vibration impacts during construction are provided below.

Mitigation measures during construction

The following measures would be implemented to reduce construction noise impacts:

- Should blasting be required, a blasting management plan would be developed in accordance with all relevant guidelines. It would include a strategy to consult with potential receivers.
- A construction noise management plan would be prepared and implemented prior to commencement of construction works. It would include:
  - Directives to keep equipment well maintained.
  - Directives to use 'quiet' practices when operating equipment (for example, positioning and unloading of trucks in appropriate areas).
  - Construction noise goals.
  - Recommendations for specific physical and managerial measures for controlling noise, noise and vibration monitoring programs and reporting procedures.
  - Measures for dealing with exceedances and mechanisms to provide ongoing community liaison.
  - A directive to appoint a liaison person to maintain relationships between the community and the contractor in accordance with AS 2436–1981 '*Guide to noise control on construction, maintenance and demolition sites'*. This directive would only come into force if noisy operations were to be carried out.
- Earth mounds not less than three metres high would be constructed on the northern and western perimeters of the WRP site. It is predicted that these mounds would provide 10–15 dBA noise reduction to the nearest existing residence (Talpa) and to future residents.
- A noise treatment plan would be devised for the nearest existing residences, including options for retrofitting improved noise insulating building elements, or property acquisition.
- Where construction is required outside of normal hours, approval would be sought from the relevant authorities. The need for this construction, and potential impacts, would be assessed on a case-by-case basis.
- If blasting is required for rock-breaking activities at the WRP or pumping station sites, a detailed blasting assessment would be conducted prior to blasting to determine the air blast overpressure levels and ground-borne vibration at the nearest receivers and propose appropriate management measures to be implemented during construction. This mitigation measure is reflected in the statement of commitments (N1A) in Chapter 18.

13.4.5 Operational impacts

Potential noise impacts

Noise modelling indicates that the proposed design of the WRP would be sufficient to limit operational noise to the project-specific noise level of 35 dBA (this is an acceptable noise level) near the site boundary, as shown in Figure 13.4. Since the land development adjacent to the WRP is still at the planning stage, the modelling results are defined in terms of the minimum buffer distance required to achieve the project-specific noise level. With the current design, and the mitigation and management measures discussed below, it is predicted that a 45m buffer zone would be required parallel to the WRP site boundary (see Figure 13.4 for the location of the buffer zone). The proposed acoustic treatment of the WRP and equipment is detailed in Appendix J (Table 23).

However, this represents an acoustically worst-case scenario and actual operational noise levels are likely to be less than those predicted for the majority of the time. Furthermore, the result is conservative, considering the land adjacent to the WRP is likely to contain larger residential lots, with the ability to be flexible when siting new buildings on the lot.

Predicted maximum noise levels from operation of the WRP during the night-time period are likely to meet the recommended sleep disturbance noise goal at all residences.

Due to the separation distance to residential and commercial premises, the level of vibration caused by the WRP is predicted to be below the level of human perception at any of the nearest premises and therefore below the criteria for 'minimal risk of cosmetic damage' at surrounding residential and commercial premises.

The pumping stations for sewage, bulk water and recycled water (all inside the WRP boundary) would be a minor source of noise, with pumps submerged in water and situated below ground level. Noise levels from these plant and equipment are likely to be below the background noise level.

Mitigation measures during operation

To achieve the project-specific noise level near the WRP site boundary, various acoustic treatments are proposed (and detailed in Appendix J – Table 23). These include:

- Installing louvers in the blower room and using minimum 150mm recast concrete for the blower room walls.
- Treating ceiling and side access doors, and providing sliding doors (or similar, to provide a positive seal) in the mechanical building.
- Enclosing odour vent fans, diaphragm and 'Flygt' pumps, actuator valves and inlet sieves.
- Installing silencers for exhaust stacks or vents servicing noisy equipment.

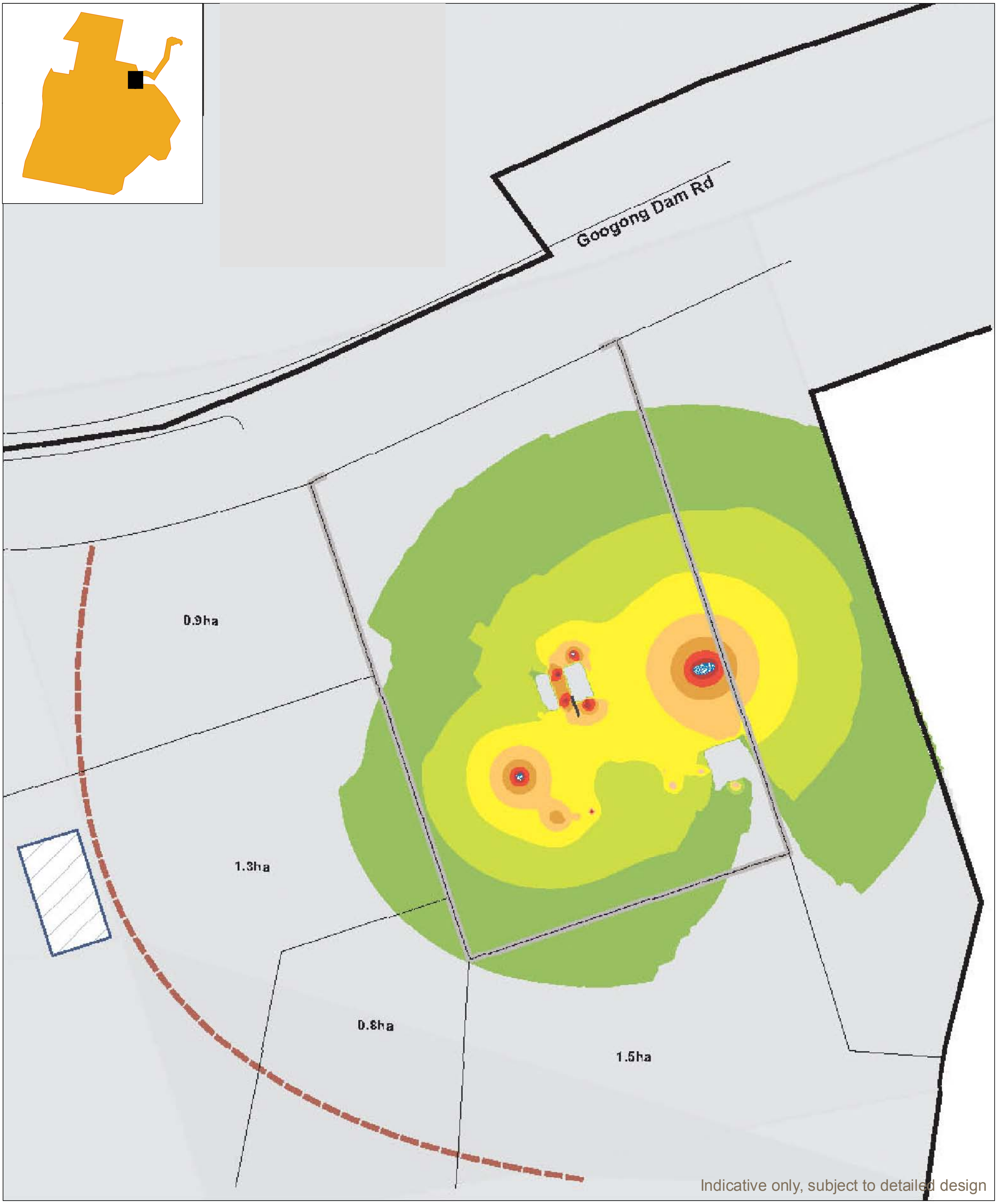
It is expected that when the plant is operational it would be feasible to fine-tune the noise control measures to ensure that the noise buffer is entirely contained within the WRP site boundary.

13.4.6 Conclusion

During construction, noise levels associated with several elements of the Project would impact on existing residences. However, these higher noise levels would largely result from a comparison to an existing rural landscape that is naturally quieter than the approved urban landscape of the future Googong township.

During operation, the main noise source would be the WRP. Potential noise impacts from the plant would be effectively mitigated through the implementation of acoustic treatments within the plant site.

Mitigation and management measures are reinforced in the statement of commitments (N1 and N2) in Chapter 18.



Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig13-4

Source Renzo Tonin, Brown Consulting

Noise level - Leq in dB(A)

. <= 25
25 < <= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < .

Proposed extent of built form
Indicative building envelope
Water recycling plant boundary
Study area

1:1,500

0 10 20 30 40m

Figure 13.4 Indicative noise contours - water recycling plant

Maunsell Roberts

13.5 Hazards and risk

Hazards and Risk – the EA shall include an assessment of the hazards and risk associated with the Project including details of hazardous materials used or kept on the premises during the construction and operation phases. The assessment must refer to the Department's guideline *Applying SEPP 33* (DUAP, 1994). If relevant, a *Preliminary Hazard Analysis* in accordance with the Department's Hazardous Industry Planning Advisory Paper No.6, *Guidelines for Hazard Analysis* must be included as part of the EA.

This section reviews the hazards and risks associated with the Project during construction and operation.

In general, the assessment found that the potential impacts would be minimal and that many features inherent in the design of the Project would manage these impacts.

13.5.1 Scope of hazards and risk impact assessment

Hazards and risks have been assessed at concept level in relation to the operation of the Project at ultimate development, and at project approval level in relation to construction and operational impacts for Stage 1.

13.5.2 Existing environment

The study area comprises predominantly agricultural land use, which results in a relatively benign hazard and risk landscape. There are few potentially impacted local residents and little development within the study area that provides an existing hazard.

However, as the development of the Googong township progresses, the potential hazards and risks to new residents becomes a consideration.

13.5.3 Methodology

Sherpa Consulting undertook an assessment of the Project (Appendix K) in accordance with *State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33)*. The report detailed the results of the screening process and review of the Project to determine whether a preliminary hazard analysis is required.

In addition, Evans and Peck facilitated a review of the overall risk identification and management for the Project. This involved workshops and reporting to identify, rank and assign treatments for likely risks associated with the Project. This was undertaken within the framework of Australian risk management standard, AS/NZS 4360:2004.

13.5.4 Construction hazards and risk

Potential construction hazards and risks would be associated with:

- Occupational health and safety of construction personnel, as well as the safety of passersby.
- Construction activities in the vicinity of roads.
- Construction near powerlines and other existing services.
- Environmental events, such as major storms, bushfires and the like.

These construction hazards and risks are considered typical of such projects and would generally be adequately managed by standard industry practices and procedures.

Risk management measures

Mitigation measures that would be mandated during construction would include:

- Implementation of appropriate safety and training procedures, such as safe work method statements, safety management plan(s), auditing of contractors' safety management and approval of construction equipment.
- A risk register and risk minimisation process.
- Implementation of a traffic management plan (see Section 13.1.6).
- Liaison with local emergency services, in particular regarding high fire-danger periods.
- Installing exclusion fencing where appropriate.

13.5.5 Operational hazards and risk

Chemical storage

The chemicals that are proposed to be stored at the water recycling plant and potable water storage reservoirs were assessed under the SEPP 33 screening process. Table 13.13 summaries the results of this screening, which determined that the quantities of each chemical stored on site would be below the relevant SEPP 33 thresholds. The polymer to be used for the Project is yet to be selected, but it is anticipated that the stored quantity would be below the SEPP 33 threshold. Therefore, a preliminary hazard analysis is not required.

Table 13.13 Summary of the SEPP 33 screening

Chemical name	Dangerous goods class	Packaging group	Quantity (L)	SEPP 33 threshold (L)	Determination
Water recycling plant					
Ferric sulphate (45%)	N/A	N/A	35,000	N/A	N/A
Magnesium hydroxide (58%)	N/A	N/A	25,000	N/A	N/A
Sodium hypochlorite (10–15%)	8	III	7,500	50,000	Quantity stored would be below SEPP threshold
Polymer (likely to be liquid)	Pending final polymer selection	Pending final polymer selection	500	Pending final polymer selection	Pending final polymer selection
Citric acid (50%)	N/A	N/A	1,000	N/A	N/A
Liquid sugar (66%)	N/A	N/A	20,000	N/A	N/A
Acetic acid (75%)	8	II	20,000	25,000	Quantity stored would be below SEPP threshold

Chemical name	Dangerous goods class	Packaging group	Quantity (L)	SEPP 33 threshold (L)	Determination
Potable water storage					
Sodium hypochlorite (10–15%)	8	III	4,000	50,000	Quantity stored would be below SEPP threshold

Source: Sherpa, 2009

Other hazards associated with the storage of chemicals relate to any reactions or incompatibilities between chemicals and to any potentially hazardous processing conditions, such as high temperatures and pressures. The material and safety data sheet (MSDS) was reviewed for each of the chemicals identified in Table 13.13. This review found that there is a risk associated with potential reactions between sodium hypochlorite and acids. This risk would be adequately managed by the measures outlined below.

Chemical transport

The SEPP 33 assessment (provided in Appendix K) reviewed the transport of Class 8 chemicals identified in Table 13.13. The thresholds contained within SEPP 33 indicate that where proposed numbers of ‘hazard materials vehicle movements’ are greater than 500 per year or greater than 30 per week, a transport route selection study is required. While the vehicle movements for the three chemicals classed as dangerous goods are yet to be finalised, it is expected that there would be between about 50–70 vehicle movements per year, with a maximum of about six vehicle movements in any given week. These estimates are well below the SEPP 33 thresholds. Therefore, a transport route selection study is not required (Sherpa, 2009).

Emergency and maintenance events

Potential operational hazards and risks associated with emergencies or maintenance activities include:

- Spills of chemicals, fuels and the like.
- Sewage overflows.
- Recycled or potable water discharge from the reservoirs into the stormwater system, either through dewatering of reservoirs for maintenance or unplanned overflows.

In addition, there would be general occupational health and safety issues for maintenance and operational personnel.

Risk management measures

A variety of measures would be implemented to manage the operational risks of the storage and delivery of chemicals associated within the Project. These measures are typical of those applied at similar facilities and include:

- Storing quantities of certain chemicals on site that are within the relevant thresholds.
- Undertaking activities in accordance with the relevant material and safety data sheets.
- Installing bunded areas for the storage and delivery of chemicals in accordance with Australian Standard AS 3780:2008 and the relevant material and safety data sheets.
- Developing and implementing appropriate procedures for delivering, handling and accidental spills of chemicals.

Measures associated with the management of risks from emergency or maintenance events associated with the system are largely engineering solutions, which, again, are typical of these types of installations and are detailed in the design. These measures include:

- Implementing back-up procedures should power to infrastructure be interrupted.
- Installing a first-flush tank at the WRP and wet well emergency storage at sewage pumping stations.
- Installing overflow structures at the WRP and sewage pumping stations.
- Implementing emergency management plans and undertaking ongoing liaison with the local emergency services.

13.5.6 Conclusion

Hazards and risks associated with construction and operation of the Project would be adequately managed by implementing industry standard measures. These would be detailed in the final design of the WRP and other infrastructure. Adherence to appropriate procedures and processes would be mandated in construction and operation contracts.

Mitigation and management measures are reinforced in the statement of commitments (R1 and R2) in Chapter 18.

13.6 Visual amenity

Visual Amenity – the EA shall include an assessment of the impact of the Project on visual amenity, particularly highly visible structures such as the proposed reservoirs. This assessment must include any proposed mitigation measures for visual amenity.

This section describes the existing visual environment and the changes that would occur as a result of the Project. It draws on the specialist studies prepared by Clouston and Associates (Appendix L).

The assessment focuses on the most highly visible structures, such as the temporary reservoir site at Hill 765 and the proposed permanent reservoirs at Hill 800.

The assessment finds that the proposed mitigation measures for the temporary reservoirs would need to be carefully implemented to ensure that the surrounding landscape is not compromised.

13.6.1 Scope of visual impact assessment

The visual assessment focuses on the areas affected by Stage 1 of the Project. It is based on a detailed desktop and site assessment of the infrastructure proposed for Stage 1.

The permanent reservoirs on Hill 800 were also assessed in detail, as this site was originally part of Stage 1 of the Project, and the design of the reservoirs is sufficiently detailed to enable assessment.

13.6.2 Existing environment

District landscape character

The landscape of the district is diverse. The topography of hills and mountain ranges provide backdrops to the north, east and south of the site. Varying landscapes include native bushland, narrow gullies and wide-open farmland valleys.

A large stone quarry lies one kilometre north of the site and the Googong Dam and associated infrastructure is visible to the east of the site from elevated viewing points along Old Cooma Road and Googong Dam Road. The dam is also a tourist attraction and is signposted as such in Queanbeyan town at the junction of Old Cooma Road and Googong Dam Road.

The vegetation of the district ranges from heavily timbered slopes and gullies to open, expansive valleys of pastureland, punctuated in places by single large native trees, groups of trees or stands of planted windbreaks.

Being mostly rural residential in nature, residential buildings in the immediate district are scattered and generally visually recessive in the landscape, often rendered most evident by associated windbreak plantings or groups of exotic tree species in the immediate vicinity of the residences.

Local landscape character

The site of the Project is located in the wider Queanbeyan River valley. The landscape of the site and immediate locality is dominated by the dramatic backdrop of various hill ranges including the Molongolo Range and Yarrow Peak to the east, Googong Hill and London Bridge Hill to the south and Faunce Hill to the north.

Key local views to the various parts of the study area are predominantly from Old Cooma Road and Googong Dam Road, which crosses contours running east from Old Cooma Road through cuttings and embankments, intermittently revealing and obscuring views of the site and locality. Land immediately to the north and east of the site falls away sharply into the Queanbeyan River Valley below Googong Dam, limiting any significant views to the site from this location.

The wide, mostly unvegetated Hill 800 (the site for the permanent reservoirs) to the southwest of the site for the first subdivision (NH1A) rises above the landscape and is the most dominant topographic feature within the study area, being highly exposed to local and middle-distance views from north, south, east and west. It comprises two peaks with a slightly lower ridgeline saddle between. The landscape of the hill comprises pastoral grasses on its slopes and a small number of individual mature Eucalypts on the lower slopes and at the base of the hill. The underlying rock outcrops widely on the surface of the crest of the hill. The hill is particularly visible from a one-kilometre length of Old Cooma Road to the west.

Hill 765 is the proposed location for the temporary reservoir site. It is situated on a small rise in the land south of the Old Cooma Road and Googong Dam Road intersection. Given its slightly elevated form and immediate proximity to Old Cooma Road, it would be described as highly visible.

Consequently, the site of the Project components have moderate to high visual accessibility from a range of locations at all points of the compass, although parts of NH1A are locally obscured from view by virtue of its varying topography. While a small number of existing residences have views to the various elements of the Project, the highest numbers of receptors viewing the Project site are from Old Cooma Road to the west of the site, which carries local traffic and tourist visitors to the area.

Water cycle infrastructure sites

The Project infrastructure addressed in the visual impact assessment comprises temporary and permanent works.

The temporary works comprise an array of four temporary reservoirs and associated infrastructure located on Hill 765

The permanent works comprise:

- A WRP on the north-eastern boundary of NH1A, comprising a series of low-rise buildings and an associated eight-metre-high ventilation stack. The landscape of the proposed WRP is primarily sloping ground in the form of a broad gully running south-west from Googong Dam Road. By virtue of this topography and aspect this area is not generally visible from Googong Dam Road or most of the key receptor locations for NH1A.
- A series of five water reservoirs located on the crest and saddle of Hill 800, with associated minor operational plant, chemical shed and an access road linking the site of the reservoirs with Old Cooma Road on the western side of the hill.
- In-ground pumping stations, each with one 150mm diameter, 12m high ventilation stack and minor aboveground construction. These pumping stations are surrounded by boundary fences.
- Underground pipework linking the reservoirs with the WRP along Old Cooma Road and Googong Dam Road as well as to the existing WRP that stands on a ridge to the north-east of NH1A and Googong Dam Road.

13.6.3 Methodology

Key visual receptors

The visual impact assessment involved identifying potential receptors within the vicinity of the study area to determine the extent of visual impacts. In the locality of the study area, the key visual receptors are:

- Occupants of existing residences, or users of associated gardens or farmland.
- Users of local roads, such as members of the local community, commercial vehicle drivers or tourists.

The locations of key visual receptors for the permanent and temporary works are shown in Figure 13.5.

Evaluation criteria

The visual impact assessment was based on a range of evaluation criteria, both quantitative (objective and measurable changes to the view and scene) and qualitative (subjective perceptions of the positive or adverse impacts of those changes based on the anticipated perceptions and experience of the different viewers/receptors).

Quantitative assessment

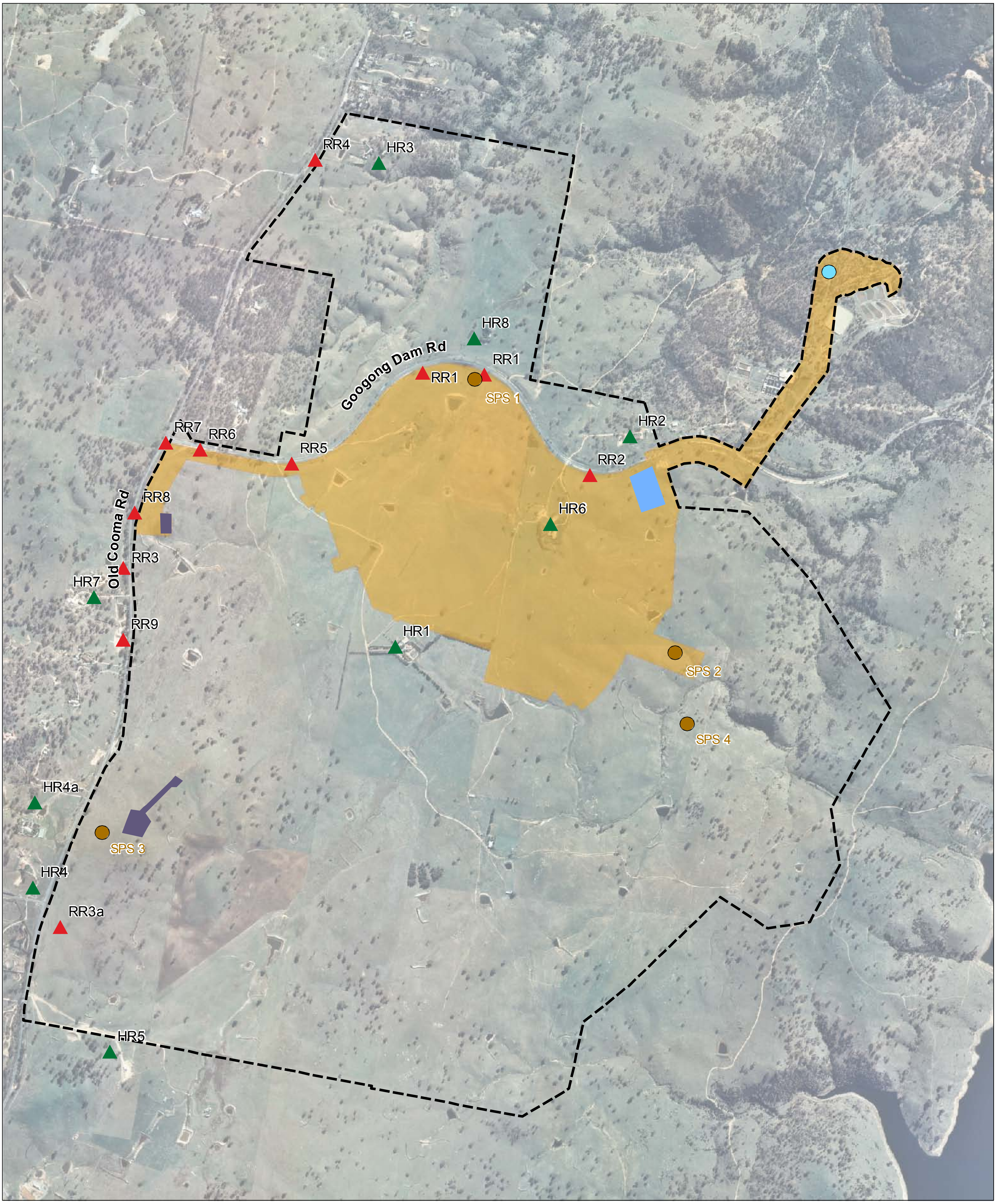
The quantitative evaluation criteria for each visual receptor include:

- Distance of the receptor from the heart of the site or Project.
- Quantum of view occupied by the development or Project.
- Duration of the view (ie would the view be from a fixed position or while passing by?).
- Magnitude of change (ie how significantly different would the Project be from the nature and form of the existing landscape?).

These elevation criteria are separately assessed on a five-point scale of high, high/medium, medium, medium/low and low. From the aggregated scoring of each of the above criteria, a total assessment of quantitative visual impacts is determined.

Qualitative assessment

Given that consultation with all of the existing and future visual receptors is not viable or practical, an assessment of the perceptual visual impacts is based on a professional evaluation of the likely receptor sensitivity (ie is the receptor viewing the development as part of their domestic or working life or is the view periodic/occasional). This experiential context affects how the qualitative impacts are perceived by the receptors, with respect to their perception of the altered view.



Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig13-5

Source Brown Consulting, MWH

Bulk water pumping station
Sewage pumping station
Water recycling plant
Permanent and interim reservoir area
Study area
Subject site
House receptor location
Road receptor location

1:20,000

0 150 300 450 600m

Figure 13.5 Visual receptors

Maunsell Roberts

13.6.4 Construction impacts and mitigation measures

Several elements may be visible during the construction period that would either be present for a limited period after the construction is complete or completely removed. They are expected to have a negligible impact. These include:

- Construction signage and fencing.
- Stockpiling and temporary erosion control measures.
- Major construction vehicles accessing and exiting the sites.
- Disturbance to ground for earthworks.
- Lighting of construction during dark hours and for security.
- Pipework construction.

13.6.5 Operational visual amenity impacts and mitigation measures

Overall impacts of water cycle infrastructure

The overall visual impacts are shown in Table 13.14. (A detailed visual impact analysis is in Chapter 5 of Appendix L).

Table 13.14 Visual impacts of the Project during operation

Level of impact	Views affected
High	• Views of the permanent reservoirs on Hill 800 from the residences immediately to the west of Old Cooma Road (house receptor HR4). • Views of the temporary reservoirs from Old Cooma Road, south of the Googong Dam Road (road receptor RR8).
Moderate to high	• Views of the permanent reservoirs on Hill 800 from Old Cooma Road, immediately to the west of the hill driving south and north (road receptors RR3 and RR3). • View to Hill 800 from house receptor HR1 and house receptors to the north of Fernleigh Drive HR4a. • Depending on exact alignment of the pipeworks along Old Cooma Road (resulting in removal or retention of trees), impacts could be moderate to high for receptors using the road south of Googong Dam Road junction at road receptor RR3. • Views of the temporary reservoirs on Old Cooma Road from immediately north and south of Hill 765.
Moderate	• Views of temporary reservoirs from 904 Old Cooma Road.
Moderate to low	• View to WRP stack (potential, subject to exact final location of stack) from house receptor HR2. • View to Hill 800 from house receptor HR3. • View to Hill 800 from house receptor HR5. • View to Hill 800 from house receptor HR6. Buildings would be removed when NH1A is built. • View to SPS1 from Googong Dam Road, near road receptor RR1. • View to WRP from road receptor RR5. • View to northern pumping station stack (potential, subject to exact final location of stack) from upper levels of house receptor HR8. • Views of temporary reservoirs from the residence at 904 Old Cooma Road.
Low	• All other listed receptors.

Water recycling plant

The location of the proposed WRP and its associated stack – on relatively steep land with a westerly facing aspect – limits its visibility from within NH1A, from nearby existing residences or from Googong Dam Road. Its visual impact would therefore be very limited.

No significant mitigation measures are required, but the following measures would be implemented:

- Buildings would be designed to be lightweight in appearance.
- The eight-metre vent stack would sited so as to minimise its visibility.

These mitigation measures would be included in the design development process for the Project.

Underground pipework and pumps

The alignment of the proposed underground pipework that would link the water tanks on Hill 765 with NH1A during Stage 1 of the Project and then Hill 800 at ultimate development, and the existing water treatment plant north of Googong Dam Road would not be visible once construction is complete and the landscape over the covered pipework has been established.

To minimise impacts, the following measures would be implemented:

- The final alignment of the pipework route would be carefully selected where it adjoins Old Cooma Road and Googong Dam Road. The alignment would be based on, where possible, the maximum retention of existing roadside trees.
- The minor visual impacts of the pump stations would be addressed by careful siting of the structures and strategic tree planting, which would be integrated in the landscape design for the site.
- Where any significant trees or groups of trees are lost, new tree groups would be planted as early as possible. New planting would be protected from any damage during pipe construction.

Bulk water pumping station

There would be no visible differences to the existing water treatment plant when viewed from Googong Dam Road after the bulk water pumping station is constructed and connected to the existing pipeline. Therefore, no formal mitigation measures are proposed.

However, the linking pipework would cross an open ridge between Googong Dam Road and the water treatment plant, and this would require appropriate post-construction landscape rehabilitation.

Temporary reservoirs on Hill 765

The temporary reservoirs on Hill 765 would have a high visual impact as the site lies within 100m of Old Cooma Road. While these reservoirs would be temporary, they may still be in place for five to seven years during Stage 1 of the Project.

Figure 13.6 is a photograph of the existing Hill 765 when viewed from road receptor RR8. Figure 13.7 is an indicative view of how the site would be viewed once the temporary reservoirs are constructed. Figure 13.8 shows the areas within the subject site and surrounding land that would be potentially visually impacted by the temporary reservoirs.

Figure 13.6 Existing view to Hill 765 at road receptor RR8

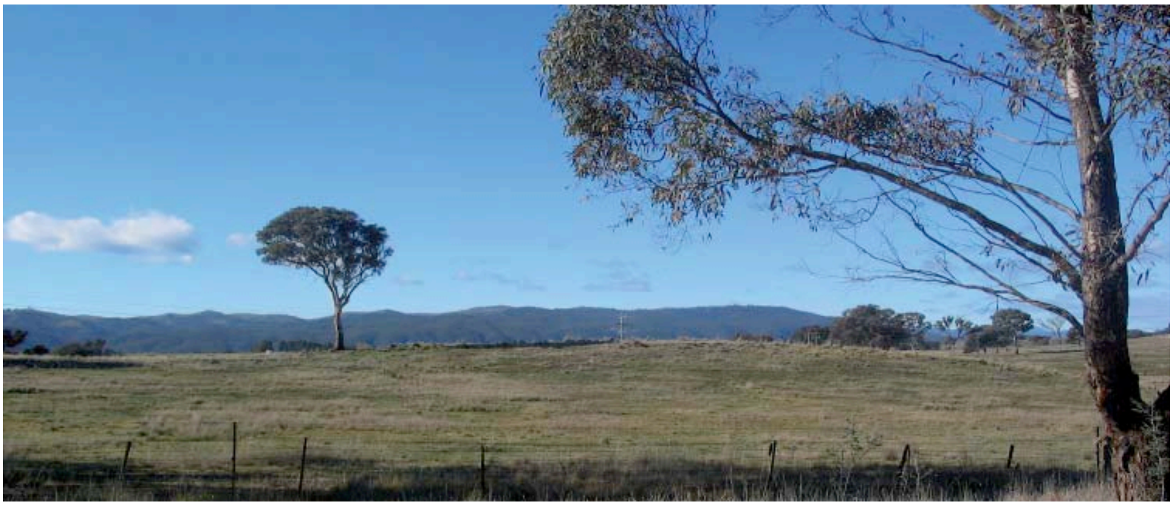
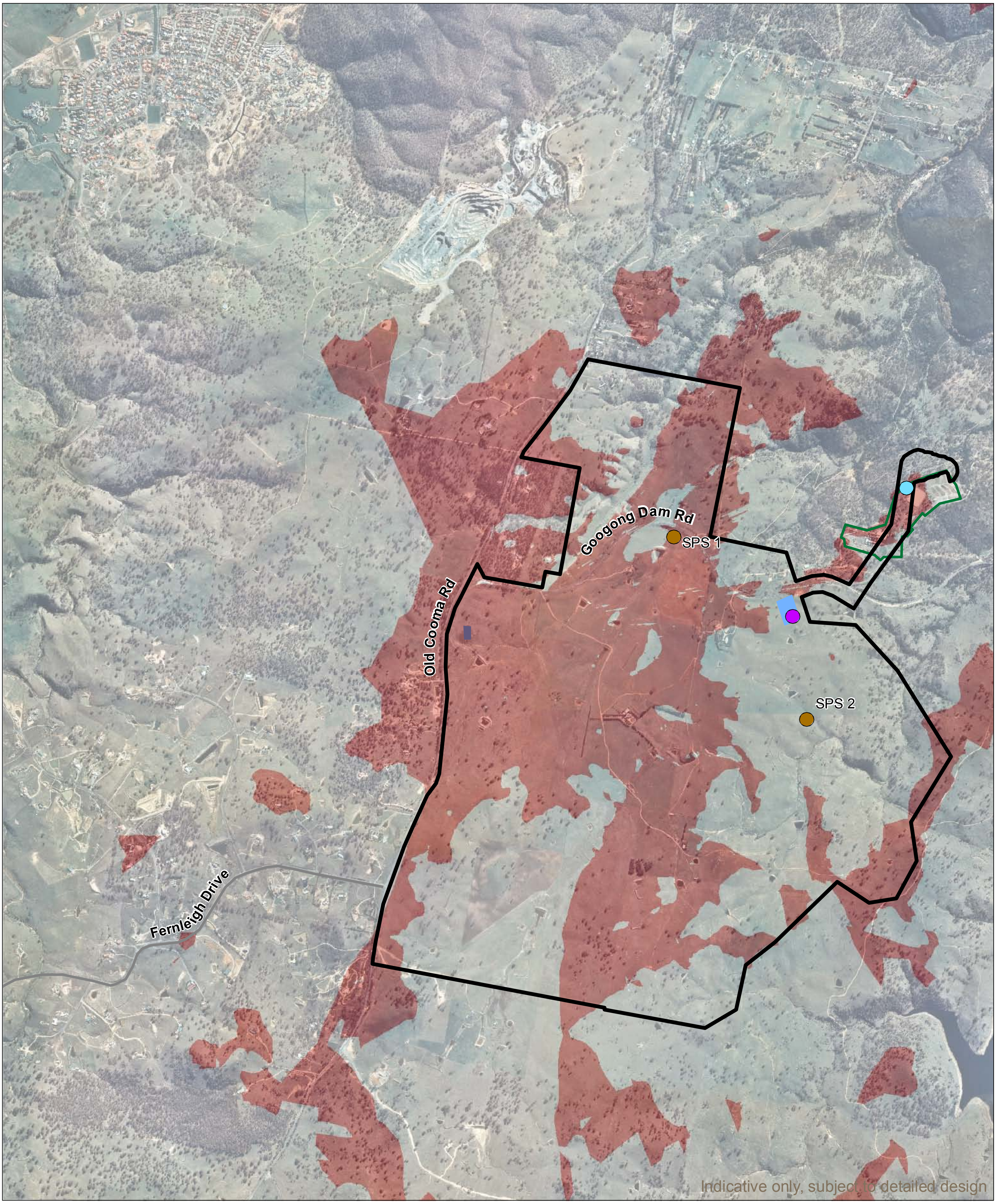


Figure 13.7 Indicative view of the temporary reservoirs on Hill 765 when viewed from road receptor RR8



Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig13-8

Source Brown Consulting, MWH

- Bulk water pumping station
- Recycled water pumping station
- Sewage pumping station
- Areas with visibility to interim reservoirs
- Existing ACTEW Googong water treatment plant site
- Water recycling plant
- Interim reservoir area
- Study area

1:30,000

0 250 500 750 1000m

Figure 13.8 Visual amenity - interim reservoir site

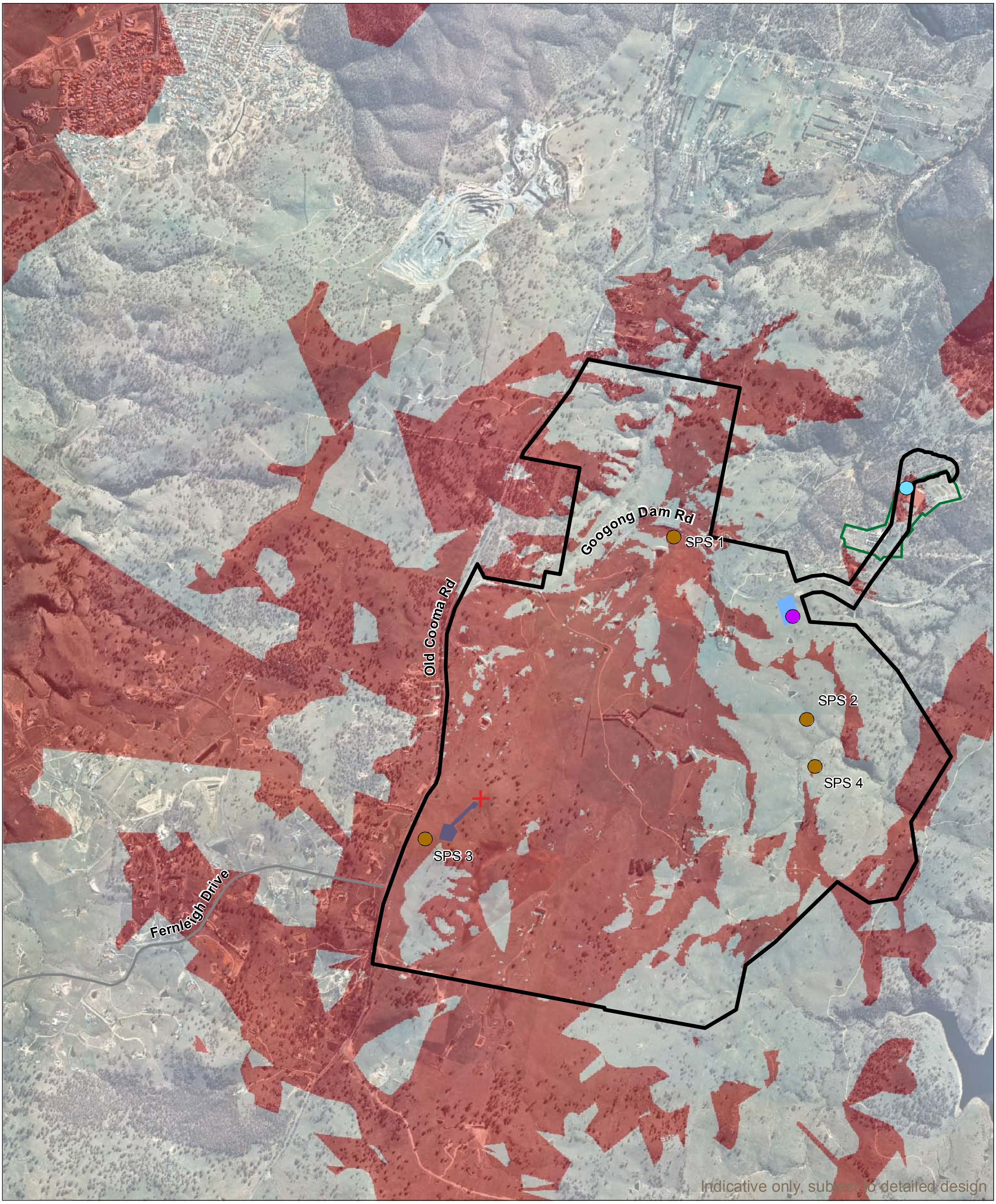
Manidis Roberts

Reservoirs on Hill 800

The most significant visual impact of the Project would be the proposed array of reservoirs and associated plant and access routes on Hill 800. Figure 13.9 is a photograph taken showing the existing view of Hill 800 from road receptor RR3, while Figure 13.10 is an indicative view of what the reservoirs would look like from the same location. Figure 13.11 shows the areas within the study area and surrounding land that would be potentially visually impacted by the reservoirs on Hill 800. The location and scale of the reservoirs is directly driven by the need for elevation to achieve a gravity-fed water reticulation system.

Figure 13.9 Existing view of Hill 800 from Old Cooma Road (looking south)

Figure 13.10 Indicative view of permanent reservoirs on Hill 800 from Old Cooma Road



Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig13-11

Source Brown Consulting, MWH

Hilltop
Bulk water pumping station
Recycled water pumping station
Sewage pumping station
Areas visible from hilltop
Existing ACTEW Googong water treatment plant site
Water recycling plant
Reservoir area
Study area

1:30,000

0 250 500 750 1000m

Figure 13.11 Visual amenity – permanent reservoir site

Maunsell Roberts

13.6.6 Mitigation measures during operation

The following mitigation measures have been developed for the temporary and permanent reservoirs, which are the elements of the Project that would have the highest visual impact.

Mitigation measures for the interim reservoirs on Hill 765

While these reservoirs would be temporary, they may still be in place for five to seven years. The most effective mitigation would be to plant groups of trees on the roadside and at points between the road and the tanks. This planting would reflect the random tree groups that exist in this landscape and limit direct views to the reservoirs. These trees would be planted when practicable before construction where they are outside the interim reservoir construction footprint. In areas within the construction footprint, trees would be planted as part of the remediation process after construction. The colour of the interim reservoirs would be painted in muted colours to help blend in with the surrounding landscape.

Mitigation measures for the permanent reservoirs on Hill 800

It is a complex challenge to select appropriate measures to address the significant visual impacts of the proposed reservoirs on Hill 800 and the saddle ridge to its south. Table 13.15 outlines a range of impact mitigation options.

Table 13.15 Visual impact mitigation options for the permanent reservoirs

Option	Objective	Approach	Mitigation Implications
1	**Accept**	**No treatment** Locate reservoirs as required for operational purposes with no treatment to reservoirs or associated infrastructure.	**Advantages:** Least disruption to existing hilltop appearance and least cost. **Disadvantages:** No reduction of the visual impact of the reservoirs.
2	**Alleviate**	**Minor/moderate treatment** Plant native tree groups at various locations at and below the crest of the hill to reduce views. Paint reservoirs in muted/recessive colours.	**Advantages:** Minimal disruption to the hilltop. Impacts of the reservoirs reduced from various views in a manner compatible with the existing landscape character. Limited costs. **Disadvantages:** Achieving healthy tree growth may be technically challenging on shallow soil and exposed hilltop, potentially taking some years to achieve optimum effect. Some views not obscured (this is not a screening approach).
3	**Celebrate**	**Moderate/major treatment** Paint the reservoirs either in strong colour(s) or with artwork accompanied by bold plantings.	**Advantages:** Minimal disruption to the hilltop reverses concept of reducing visibility and is easily modified over time. A popular community initiative. **Disadvantages:** Challenge to achieve artwork that is equally effective at close and long distance. May be controversial within the community.
4	**Accentuate**	**Major treatment** Apply architectural treatments to reservoirs and associated plant and undertake ground modelling and planting.	**Advantages:** Minimal disruption to the hilltop reverses concept of reducing visibility. Strong design statement for the development. **Disadvantages:** Challenge to achieve design that is equally effective at close and long distance view. Potentially very expensive.
5	**Reduce**	**Major treatment** Excavate more deeply into the hilltop to create a lower platform for reservoirs, to reduce their visibility from all views.	**Advantages:** Most significant reduction in visual impact with no other treatment required. **Disadvantage:** Major disruption to the hill, significant excess in cut/fill balance required to be used for landform. Significantly most expensive option for level of reduction gained.

Alleviation (option 2) is the preferred mitigation measure. The primary focus of this technique is to achieve sound design outcomes that complement the adjoining landscape, rather than masking the reservoirs completely. Therefore, measures such as screening (through dense planting surrounding the reservoirs) would not be adopted, as it would draw attention to, rather than obscure the reservoirs.

Alleviation is most compatible with the existing landscape character, demonstrated in Figure 13.10, where the indicative view of the reservoirs is partially alleviated by random trees that already exist across the landscape. This indicative view also shows that painting the reservoirs in natural, muted colours further enhances alleviation.

Alleviation of the permanent reservoirs would be achieved through:

- Planting informal groups of native trees, carefully sited on slopes and crests of Hill 800 and its southern saddle to mitigate views from key visual receptors and viewing points.
- Carefully siting the associated plant and access road for the reservoirs.
- Assessing the need for off-site planting before commencing consultation with Council (for roadside tree plantings) and or/affected property owners for mitigation plantings on their properties.
- Overcoming technically challenging conditions by commencing off-site planting and preparation during early stages, as well as identifying tree species and planting techniques during the detailed landscape design process that would be most suited to the physical conditions of Hill 800. These would be similar species to those that already exist in the region.
- Painting the reservoirs in muted or recessive colours at the completion of construction.

With respect to design development of the reservoirs and the associated access road, it is important to ensure that the landscaping approach addresses:

- The most appropriate finished landform profile of the top of the hill that integrates the reservoirs.
- The detailed siting and design of any elements over and above the reservoirs (plant equipment, fencing, signage, lighting etc) to minimise visibility.
- The access road alignment so that it is a careful balance of limited visible road profile and minimised cutting/embankment visibility where following contours.
- The location and extent of tree groups so they best mitigate impacts.
- Soil and microclimate factors and amelioration of soil profiles to ensure healthy and rapid tree growth.

Off-site mitigation and compensation would be implemented in situations where the view of the proposed reservoirs from nearby properties cannot be mitigated through alleviation. While on-site mitigation measures described above would substantially reduce the impacts on surrounding properties, consultation with property owners would also take place to establish whether additional plantings on their site boundary would assist mitigation from their perspective.

13.6.7 Conclusion

While the infrastructure associated with the Project would be part of the urban environment of the Googong township, certain elements would have a visual impact on residents and visitors (current and future). The largest impact would be from the temporary and permanent reservoirs on Hill 765 and Hill 800, respectively.

Visual impacts of the reservoirs on Hill 800 would be mitigated through alleviation, following the recommendations outlined in the visual impact assessment.

Mitigation and management measures are reinforced in the statement of commitments (V1 and V2) in Chapter 18.