Additionally, it has been assumed that the bulk of emissions would likely be associated with the movement of heavy vehicles along haulage routes within the construction site boundary. It is not considered likely there would be a significant impact on local air quality due to the distance between sensitive receptors and emissions sources, the diffuse nature of emissions and the broad area over which emissions would occur.

Notwithstanding this, the air quality management plan for construction would include appropriate measures to reduce these emissions where practicable. Maintenance of plant in accordance with manufacturers recommendations and switching off plant when not in use are examples of management measures that could be implemented.

### 16.2.6 Emissions from road construction activities

Emissions from road construction activities are expected to be generally similar to those associated with dam construction activities though on a smaller scale and varying over time as specific work phases are completed in individual locations. The potential for emissions would progressively decrease over time as the area of bare ground is reduced as the road pavement is constructed.

The greatest potential for dust emissions would occur following land clearing and during the early stages of construction when movement and stockpiling of unconsolidated material would take place. Dust emissions would be associated with wind erosion from unsealed surfaces and exposed stockpiles, and with wheel generated dust from the movement of heavy machinery, etc. Emissions from these localised sources would be readily controlled through mitigation measures such as watering of exposed surfaces and covering of stockpiles.

Potential air quality impacts associated with the realignment of Salisbury Road were considered by simulating emissions from the construction activities as a line source over the worst case period and for the most likely affected receptors. The period used was the same for the predicted maximum particulate and TSP concentrations from emissions associated with the principal dam construction activities. The predicted contours for the $PM_{10}$ daily averaged ground level concentrations are provided in Figure 16.14.

These show that the $PM_{10}$ daily averaged ground level concentration at the nearest sensitive receiver (13) would be between 25 µg/m$^3$ and 35 µg/m$^3$. This would not exceed the DECC GLC criterion.

### 16.2.7 Emissions from operational activities

**Traffic**

The main concern with regard to potential traffic-related emissions is the possible increase in the number of vehicles travelling along Salisbury Road (possibly associated with potential recreational activities on and around the storage). The realigned section of Salisbury Road would be closer to some residences than previously. The main air emissions of potential concern in relation to this are CO, $NO_x$, $PM_{10}$, $PM_{2.5}$, VOCs and heavy metals.

Annual average daily traffic flows are expected to increase to approximately 375 vehicles per day by 2023 from the current average of 280 vehicles per day. This could vary substantially depending on the type of development that might occur around and in the vicinity of the storage. Less than one per cent is expected to comprise heavy vehicles. This level of growth is not expected to significantly impact on receptors.

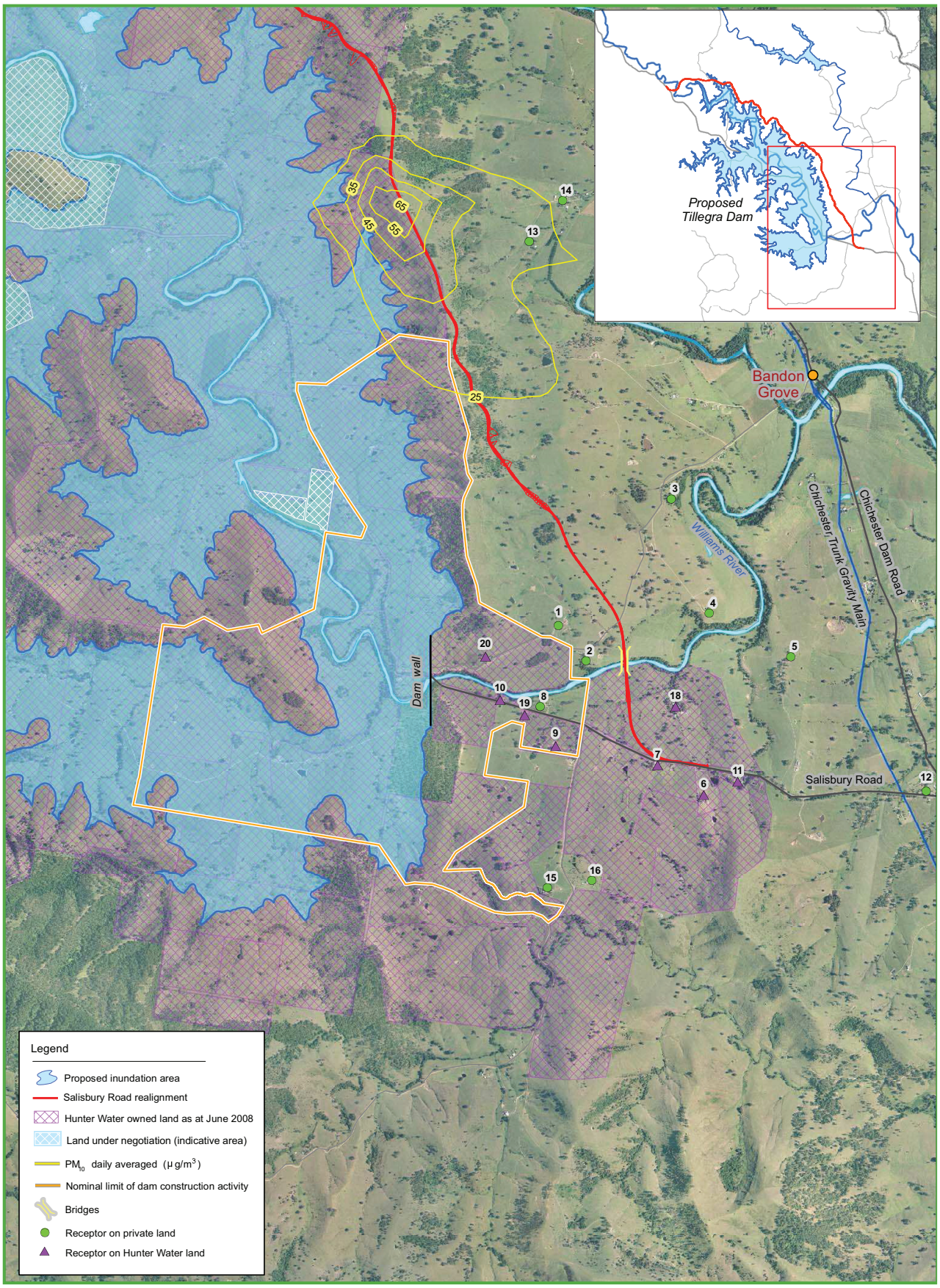


**FIGURE 16.14** SALISBURY ROAD $PM_{10}$ DAILY AVERAGED

It is considered that this level of traffic would not lead to any significant air quality impacts on the receptors in the Project area. This conclusion is based on the findings of an air quality assessment that modelled pollutant emissions from Port Wakefield Road, a major arterial road in South Australia that experiences significantly higher levels of traffic flow and congestion than would be experienced along Salisbury Road. This assessment demonstrated that the expected emissions from 43,400 vehicles per day would not lead to any exceedances of the ambient air quality criterion at the exposed sensitive receptors and predicted the likely ground level concentrations of NEPM criteria pollutants including $PM_{10}$, $PM_{2.5}$, $NO_x$ and air toxics (Consulting Environmental Engineers 2007).

**Dam operation**

Air emissions from dam operations are expected to be negligible. Emissions would be related mainly to maintenance activities such as vegetation control using petrol-powered equipment such as weed slashers. There would also be a very small level of emissions associated with the use of motor vehicles to travel around the storage. These are not considered significant. It is expected there would be a minimal post-construction air quality impact from the proposed Project.

### 16.2.8 Mitigation and management measures

During construction, monitoring would be undertaken at appropriately representative locations to assist in maintaining air emissions within regulatory limits, particularly for adjacent receptors.

These monitoring activities would be undertaken within the framework of an air quality management plan which would form part of the overall construction EMP. The following mitigation measures would be incorporated into this plan (noting that some of these are not specific to managing air quality) to minimise air quality impacts from construction activities:

- construction activities would generally be limited to Monday to Saturday between 7.00 am and 6.00 pm
- development of a construction traffic management plan to require all truck drivers, contractors and mobile plant operators to use designated vehicle access routes
- position frequently trafficked haulage routes as practicable from potentially affected private residences
- seal heavily trafficked areas if dust generation is affecting residents
- restrict vehicle speeds on unsealed routes to minimise wheel-generated dust
- minimise diesel engine idle times and queuing
- installation of truck cleaning stations at site boundaries to minimise offsite transport of material which could cause dust emissions
- covering of all truck loads carrying spoil and other construction materials with potential for dust emissions
- limiting truck loads to a vertical height no greater than 0.5 metres above the side walls of the vehicle
- maintenance of all fossil-fuelled plant and equipment to facilitate efficient operation
- installation of appropriate emission control mechanisms to minimise emissions
- undertaking regular watering of exposed surfaces including stockpiles, unsealed roadways, dry/fine material in regions within blasting/drilling areas
- covering/protection of areas susceptible to significant dust emissions from wind erosion
- locate stockpiles as far away from sensitive receptors as practicable

- use of natural landforms to shield exposed areas and dust-generating construction activities from prevailing strong winds blowing towards sensitive receptors
- use of water sprays on all conveyor transfers on concrete batching operations to minimise dust emissions
- minimise drop heights of conveyor transfer systems and other material transfer systems to control visible dust
- installation of emission control devices on concrete batching/crusher plants
- restrict/cease activities with high dust-generating potential during periods of strong winds blowing towards sensitive receptors
- consideration of potential for dust emissions as part of blast design
- engagement of the affected community such as by responding to queries regarding construction methodologies and responding to complaints/concerns offered by community members
- provide regular updates to community members to inform them of upcoming work that could result in any increased levels of emissions.

The above list is not exhaustive and would be subject to applicable conditions attached to the Project approval and other licences, permits, etc which may be required.

## 16.3 Traffic and transport

### 16.3.1 Key features of the existing environment

The main access routes for the Project (Figure 16.15) comprise MR101 (Dungog Road), MR301 (Seaham Road and Clarence Town Road), local streets through Dungog, Chichester Dam Road and Salisbury Road. Southwest of the Wirragulla intersection with MR301, MR101 (Dungog Road) would not be a key access route, particularly in regard to the movement of heavy machinery or general haulage. However, occasional and incidental use of this road from Maitland/Paterson or any other public road by small business servicing the primary construction contractors cannot be ruled out.

The key features of each of these routes are described as follows.

**MR101**

MR101 is predominantly a north-south route which provides connection between the New England Highway at Maitland. MR101 passes through suburbs of Lorn and Bolwarra and the towns of Paterson and Martins Creek through to the township of Dungog. It is a two-lane Regional Road within the RTA hierarchy of the State Road Network.

Pavement conditions range from substandard to reasonable quality although some sections show evidence of extensive pothole repairs and deformation. Road safety issues generally relate to narrow and undulating sections of road that contain inadequate guard rail protection for steep embankments. The route carries an Annual Average Daily Traffic (AADT) volume of approximately 940 vehicles per day.

**MR301**

MR301 is predominantly a north-south route that provides an approximate 52 kilometre link between the Pacific Highway at Raymond Terrace and the community of Wirragulla, south of Dungog. The route passes through the Port Stephens suburbs of Nelsons Plains and Brandy Hill, as well as Seaham.

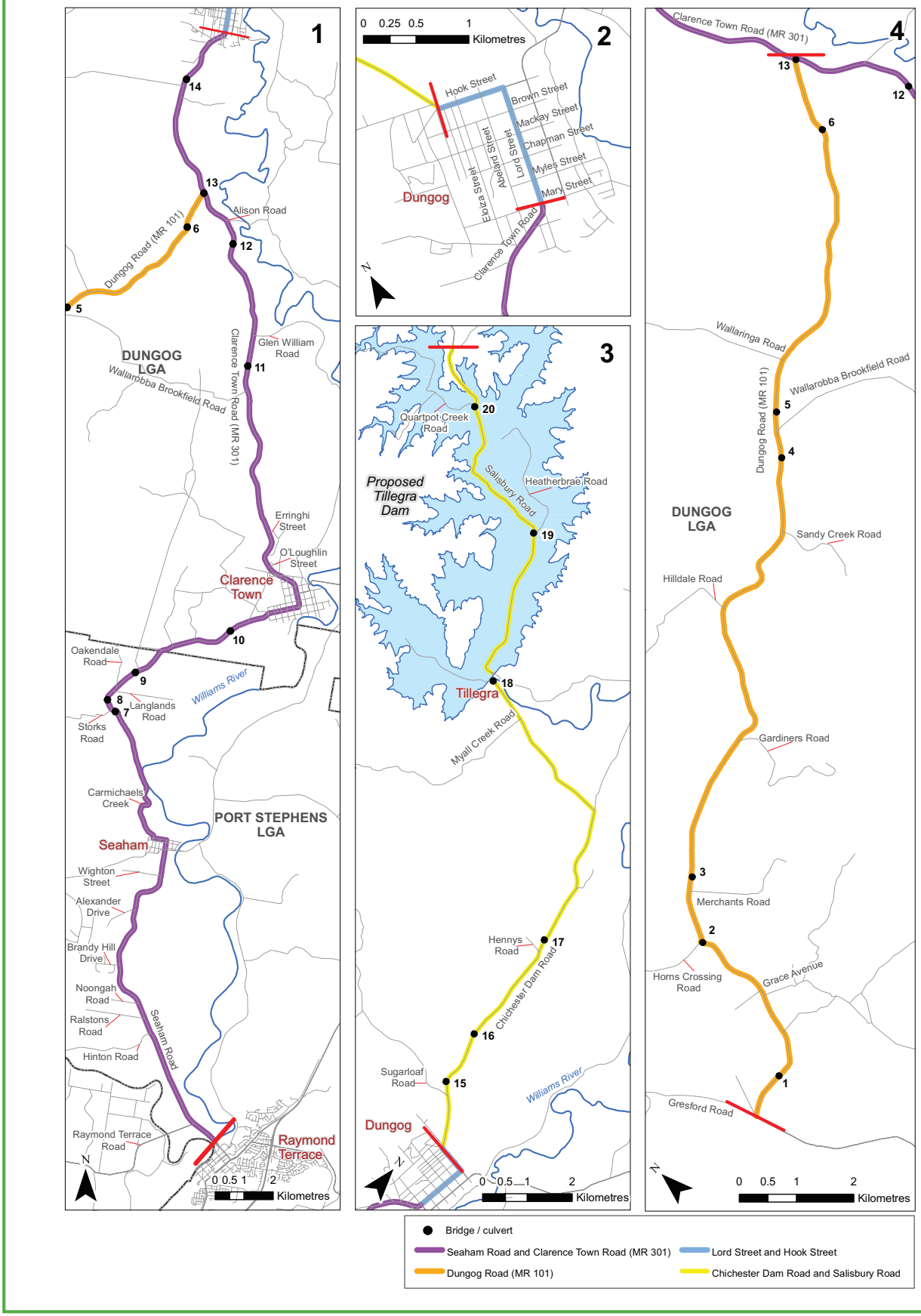


**FIGURE 16.15** MAIN ACCESS ROUTES TO THE PROJECT SITE

Pavement conditions are of reasonable quality although some sections display severe deformations such as at Carmichaels Creek and the length of Queen Street in Clarence Town. Road safety issues mainly involve old timber fencing being use to protect steep embankments. MR301 carries an AADT volume of about 1,800 vehicles per day.

**Dungog local streets**

Roads and streets within the township of Dungog are generally set out in a north-south and east-west grid pattern. On the immediate approach to the town, MR101 turns right from Lord Street into Mary Street and then left into Dowling Street, which is the main street through the town centre. At the northern end of Dowling Street, Hooke Street runs in a westerly direction toward the northwestern extremity of the town.

Lord Street continues north from Mary Street, parallel to Dowling Street where it then intersects with Hooke Street. Lord Street is a wide street with some residential frontages but has other adjacent land uses such as parks and commercial buildings.

Pavement conditions are generally good for local roads within the township. The intersection of Brown Street and Lord Street displays deteriorated pedestrian markings.

**Chichester Dam Road**

Chichester Dam Road runs from the western end of Hooke Street, heading north from Dungog. Approximately 10 kilometres north of Dungog it intersects with Salisbury Road at Bendolba. It then continues past Bendolba for about another 15 kilometres eventually reaching Chichester Dam.

The road is approximately 6-7 metres in width to accommodate a single lane of traffic in each direction but there is no centre line marking or defined shoulder. Three bridges are located along the road. Two are small and unnamed with a third, significantly older, located at Myall Creek.

The pavement condition is of reasonable standard. Few sections have high concentrations of repaired potholes. Road safety issues relate to crests with poor sight distance, roadside objects within the clear zone and narrow bridge widths.

**Salisbury Road**

Salisbury Road would be the primary access route to the proposed dam site. The road is about 6-7 metres wide with one lane in each direction. There are no line markings along the entire length. There are four waterways along the road crossed by bridges in varying conditions. Munni Bridge is considered to be of particular concern with inadequate barrier protection.

Pavement condition is considered to be generally satisfactory for rural access road usage. Road safety issues relate to adverse road curvatures not properly signposted leading to poor delineation and embankments not properly protected.

### 16.3.2 Construction impacts

The amount of material needing to be transported to the dam construction site is considerably less than many other major construction projects of an equivalent nature as the majority of construction materials for the dam would be quarried from borrow pits within the proposed inundation area and processed on site. Nonetheless, a considerable volume of material would still be required to be delivered to the construction site by road.

An estimate of the likely number of construction vehicle movements has been derived from estimates of construction material quantities that would need to be brought to the site. This incorporates a 20 per cent allowance for uncertainty. Based on a six–day working week (Monday to Saturday), the average peak number of heavy vehicle movements (two way) would be approximately nine per day over the total construction period. There would also be light vehicle traffic on these routes associated with construction workforce commuting.

The increased number of vehicles (principally heavy vehicles) associated with construction of the dam and related infrastructure (including the relocation of Salisbury Road) could have adverse impacts on road pavements on access routes, many sections of which are already in a poor condition. The magnitude and nature of these impacts would, to a substantial degree, be influenced by the existing condition of roads in terms of the current condition of the road pavement and the existing layout.

Existing traffic movements on MR101 and MR301 average about 1,800 vehicle movements per day with about 270 of these relating to heavy vehicles. Some sections of the road, such as from the intersection of MR101/MR301 to Dungog carry traffic as high as about 2,200 vehicle movements with 467 of these attributable to heavy vehicles.

On this basis, the increase in heavy vehicle movements generated by the project equates to an approximate annual increase of about three per cent over the life of the Project, dependant on which section of road is examined and the final staging of construction work. An increase of this magnitude is unlikely to have significant impacts relevant to the ongoing maintenance or safety, however, it would be prudent for this issue to be managed on an ongoing basis by HWC.

With a project of this magnitude, at times there would be a need to deliver oversize plant and materials outside of normal working hours. These movements would be conducted in a controlled manner with all necessary safety and traffic management measures in place. Planning for these would include appropriate consultation with the RTA and relevant councils. It is anticipated that these movements would be infrequent and largely confined to the early and finishing stages of the Project.

The location of the proposed dam would sever the existing Salisbury Road at Tillegra which, if not mitigated, would affect access to properties further up the Williams River catchment. Alternative access would be available via Salisbury Gap Road, however, this would necessitate travelling from the Gresford/East Gresford locality which would be a substantial additional distance compared to the existing access. This particular impact would be mitigated by the provision of a temporary access around the dam construction site, part of which would also form part of the southern section of the realignment of Salisbury Road.

This bypass may also be used at times by construction traffic to move more efficiently around the construction site. Any such use by construction vehicles would be in accordance with all applicable road regulations and in accordance with a Project-specific construction traffic management plan.

Construction of some components of the Project such as the CTGM water transfer pipeline may temporarily affect access to some properties. In all such cases, temporary (or permanent if required) access arrangements would be made in consultation with the affected property owners.

A detailed description of the anticipated access routes is provided in Section 2 of Working Paper I *Roads and Other Infrastructure*. The routes traverse several built up areas, notably Seaham and Clarence Town as well as Dungog. There are a number of public facilities such as schools and parks adjacent to the route (schools have associated 40 km/h speed limit restrictions).

Section 5.3 of Working Paper I documents the findings of a road safety audit undertaken for the Project. Given their small size, there are no practicable alternatives through Seaham and Clarence Town. As noted in Working Paper I, the proposed access route through Dungog avoids the main thoroughfare (Dowling Street) which would reduce the likelihood of conflicts with pedestrian and other non-vehicle road users such as cyclists. Nonetheless, there would still be potential for these conflicts within the urban area. Appropriate management strategies, for example the imposition of a lower speed limit (similar to a school zone), would need to be implemented to address this issue.

### 16.3.3 Operation impacts

In the long term, it is unlikely that there would be any negative impacts on access both locally and within the wider area (such as to Barrington Tops National Park). There would be an obvious improvement to access to the area above the storage through construction of the new section of Salisbury Road.

The main issue regarding operation is the extent to which the dam could generate additional traffic movements, mainly through visitors to the locality (once the storage fills). This is a clear possibility as the Project includes the provision of recreational facilities such as picnic areas, boat ramps, etc to offset the broader social impacts on the community.

The dam is expected to take three to six years to fill so immediately post-construction this is unlikely to be an issue. Longer term it would be difficult to quantify, particularly if other development took place (eg caravan park) which would in turn likely generate a certain level of traffic. Any such development would be undertaken by parties other than HWC and would be subject to the planning controls in force at that time, and it is expected that consideration of associated impacts would address the issue of traffic generation.

Appendix 5 to the *Dungog Local Government Area Situational Analysis* (Planning Workshop Australia 2008) provides an assessment of recreation and tourism potential associated with Tillegra Dam. It includes a review of potential visitation levels based on a comparison with other water storage dams, both in the Hunter Valley and wider NSW. The analysis notes that the level of visitation to water storage dams is dependent on a range of factors including activities permitted on the storage and any restrictions (eg boat speed limits) that may be in place, water levels, and the diversity and quality of the facilities available.

As noted in Section 12.10.4, Glenbawn Dam, which is also in the Hunter region, experiences visitation rates estimated at between 50,000 and 70,000 when the storage is at full capacity. Assuming a similar level of visitation when Tillegra Dam reached full capacity, this could equate to between 68 and 96 additional vehicles daily (assuming an average of two occupants per vehicle) that could be experienced on Salisbury Road. The exact number of vehicles cannot be determined definitively as this will be dependent on the type of recreational activities permitted on the storage. As indicated in Section 12.10.2, submissions are invited from the public on the issue of recreational access and the type of activities that should be permitted or restricted on the storage.

In terms of dam operation, traffic impacts would be negligible. HWC staff would need to travel to the dam site periodically to undertake routine maintenance and there may be a need for deliveries from time to time.

### 16.3.4 Mitigation and management measures

**Construction**

The impact of construction traffic has been identified as potentially contributing to further deterioration of sections of the access routes which are already in a poor condition. This would be mitigated through HWC making a financial contribution to Dungog Shire Council (as the local roads authority) for the upkeep of the routes. The amount of this contribution would be commensurate with the increase in heavy vehicle traffic which, due to their high overall mass and axle load, have the most significant likelihood of damaging roads.

Council currently estimates a requirement to spend $3.71 million annually on works to gradually improve its entire rural road network over a 30 year period (Dungog Shire Council 2008). Based on this rate, $864,000 would be required to be spent per year on MR301 and associated roads to the proposed construction site (a total length of 64.8 kilometres). As a consequence and allowing for inflation, for the overall construction period an amount of $142,000 would be required from HWC to satisfactorily account for the estimated three per cent increase in heavy vehicle traffic thereby making the project cost–neutral for Council.

At peak, the construction workforce would increase light vehicle movements by about 10-20 per cent on some sections of the route to the dam construction site. Light vehicle traffic does not carry the same axle loads as heavy vehicles; accordingly accelerated pavement wear is not a primary factor for consideration in comparison to road safety.

As the route is currently considered to be in an unsatisfactory condition, additional traffic movements would increase the risk of an accident occurring. To address this, basic road safety improvements to the access route would need to be undertaken to improve both worker and general community safety.

HWC proposes to undertake work to establish new line markings, install critical guide rails, erect proper signage where necessary and upgrade road safety aspects at school crossing zones. This would not necessarily ensure a 'safe' road as no remedial works can eliminate all risk. It would, however, represent a demonstrable improvement to the current road safety condition. Required works have been currently costed at $171,000.

Traffic construction impacts would generally be managed through implementation of appropriate traffic controls within the framework of an overarching traffic management plan which would form part of the construction EMP. This would be prepared in accordance with relevant guidelines and include consultation with relevant stakeholders including Council.

Deliveries of oversized plant/materials would occur under escort in accordance with all necessary road regulations.

**Mitigation of disruption to access**

Access to properties/localities above the dam construction site would be maintained through provision of a temporary detour around the construction site. This would occur prior to commencement of construction work at the dam site.

Alternative temporary access would be provided to properties directly affected by construction activities. Where a permanent change was required, new access would be provided to a standard equal to or better than previous existed.

**Operation**

No other significant operational impacts are anticipated therefore no specific mitigation measures are considered necessary. It is noted that potential issues associated with the use of the new section of Salisbury Road would be addressed principally through the design process and subsequently by operational control measures such as signposting of speed limits and appropriate warning signage.

In terms of increased traffic due to recreational visitation, no specific mitigation measures are proposed. As indicated previously, HWC would make a financial contribution to Council with regard to road safety improvements which would provide some mitigation in this regard.

## 16.4 Resource management

### 16.4.1 Waste management strategy

This section outlines legislation and other policies related to waste and waste management strategies which have been used to develop resource management strategies for the Project.

The POEO Act *(Protection of the Environment Operations Act 1997)* defines waste as:

- any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment
- any discarded, rejected, unwanted, surplus or abandoned substance
- any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance
- any processed, recycled, reused or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations
- any substance prescribed by the regulations to be waste
- a substance is not precluded from being waste for the purposes of this Act merely because it is or may be processed, recycled, reused or recovered.

Waste management strategies, when implemented correctly, are effective in assisting in avoiding or minimising negative environmental impacts associated with waste, while allowing economic development and improvement in human quality of life (Commonwealth Scientific Industrial and Research Organisation 2008). According to the CSIRO, waste management strategies should aim to:

- control land, air and water pollution
- improve occupation health and safety
- conserve natural resources, including water, energy and raw materials
- enhance business performance and maintain corporate social responsibility.

**Waste Avoidance and Resource Recovery Act 2001**

The objectives of the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) have also been considered in the waste management approach for the Project. These are:

- to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development

- to ensure that resource management options are considered against a hierarchy of the following order:
  - avoidance of unnecessary resource consumption
  - resource recovery (including reuse, reprocessing, recycling and energy recovery)
  - disposal
- to provide for the continual reduction in waste generation
- to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste
- to ensure that industry shares with the community the responsibility for reducing and dealing with waste
- to ensure that efficient funding of waste and resource management planning, programs and service delivery
- to achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis
- to assist in the achievement of the objectives of the POEO Act.

**Code of Best Practice for Waste Processing in the Construction and Demolition Industry**

The *Code of Best Practice for Waste Processing in the Construction and Demolition Industry* (Dept of the Environment and Heritage 2000) outlines the waste management hierarchy in a simple diagrammatic form for all construction and demolition activities to abide by (refer Figure 16.16). The waste management hierarchy is an important component of the resource management approach developed for the Project.

In relation to waste, HWC recognises that while avoidance is the most desirable outcome, it is not always possible. The principles to follow when avoidance is not possible are reduce, reuse and recycle. The process is as follows (Dept of Environment and Climate Change 2008a):

- reduce: to create less waste
- reuse: to use a product again for a different use without going through processing
- recycle: to process an old product into a new one.

Minimisation or avoidance of resource use is most effective at the design stage of a project through innovation and early consideration of key sustainability issues. However, it can also be meaningfully implemented at the construction and operation stages.

The waste management approach for the Tillegra Dam project would implement the above waste hierarchy in accordance with the WARR Act. The details of HWC's approach to sustainable resource use and waste reduction are discussed in Chapters 2 and Working Paper F *Sustainable Resource Use*.

An important aspect of resource management is cleaner production which emphasises resource and waste minimisation, rather than the more traditional approach to the use of materials and waste treatment (Australian Academy of Science 1998). To achieve cleaner production, components that are dependent on the use of natural resources have been analysed to identify the most efficient allocation and use of resources over the life of the Project. Additional analysis during detailed design would include explicit consideration of the viability of suitable alternatives to conventional

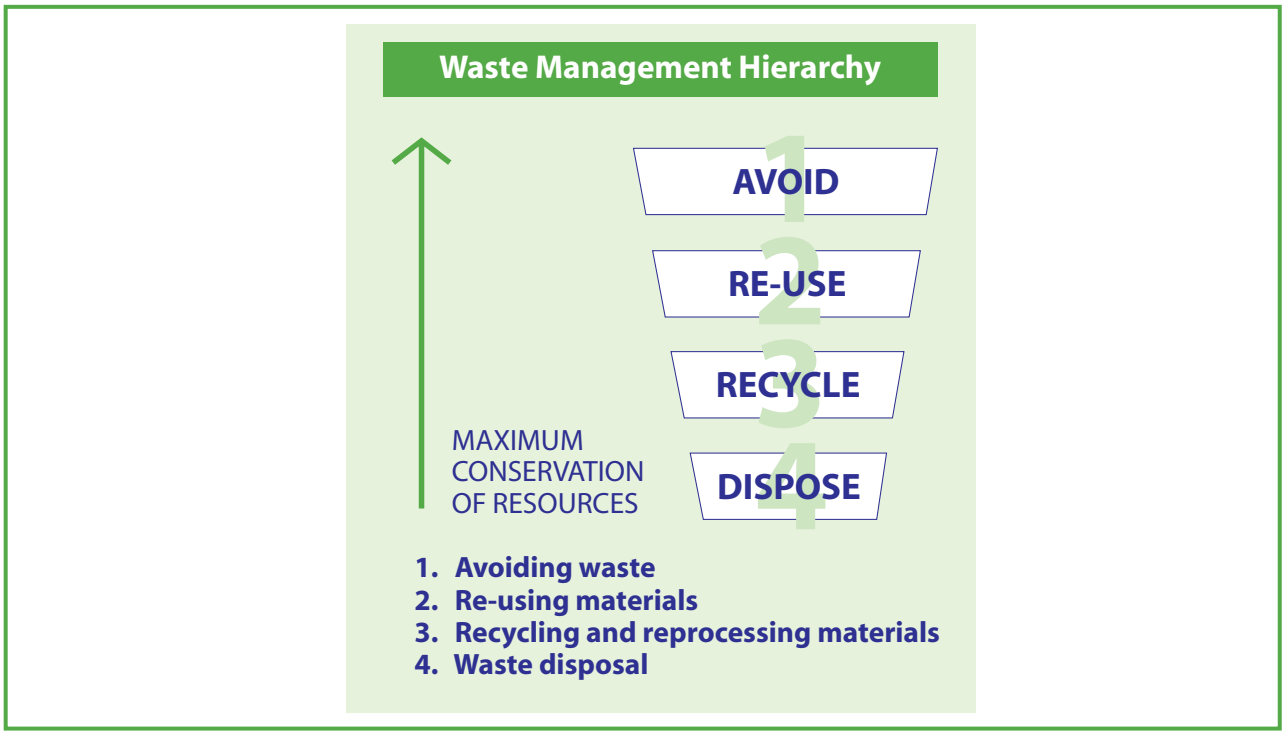


**FIGURE 16.16** WASTE MANAGEMENT HIERARCHY

construction materials. On the premise that all relevant materials considered for use in dam or road construction could be demonstrated as being durable and safe, material selection would be undertaken on a sustainability basis including a review of issues such as:

- recycled content
- embodied energy
- life cycle/reliability of the product
- cost.

For the Project, waste would be classified in accordance with the *NSW Waste Classification Guidelines*[1] (Dept of Environment and Climate Change 2008a) to manage the risks to the environment and human health in an appropriate manner in accordance with the POEO Act. Should any waste be classified as special, liquid, hazardous, or restricted solid, appropriate treatment and disposal methods would be used.

The POEO Act requires that the transport of certain wastes into, within and out of NSW must be tracked. Waste tracking involves obtaining prior approval for the waste to be transported and completing required documentation each time such waste is transported. Wastes that have been classified as requiring special transport conditions, using the *NSW Waste Classification Guidelines 2008* would be tracked using the NSW DECC's *Online Waste Tracking* system. If waste material is classified as dangerous or hazardous the movement of such waste would be conducted in accordance with the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (7th edition).

1 The Environmental Guidelines: Classification and Management of Liquid and Non-liquid Waste (EPA 1999) have recently been replaced by the NSW Waste Classification Guidelines (DECC 2008).

**WasteWise Construction Program Handbook Techniques for Reducing Construction Waste**

The Commonwealth Government has published a handbook which outlines the ways an organisation can reduce the amount of waste generation during construction. The handbook is written as a practical guide for businesses, especially those in the construction and demolition industry, for best practice in waste reduction.

The guidelines are based on the principles of ESD and outline how these apply to waste management. The handbook encourages companies to practice sustainable waste management and uses the waste management hierarchy (refer Section 2.2 *Code of Best Practice for Waste Processing in the Construction and Demolition Industry)*.

**NSW Government Waste Reduction and Purchasing Policy**

The NSW Government's Waste Reduction and Purchasing Policy (WRAPP) requires all State government agencies to develop and implement a WRAPP plan. A WRAPP plan details strategies and targets for reduction in waste generation, resource recovery and increased purchasing of products with recycled content in the following areas:

- paper products
- office consumables
- vegetation and landscape material
- construction and demolition material.

The Policy requires all government agencies to collect data on the quantities of specified types of materials being disposed of. The data collected is then reported to the DECC every two years in order for the NSW Government to determine compliance with the WRAPP, or individual agency strategy.

**HWC's Waste Reduction and Purchasing Policy (WRAPP)**

HWC has committed to conserving natural resources through responsible purchasing and waste management practices through the development of its own WRAPP 2001. Through this, HWC strives to:

- reduce waste created from its day to day activities as far as practical
- design its management systems, services and products to avoid generating wastes that must be disposed to landfill
- purchase services and products that are recycled or low waste and that are also competitive in price and performance
- involve staff, clients and customers where they can contribute to HWC successfully reducing waste.

HWC is required to hold an operating licence issued by the NSW Government to lawfully provide services within its Area of Operations. The operating licence requires HWC to implement a monitoring and reporting protocol, elements of which are contained within an environmental management plan, the most recent being the *Corporate Environmental Management Plan 2008-2013* (Hunter Water Corporation 2007a). The licence is supervised and reviewed by the Independent Pricing and Regulatory Tribunal (IPART).

HWC must record, compile, monitor, measure and report against the environmental performance indicators contained within the licence and environmental management plan. There are 27 indicator categories and 74 individual performance measures. Indicators that directly relate to sustainable resource use include:

- electrical energy efficiency of water assets
- electrical efficiency of wastewater assets
- electricity consumption from renewable sources or renewable sources generated by HWC expressed as a percentage of total electricity consumption
- solid waste generation
- waste recycled or reused expressed as a percentage of solid waste generated.

The *Corporate Environment Management Plan* also outlines areas of opportunity where HWC can efficiently use resources and implement measures to reduce demand for water. The Plan also identifies a number of objectives and subsequent actions relevant to sustainable resource use. These objectives include those relevant to energy efficiency and the consequent reduction in greenhouse gas emissions. A waste recycling and reduction policy is also articulated. Direct actions in the Plan include:

- development and implementation of energy savings plans for major facilities
- development of an incentive program for HWC to take up fuel efficient fleet cars
- consideration of LPG and biodiesel fuel alternatives
- development of a recycled materials strategy, including initiatives that would reduce the use of virgin extracted natural materials
- commitment to increase the amount of recycled materials used for new infrastructure projects where it is feasible and appropriate for this to occur.

These actions are currently being pursued by HWC and would be reported in its annual catchment report to IPART as well as in its annual report.

### 16.4.2 Construction

Table 16.15 details the types and quantities of waste anticipated to be generated during construction of the Project. Potential avoidance/minimisation strategies are also identified.

Waste produced during the construction would be classified in accordance with the *NSW Waste Classification Guidelines* (Dept of Environment and Climate Change 2008a). It is expected that the majority of solid construction waste would be classified as general solid waste (non-putrescible). It is anticipated there would also likely be some small quantities of liquid waste (refer Table 16.15).

**TABLE 16.15** ANTICIPATED TYPES OF CONSTRUCTION WASTE

| WASTE TYPE | ESTIMATED QUANTITY | AVOIDANCE/MINIMISATION STRATEGIES |
|---|---|---|
| Evacuated waste/spoil | Minor | Use of excavated materials as fill during the construction of the dam wall and associated infrastructure |
| Cleared vegetation (inundation area and road) | Approximately 210 hectares | Do not remove more than is required<br>Reuse mulch from removed vegetation for landscaping purposes<br>Replanting of trees for landscape values and mulching |
| Concrete | ~1% of total concrete produced | Produce only the required amount |

| WASTE TYPE | ESTIMATED QUANTITY | AVOIDANCE/MINIMISATION STRATEGIES |
|---|---|---|
| Wastewater–concrete production wastewater, sewage/greywater | 1,500 kL/yr | Concrete production wastewater would be treated through the use sedimentation ponds, with the potential to reuse onsite<br>Sewage/greywater water would be disposed of using a septic system or at the appropriate municipal wastewater treatment plant, and opportunities for treatment and reuse of grey water would be investigated) |
| Steel, metal off-cuts, drums | Minor | Review ordering strategies to limit potential over ordering<br>Reuse excess for other construction activities |
| Timber–fence posts, power poles | Minor | Review ordering strategies to limit potential over ordering<br>Reuse excess for other construction activities |
| Bitumen | Minor | Review ordering strategies to limit potential over ordering<br>produce only the required amount |
| General wastes | Minor | Implement recycling facilities at all work sites to allow for the separation of waste streams |
| Paper, cardboard, plastics, glass and other recyclable materials | Minor | Collection and separation through the use of recycling facilities<br>Waste would be collected by a suitable waste contractor and deposited at a recycling facility |
| Waste acids from concrete cleaning, batteries | Minor | Waste would be collected by licensed waste contractors and disposed of to a suitable licensed waste facility. |
| Grease, oil and other materials from the maintenance of machinery and vehicles | Minor | Grease and oil would be collected in appropriate containers and transported to the appropriate waste/recycling facility<br>Materials from maintenance of vehicles would be collected and transported to the appropriate waste/recycling facility |

### 16.4.3 Operation

It is expected that waste produced from operational activities would be predominantly household waste including general rubbish and wastewater from the caretaker cottages and interpretive centre. Additional waste would be generated from visitor day use areas, public toilets and the provision of general amenities. Some non-domestic waste may be generated from maintenance activities at the dam and around the storage. The waste would not increase the impact on the existing environment as production and subsequent collection would be reduced in comparison to current levels.

Wastewater would be produced through the use of washing machines, bathrooms and public toilet facilities. Putrescible waste could include the following common items (Dept of Environment and Climate Change 2008a):

- food waste
- organics
- disposable nappies, incontinence pads or sanitary napkins
- animal waste.

It was not possible to accurately estimate the quantities of waste likely to be generated from the operation of the Project, but it is expected these would generally be minor and unlikely to generate significant demands on existing collection and disposal facilities.

Management of putrescible waste and recyclables would involve collection and transportation to an appropriate waste/recycling facility. Wastewater would be disposed of using an on-site sewage management system (as is proposed for the new RFS station) or collected and disposed of to the Dungog wastewater treatment plant. Composting public toilets would be installed at visitor areas.

### 16.4.4 Resource recovery

There is a variety of materials within the inundation area which potentially could be recovered for reuse and or recycling. A preliminary inventory of these materials has been prepared and is provided in Table 16.16. Quantities for most items are approximate only and for some items (eg fencing) the quantity is not known.

The process by which materials may be recovered would be clarified should the Project be approved. One option may be for HWC to call for expressions of interest from commercial operators to come into the area prior to inundation and remove salvageable materials.

**TABLE 16.16** POTENTIALLY REUSABLE/RECYCLABLE MATERIALS WITHIN THE INUNDATION AREA

| ITEM | ESTIMATED QUANTITY |
|---|---|
| House | 27- including RFS station |
| Shed | 55 |
| Grain storage | 2 |
| Bridges | 3 |
| Road signs | 10 |
| Cattle transport yards | 4 |
| Irrigation equipment and water pumps | 5 |
| Dairying equipment | Various |
| Fences | Not known |
| Gates | Not known |
| Water tanks | 49 |
| Power poles | Approximately 250 |

**Prioritisation**

Clearing of resources within the inundation area would be prioritised according to the anticipated level of risk to the environment and to safety if the materials were to be left in situ. A preliminary prioritisation of resources is provided in Table 16.17 as follows.

**TABLE 16.17** SUGGESTED ORDER OF REMOVAL OF MATERIALS

| PRIORITY RANKING | MATERIAL TYPE | JUSTIFICATION OF RANKING | MATERIALS INCLUDED | REUSE AND RECYCLING OPPORTUNITIES |
|---|---|---|---|---|
| 1 | Potentially hazardous materials | Prevention of contamination of the water body<br>Prevention of hazard to the environment and humans | Asbestos sheeting other materials | N/A |
| 2 | Materials required to be removed for recreational safety | Safety of recreational users | Power poles<br>Other structures<br>Electrical wiring<br>Other protrusions in the inundation area<br>Tall trees | |
| 3 | Materials that can have a high value for reuse/recycle | Waste prevention<br>Minimisation of resource consumption | Sheds<br>Fences<br>Gates<br>Housing materials (bricks, wood, tiles)<br>Water tanks<br>Trees and other vegetation | Reuse of materials by external parties for example recycling facilities<br>Replanting of trees for landscape values and mulching |
| 4 | Materials for aesthetic purposes | Removal of items that may detract from the aesthetic appeal of the area | Trees on edge of inundation area that may die due to water logging<br>Roads that may be able to be seen when storage level drops below normal operating level<br>Buildings/structures | As above |

**Resource recovery strategy**

A resource recovery strategy has been developed for the Project which outlines the likely process for the removal of resources within the inundation area. The Strategy would continue to be developed should the Project be approved. The process for the removal of resources would be as follows:

- finalise inventory of resources currently located within the proposed inundation area
- tender process for the removal of potentially hazardous materials and sources of contamination of the storage
- removal of any remaining potentially hazardous materials and sources of contamination of the storage
- recovery of resources for reuse/recycling, removal for the safety of recreational users and aesthetic reasons
- tender process for removal of resources for reuse/recycling and safety of recreational users.

The quantification of the amounts of reusable/recyclable materials currently located within the proposed inundation area would occur prior to, or in the early stages of detailed design to allow for opportunities to reuse/recycle suitable materials where practicable and cost effective.

The resource recovery strategy would comply with the aims of HWC's WRAPP through the reduction of total waste generated, avoidance of the generation of wastes that must be deposited in landfill and encouraging the use of products that are recycled, where cost efficient.

### 16.4.5 Water

Expected demand on overall water resources for construction of the Project is expected to be negligible. The most significant water uses predicted for the Project are for concrete batching and dust suppression. Cement is mixed with water at an approximate ratio of 3:1 and batching of 10,000 tonnes of cement would therefore require approximately 3,500 cubic metres (3.5 megalitres) of water. The amount of water required for dust suppression cannot be accurately estimated as this would be influenced by the extent of bare ground, soil moisture content, local topography and prevailing meteorological conditions.

Water required for the construction phases of the Project would generally be taken from the Williams River in accordance with the terms of any permit(s) HWC holds for water extraction and with the approval of DWE. During times of low flow in the Williams River, water could be sourced from the CTGM and carted to the construction site(s). Opportunities for the reuse of grey water would be investigated as part of pre-construction planning to assist in reducing demand on the Williams River. Potable water would be sourced external to the site and delivered by tanker to holding tanks. The CTGM is the most likely source for potable water. Water collected from erosion and sediment controls such as retention basins would be used for dust suppression and landscaping to also reduce demand on the Williams River.

In addition to water collected from erosion and sediment controls, the following bullet points outline methods to assist in the sustainable use of water in the construction and operation phases of the Project. The implementation of these and other management strategies would be subject to the ongoing development of the Project, contractor requirements and other innovation and technological advances.

Construction:

- utilise a local water source
- minimise excessive evaporation when undertaking dust suppression
- utilise native drought tolerant plants in landscaping activities
- undertake regular maintenance of equipment to maintain water efficiency
- reuse of wastewater (where of a suitable quality) for watering of landscaped areas
- use water saving equipment (such as composting toilets, rainwater tanks) for on-site facilities
- recycle wastewater sourced from dewatering or wash down for use in other parts of construction, or treat to a sufficient quality for release back into the Williams River.

Operation:

- incorporate water saving technology into the design of facilities such as composting toilets, flow restricting tap fixtures, etc
- install rainwater tanks for use in buildings
- regular maintenance of equipment to maintain water efficiency
- reuse of wastewater (where of a suitable quality) for watering of landscaped areas.

## 16.5 Contamination

A preliminary (Phase 1) environmental site assessment (ESA) comprising a desktop study and limited site inspection was undertaken as part of the environmental assessment for the Tillegra Dam project.

### 16.5.1 Review of site information

The following matters were considered during the site review process:

- surrounding land use
- topography
- regional geography
- soil characteristics
- acid sulphate soils (ASS)
- regional hydrology
- watercourses.

A review of the *NSW Acid Sulphate Soil Risk Map* (Dept of Natural Resources 2006) indicated that the Project area has no known occurrence of acid sulphate material. The risk of acid sulphate occurrence in the Project area is considered to be low and it is unlikely that this would present itself as an issue. As a result, ASS are not considered to require specific management.

### 16.5.2 Development of site history

A review of existing information relating to current and historical land uses was undertaken to identify potential contamination sources associated with activities recorded in and around the Project area. The activities involved in the development of site history are summarised in Table 16.18.

**TABLE 16.18** SITE HISTORY INVESTIGATION

| MATTER INVESTIGATED | ACTIONS INVOLVED |
|---|---|
| Contaminated site register | Search of DECC's Online Contaminated Site Register undertaken 6 November 2007 |
| POEO Act public register | Search of DECC's online POEO Act public register undertaken 6 November 2007 |
| Cattle dip register | Search of DPI's online Cattle Dip Site Locator undertaken 6 November 2007 |
| Review of previous reports | A review of previous reports undertaken in the Williams River catchment was conducted and included the *Williams River Catchment Regional Environmental Study* (Dept of Urban Affairs and Planning 1996) and State of River Report attached as an Appendix to the *Regional Environmental Study* |
| Historic aerial photographs | Aerial photographs from 1958 to 2007 were reviewed to obtain information on historical development in the area. Photos are held at the Dept of Lands Sydney office or were provided by HWC |
| Contamination potential and potential contaminants of concern<br>Gaps in site history | Potential contamination associated with past and current activities was identified through the site history search<br>Due to the limited availability of information, there are potential gaps in the historical and land use data |

## 16.5.3 Site investigations

A site investigation consisting of a limited walkover of targeted areas within the Project area was conducted on 17-18 December 2007. The targeted areas were selected through the site history investigation and accessibility considerations. Potentially contaminating activities identified during the site inspection are listed in Table 16.19.

**TABLE 16.19** POTENTIAL SOURCES OF CONTAMINATION WITHIN THE PROJECT AREA

| ACTIVITIES/POTENTIAL SOURCES | POTENTIAL CONTAMINANTS OF CONCERN (PCOC) |
|---|---|
| Dairy properties (present and former) – including sheds, effluent ponds, etc | Faecal coliforms, phosphorus, organochlorine pesticides (OCP), organophosphorous pesticides (OPP), carbamates and asbestos |
| Chemical storage in sheds | Petroleum hydrocarbons (TPH, BTEX and PAH), semi-volatile organic compounds (sVOC), volatile organic compounds (VOC), polychlorinated biphenyls (PCB), OCP, OPP, carbamates and heavy metals |
| Cattle dip sites (none located during site inspection; unlikely to occur south of Kempsey, northern NSW) | Heavy metals (arsenic) and OCP (DDT) |
| Cropped areas (present and former)<br>Septic tanks | OCP, OPP, carbamates, synthetic pyrethoids and phosphorus<br>Petroleum hydrocarbons (TPH, BTEX and PAH), faecal coliforms and phosphorus |
| Dump sites (present and former) | Unknown but typically may include heavy metals, TPH, BTEX, PAH, OCP, OPP, carbamates, synthetic pyrethoids, VOC and asbestos |
| Quart Pot/Munni Cemetery | Enteric and other pathogens |
| RFS station | Petroleum hydrocarbons (TPH, BTEX and PAH), faecal coliforms, phosphorus, fire retardant/ suppressant chemicals (such as aqueous film forming fire suppression – AFFF) and bacteria |

Some potential contaminants (eg sourced from septic tanks and effluent ponds) may not necessarily be of major concern due to the dilution that would occur from the 450 gigalitres of water in the storage. Decommissioning would be considered after a final site-by-site assessment of each structure.

Figure 16.17 shows the locations of individual properties within the inundation area identified during the site walkover as potentially containing sources of contamination. A total of 11 potentially contaminating activity categories were established as follows:

- dairying
- cropped areas
- chemical storage
- dump sites
- Quart Pot/Munni Cemetery
- RFS station
- mixed use 1 (dairy, chemical, effluent)
- mixed use 2 (chemical, dump)
- mixed use 3 (dairy, chemical, dump)
- mixed use 4 (dump, effluent)
- mixed use 5 (dairy, chemical).

A number of sensitive receptors which have the potential to be impacted by contaminated soils or groundwater during construction and operation were also identified during the site walkover. These were as follows:

- Williams River catchment (including associated tributaries)
- proposed storage (including any associated recreational activities)
- potential end-users of the water stored within the facility – commercial, residential, agricultural and recreational
- environmentally sensitive areas (native vegetation)
- agricultural properties in the areas adjacent to the storage
- construction workers
- groundwater.

The key concerns with respect to the proposed works are anticipated to be the potential for on-site and off site impacts resulting from the mobilisation of on-site contamination within the ground and subsurface conduits when the land is inundated. Soil contamination may also be mobilised through generation of dust during construction. Additionally, the potential exists for the direct impact from contaminants within the soil and groundwater, notably for construction personnel who may come into direct contact with potentially contaminating materials.

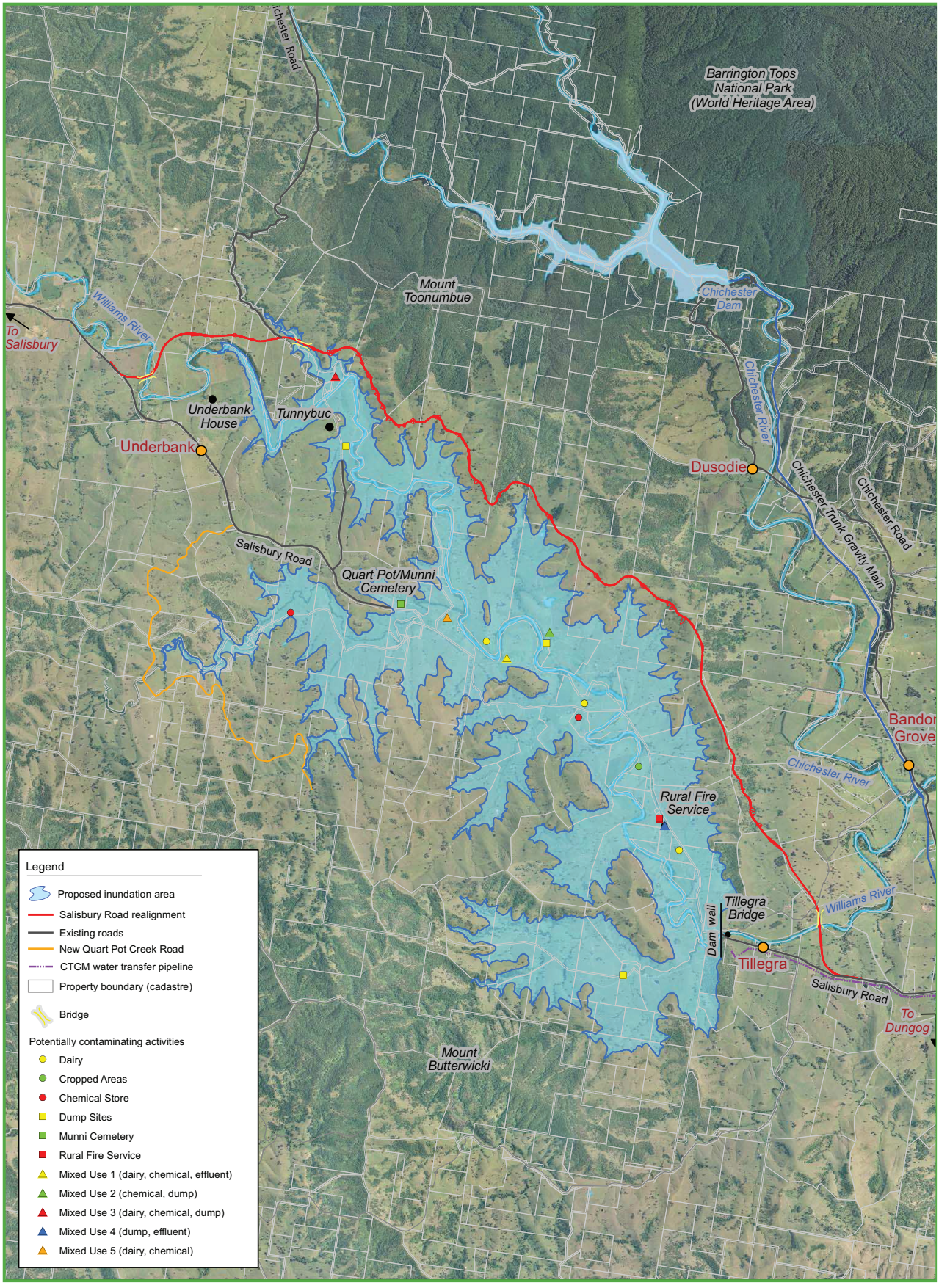


**FIGURE 16.17** LOCATIONS OF POTENTIALLY CONTAMINATING ACTIVITIES

### 16.5.4 Risk assessment

For an environmental risk to exist the following three factors must be present:

- a contaminant
- an exposure pathway
- a receptor.

Based on the results of the preliminary ESA and an understanding of the likely construction activities and the future land use (ie as a water storage facility), the likelihood or risk of contamination being encountered on the site during construction is considered to be low to moderate due to the presence of potentially contaminating sources on and off site. A summary of the likelihood or risk of contamination being encountered in soil and/or groundwater in targeted areas within the inundation area is presented in Table 16.20.

**TABLE 16.20** PRELIMINARY RISK ASSESSMENT FOR TARGETED LOCATIONS

| POTENTIAL AREAS OF CONCERN (PAOC) | POTENTIAL HAZARD TO RECEPTOR IDENTIFIED | RISK OR LIKELIHOOD OF ENCOUNTERING CONTAMINANTS DURING DEVELOPMENT |
|---|---|---|
| Dairy properties (present and former) – including sheds, effluent ponds, etc | Worker exposure to faecal coliforms, phosphorus, OCP, OPP, carbamates and asbestos in soil | Moderate, depending on whether facilities are necessarily demolished. |
| Chemical storage in farm sheds | Worker exposure to TPH, BTEX, PAH, sVOC, VOC, PCB, OCP, OPP, carbamates and heavy metals in soil<br>Surface water contamination<br>Groundwater contamination | Moderate, as chemical storage was observed during inspections, and is likely to exist given the activities and land uses. Chemical collection service would be implemented. |
| Cattle dip sites (none located during site inspection) | Worker exposure to heavy metals (arsenic) and OCP (DDT) in soil | Low to nil–outside of historic cattle tick quarantine area. |
| Cropped areas (present and former) | Worker exposure to residual pesticides and herbicides in soil<br>Groundwater and surface water contamination/nutrification (phosphorus)<br>Local environment | Moderate, as disturbance to and inundation of the existing area is currently proposed |
| Septic tanks | Worker exposure to TPH, BTEX and PAH, faecal coliforms and phosphorus in soil<br>Groundwater contamination<br>Local environment | Moderate, as septic facilities are likely to be removed during proposed works that would include exposure to surrounding soils |
| Dump sites (present and former) | Worker exposure to Heavy metals, TPH, BTEX, PAH, OCP, OPP, carbamates, synthetic pyrethoids, VOC and asbestos in soil | Moderate to high, as dumped material is likely to require removal under current proposal. Localised underground waste fill pockets on farms and illegally dumped waste materials potentially exist across the Project area |

| POTENTIAL AREAS OF CONCERN (PAOC) | POTENTIAL HAZARD TO RECEPTOR IDENTIFIED | RISK OR LIKELIHOOD OF ENCOUNTERING CONTAMINANTS DURING DEVELOPMENT |
|---|---|---|
| Quart Pot/Munni Cemetery | Relocation of burials | High, if excavation works are required pursuant to relocation plan |
| RFS station | Worker exposure to fire retardant/ suppressant chemicals (AFF, TPH, BTEX, PAH)<br>Groundwater contamination<br>Local environment | Moderate, as area is proposed to be relocated/disturbed |

As part of preparation of the management plan for the relocation of Quart Pot/Munni cemetery, HWC commissioned a technical review of the potential for contamination of the storage associated with both the existing and new cemeteries. This found the potential risk to water quality to be negligible.

**Management**

No sites within the planned inundation area were identified as constituting contaminated land to the extent that significant remedial works would be required prior to construction of the dam wall. The preliminary qualitative risk assessment has taken a precautionary point of view.

A final site-specific inspection of each property within the inundation area would be undertaken to ensure that any hazardous materials are removed from the inundation area as properties are progressively vacated. Full inspections would only occur after properties are vacated to ensure that all existing materials (such as agricultural chemicals) have been properly disposed of and so new materials cannot be introduced. Septic tanks and infiltration systems would also be decommissioned with the contents disposed of at this time.

Should the presence of a contaminating material be confirmed during a final inspection, the need would be assessed for additional investigations to delineate the extent of the contamination.

Should potentially asbestos–containing materials be encountered during investigation and/or construction, the management and/or removal of asbestos materials would be undertaken in accordance with the *NSW Occupational Health and Safety Regulation 2001*.

All excavated material from locations identified as containing contaminated material would be appropriately sampled, classified and stockpiled prior to off site disposal to a licensed facility, beneficial reuse on site or treatment in accordance with the relevant NSW guidelines.