6. Construction

This chapter describes the proposed construction of the project. The chainages referred to throughout this chapter refer to those along the southbound carriageway of the project (refer to Figures 5-2 to 5-5 for chainages along the project).

6.1 Construction activities and equipment

6.1.1 *Construction phases and activities*

Table 6-1 provides a summary of the likely construction phases and associated activities that would occur for the project, and the likely plant and equipment that would be used for those activities. Conventional techniques employed on most highway construction projects would be used during these construction activities.

Table 6-1 Proposed construction phases and activities, plant and equipment

Construction phase	Activities	Plant and equipment
Environmental Management System (EMS)	▪ EMS development. ▪ Environmental management plans. ▪ Statutory approvals and licensing.	-

Early works	▪ Land acquisition.
	▪ Relocation of farm dams/fencing.
	▪ Survey of construction site.
	▪ Geotechnical investigations.
	▪ Notify residents of commencement of work.
	▪ Site establishment.
	  ▸ Site compounds.
	  ▸ Fencing of site boundaries and areas to be used for stockpile sites.
	▪ Fencing of sensitive environmental and heritage areas.
	▪ Installation of erosion and sediment control outside identified environmental constraint areas.
	▪ Establishment of access tracks where required for earthworks.
	▪ Other activities determined by the Environmental Representative to have minimal environmental impact.
		▪ Fences.
		▪ Sheds.
		▪ Fuel storage tanks.
		▪ Graders, rollers and water carts.
		▪ Excavators.
		▪ Generators.
		▪ Concrete batch plants.
		▪ Water tanks.

Construction phase	Activities	Plant and equipment
Service relocations	▪ Service relocations.	▪ Trucks, cranes and excavators. ▪ Elevated platform vehicle. ▪ Backhoes. ▪ Trenchers. ▪ Under boring machines. ▪ Bulldozers. ▪ Small equipment (eg hand tools, compactors).
Site preparation	▪ Clearing and grubbing of vegetation. ▪ Mulching. ▪ Stripping and stockpiling of topsoil. ▪ Establishment of access tracks. ▪ Establishment of temporary and permanent crossovers.	▪ Fences. ▪ Sheds. ▪ Fuel storage tanks. ▪ Graders, rollers and water carts. ▪ Excavators. ▪ Generators. ▪ Concrete batch plants. ▪ Water tanks.
Earthworks	▪ Excavation of cuttings. ▪ Fill embankments. ▪ Rock blasting (if required). ▪ Quarrying. ▪ Rock crushing (if required). ▪ Placement of select materials. ▪ Batter treatments.	▪ Mulching plant and chipper. ▪ Chainsaw. ▪ Rock breaker. ▪ Rock crusher. ▪ Excavators. ▪ Bulldozers. ▪ Trucks. ▪ Scrapers. ▪ Graders. ▪ Water carts. ▪ Street sweepers. ▪ Compactors. ▪ Vibratory rollers. ▪ Drilling and blasting equipment for hard rock cuttings. ▪ Bitumen sprayers. ▪ Rubber-tyred rollers.
Bridges and drainage	▪ Bridges. ▪ Culverts. ▪ Catch drains. ▪ Drainage blankets. ▪ Permanent water quality control basins.	▪ Piling rigs. ▪ Concrete pumps. ▪ Cranes. ▪ Overhead gantry crane. ▪ Excavators. ▪ Trucks.
Interchanges	▪ On-load/off-load ramps.	▪ Scaffolding. ▪ Small equipment (eg hand tools, concrete vibrators, curing equipment).

Construction phase	Activities	Plant and equipment
Pavement	▪ Concrete paving (rigid pavements). ▪ Gravel base/sub-base layers and asphalt paving (flexible pavement).	▪ Trucks. ▪ Concrete paver. ▪ Profiler. ▪ Concrete curing equipment. ▪ Concrete saws. ▪ Asphalt paver. ▪ Concrete pumps. ▪ Concrete trucks. ▪ Concrete batch plant. ▪ Stabiliser. ▪ Water carts. ▪ Vibratory rollers. ▪ Rubber-tyred rollers.
Other works	▪ Property access. ▪ Local roads. ▪ Tie-ins.	▪ Graders. ▪ Backhoes. ▪ Excavators. ▪ Trucks. ▪ Water carts. ▪ Vibratory compactors. ▪ Bitumen sprayers. ▪ Vibratory rollers. ▪ Rubber-tyred rollers.
Finishing works	▪ Noise barrier(s) (if required). ▪ Safety barrier(s). ▪ Safety screens(s). ▪ Lighting. ▪ Line marking. ▪ Signposting. ▪ Signage. ▪ Landscaping. ▪ Site clean up.	▪ Trucks, cranes and excavators. ▪ Elevated platform vehicle. ▪ Backhoes. ▪ Trenchers. ▪ Under boring machines. ▪ Bulldozers. ▪ Small equipment (eg hand tools, compactors).

The construction period for the project is expected to be approximately two years. An indicative program of activities is provided in Figure 6-1.

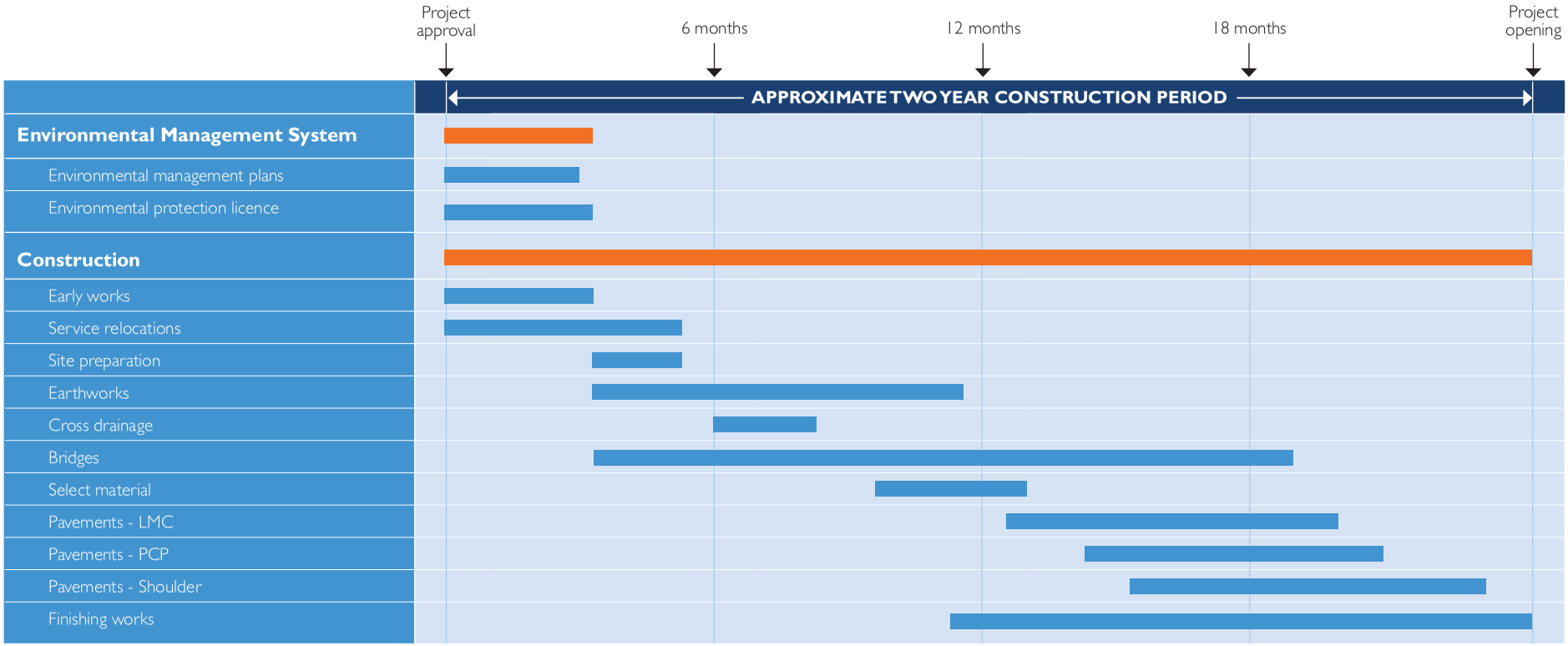

Figure 6-1 **Indicative construction program**

6.2 Construction programming and traffic management

6.2.1 Staging

Given the short section of road to be constructed, it is anticipated that the project would be constructed in one stage.

6.2.2 Construction programming and traffic management

The proposed construction works would be programmed to minimise interaction between the construction works and the local and regional road network. This would minimise disruption to local and through traffic.

Standard traffic management measures would be employed to minimise short-term traffic impacts expected during construction. These measures would be identified in specific traffic management plans and would be developed in accordance with the RTA's *Traffic Control at Works Sites Manual* (RTA 2003a).

Temporary roadworks (including the provision of side tracks to divert traffic) would be required during construction to tie the existing road network into the construction works. Locations at which temporary roadworks are likely to be required include the northern tie-in to the existing highway, Anderson's Lane, the intersection of Wagga Wagga Road, Tip Road, Culcairn Road and the southern interchange. Temporary roadworks may be constructed under traffic and could result in some short-term traffic impacts to users of the existing road network.

A detailed assessment of traffic and transport impacts is presented in Section 9.5 and measures to mitigate these impacts are identified in Section 9.5.5.

6.3 Resource consumption

6.3.1 Materials and spoil disposal

The project would require the importation of fill. The majority of the project is raised on embankment and there are only two relatively shallow cuts into hillsides. It is anticipated that approximately 800000 cubic metres of cut material would be excavated and 1.5 million cubic metres of fill material would be required. Accordingly, there would be a need to import approximately 700000 cubic metres of fill material. This calculation assumes that the excavated material is suitable for base and select layers with minimal reprocessing on site (ie crushing and screening). As geotechnical investigations are yet to be completed, the suitability of the excavated material is still to be confirmed.

Existing quarries may provide this material, however, as large volumes of select fill would be required over a relatively short timeframe, existing quarries may not be able to provide the required quantities or quality of this select fill. Potential quarry locations within the region are being investigated to supply the select fill material for the project.

In the case that suitable existing quarries are not identified or are unable to provide sufficient fill, new quarries may need to be sourced. Any quarry established or expanded to meet the needs of the project would be undertaken in accordance with all relevant environmental guidelines and legislation.

Quarry locations would be guided by the following criteria:

- More than 40 metres from waterways.
- Areas of low ecological and heritage conservation value.

- Greater than 100 metres from closest sensitive receiver (unless a negotiated agreement is in place).

Adopting the above criteria would ensure environmental impacts are minimised.

Given that the design of the project has resulted in a need for a net import of material, excess spoil material is not anticipated to be generated during construction. Any spoil found unsuitable for reuse would be disposed of in accordance with the *Waste Classification Guidelines: Parts 1 and 2* (DECC 2008a).

Other natural resources required for construction of the project include aggregate for use in concrete batching, sand, aggregate and select material for use as backfill around pipes and production of Portland cement, and densely graded base and sub-base. Where feasible, materials would be sourced from existing regional quarries. Figure 6-2 shows the locations of existing hard rock and sand quarries in the region.

Manufactured items, including reinforcing steel, pre-cast bridge components, and stormwater pipes and pits, would also be required for the project. These would be sourced from existing commercial providers, and where possible, from local and regional providers as required.

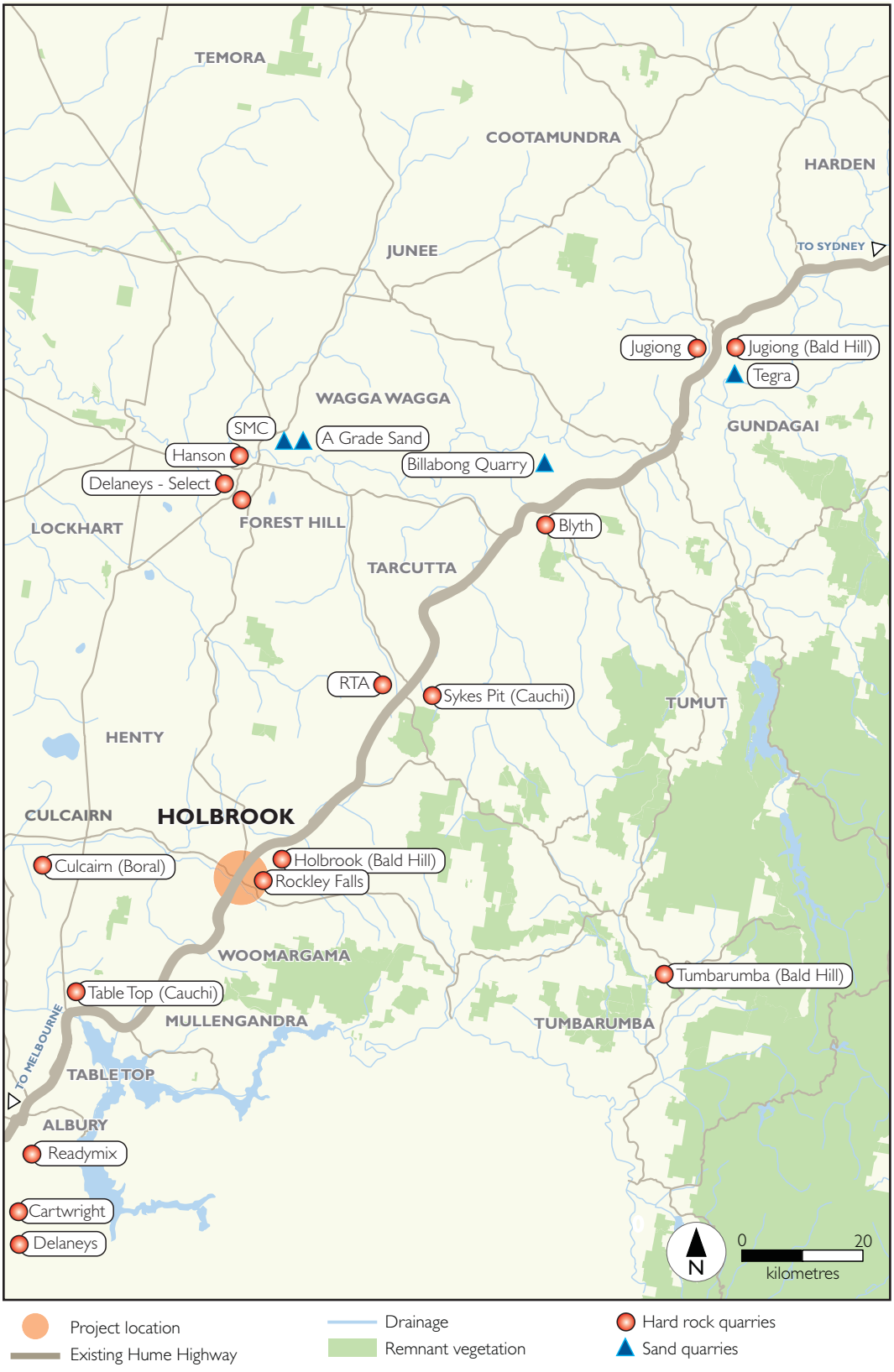

Figure 6-2 **Existing quarry locations in the region**

6.3.2 Water

Water would be used during construction, including for dust suppression, compaction and pavement stabilisation during earthworks, and concrete batching, washing of plant and equipment, drinking water, hand washing, toilets and watering of landscaped areas. Water for the construction of the project could be supplied from a number of sources including the following:

- Sediment basins: Water stored in the sediment basins installed for construction of the project would be re-used wherever practicable.
- There is currently an embargo on granting new licences under the *Water Act 1912*. Accordingly, use of existing groundwater allocations from licences held by private landholders or Riverina Water County Council may be investigated. This may require a change of licence conditions to permit industrial use and would be carried out in consultation with DECCW.
- Other surface water: Water from local dams may be sourced for use during construction in consultation with landholders.
- Off-site: Water could be transported to the site from an off-site source. Water would need to be obtained through the Murray-Darling Basin water trading market due to the current embargo on obtaining new water licences within the basin. This may be in the form of a temporary or permanent water licence.

Above-ground pipes may be used to deliver water across the construction site. These pipes would be small (approximately 150 millimetres in diameter) and temporary, and would be located to avoid impacts on the environment.

Any groundwater extraction required for the project would be undertaken in accordance with Part 5 (groundwater) of the *Water Act 1912*. Section 10.2 addresses the potential impacts of water requirements for construction on water sources and surrounding water users.

6.3.3 Estimated quantities of natural resources

Table 6-2 lists the estimated quantities of natural resources required for construction of the project. These quantities are indicative and are subject to change during detailed design.

Table 6-2 Estimated quantities of natural resources for construction

Material	Estimated quantity required
Fill[1]	700000 cubic metres
Concrete	60000 cubic metres
Asphalt	20000 cubic metres
Base/sub-base	10000 cubic metres
Water (non-potable and potable)	400 megalitres

Note: 1 Assumes that the excavated material is suitable for base and select layers.

6.4 Ancillary facilities and temporary works

A range of ancillary facilities and temporary works would be required during construction of the project. These are identified and discussed in the following sections.

6.4.1 Construction work sites

Construction work sites would be required for main site compound(s), satellite compounds and concrete batch plant(s).

The construction site boundary defines the likely extent of the area required for construction of the project. It includes the concept design (refer to Figure 5-1) plus a 10 metre buffer to either side for construction.

Construction site locations have not yet been identified. These would be identified during construction planning phase. The locations of these facilities would be assessed against the following environmental criteria:

- More than 40 metres from waterways.
- Areas of low ecological and heritage conservation value.
- No significant clearing of native vegetation beyond that already required for the project.
- Minimises impact on amenity of the closest sensitive receiver (unless a negotiated agreement is in place).
- On relatively level ground.

Operation of the construction work sites would have the potential to result in some noise and vibration, traffic, water quality and air quality impacts. These have been addressed in Sections 9.3, 9.5, 10.3 and 10.5 respectively.

Main site compound

The main site compound for the project would include:

- Site offices.
- Traffic office.
- Lunch room.
- First aid room.
- Amenities.
- Workshop.
- Crib shed.
- Car parks.
- Soil lab.
- Plant yard (including plant maintenance).
- Laydown area.
- Septic system.
- Fencing and security.
- Erosion and sediment controls.
- Rainwater tank(s).

Access to the main site compound would need to be provided from the public road. Access points may require the provision of new turning lanes or widened shoulders to ensure safe access.

Satellite compounds

It is likely that a number of temporary satellite compounds would be required for the project. These satellite compounds would be approximately 50 by 50 metres in size and are likely to include:

- Gravel placed across the entire area.
- Shipping containers for tools and equipment.
- Small offices.
- Limited parking.
- Crib shed(s).
- Portable toilets.
- Generators.
- Bunded storage of chemicals (eg fuel).
- Storage of materials, scaffold.
- Fencing and security.
- Erosion and sediment controls.

The location of any satellite compound would be determined during detailed design. If required, the satellite compound would be located in areas that meet the above criteria and would be assessed to determine if any additional mitigation measures are required to minimise environmental impacts.

Concrete batch plant

Temporary concrete batch plant(s) would be required to provide concrete for construction of the project. The final number of batch plants would be confirmed during detailed construction planning.

Concrete batch plants may require an area of approximately three hectares and would include:

- 'Wet mix' mobile batch plant.
- Diesel generator.
- Silos.
- Security fencing.
- Water storage tanks.
- Storage areas.
- Site office.
- Amenities.
- First aid room.
- Car park.
- Access road.
- Erosion and sediment controls, including a sediment pond.
- Waste water system.
- Septic system.

Should the batch plant be co-located with the main site compound, then not all of the auxiliary facilities listed above would be required.

The location of concrete batch plant(s) would be determined during detailed design. If required, the batch plant(s) would be located in areas that meet the above criteria and would be assessed to determine if any additional mitigation measures are required to minimise environmental impacts.

6.4.2 Storage and stockpile areas

Several stockpile sites are likely to be required for the project to store, prepare and distribute materials. The proposed locations of temporary stockpiles would be assessed against the following environmental criteria:

- Of low ecological and heritage conservation value.
- Constructed on the contour at least 40 metres from waterways.
- Outside the 10 ARI floodplain.
- On relatively level ground.

Adopting the above criteria would ensure environmental impacts are minimised.

Areas would be required for the stockpiling of topsoil materials from cut and fill areas prior to placement on medians, embankment slopes and cut batters. Other materials such as topsoil, mulched vegetation, bedding material for drainage works, unsuitable material and other materials not included so far in this list would be protected to prevent erosion and sedimentation.

6.4.3 Temporary sediment basins

An assessment of the soil, landform and hydrological constraints associated with the project enabled the identification of indicative locations for sediment basins (refer to Section 10.3). Sediment basins would be located in areas of low ecological and heritage conservation value.

Sediment basins would be designed and maintained in a manner consistent with the measures identified in Section 10.3 to mitigate impacts on the surrounding environment during construction. At sensitive environmental areas (eg Ten Mile Creek), temporary sediment basins may be retained as permanent spill containment structures during operation of the project. The remaining temporary basins would be removed and rehabilitated upon opening of the project. Determination of which temporary sediment basins used during construction would be retained as permanent sediment basins for use during operation of the project would be considered during the construction phase of the project.

Figure 6-3 shows indicative locations of sediment basins.

Erosion and sediment control measures would be constructed in accordance with the 'Blue Book'' *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2006) and *Managing Urban Stormwater: Soils and Construction, Volume 2D, Main Road Construction* (DECC 2008b).

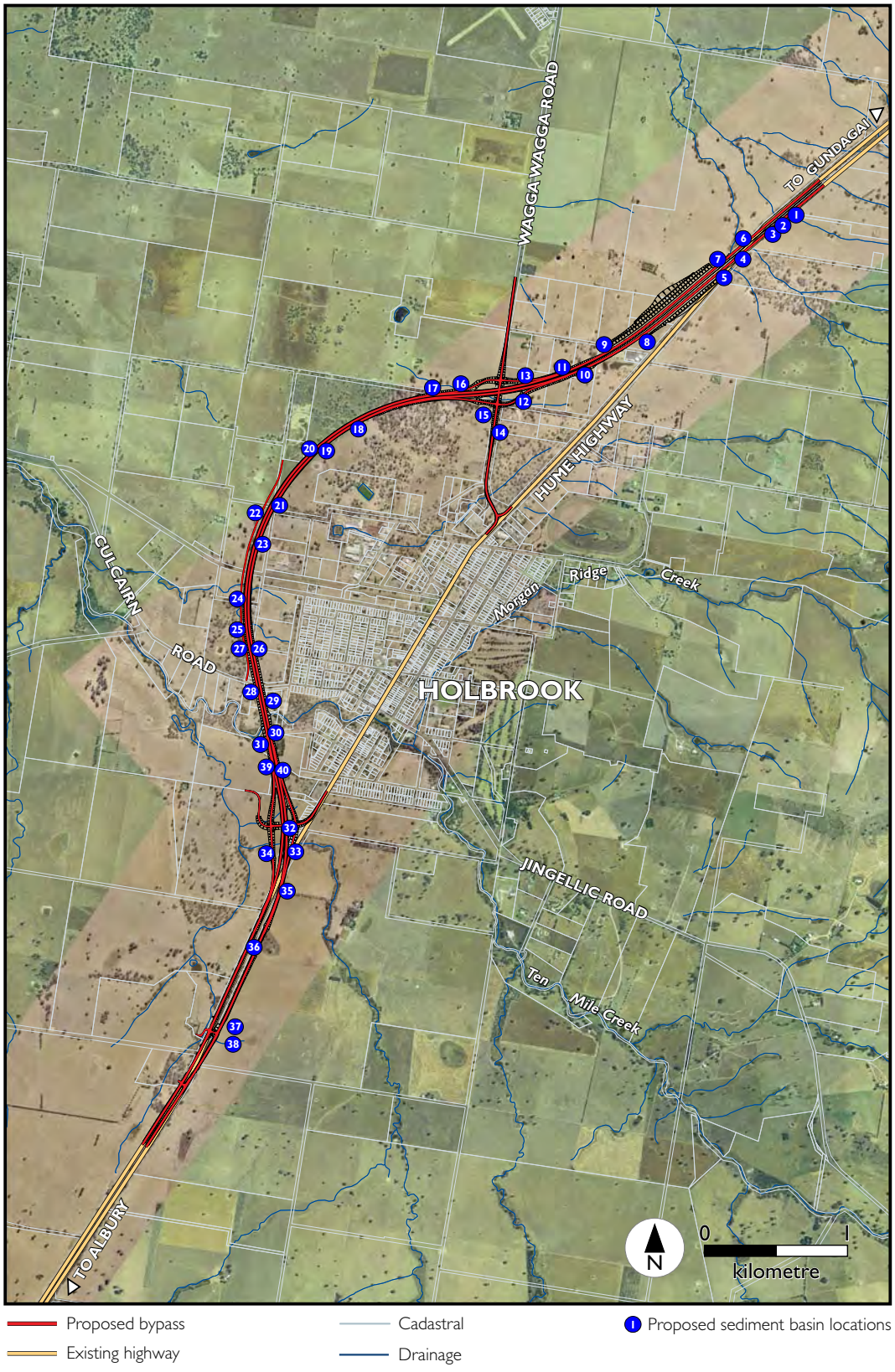

Figure 6-3 **Proposed sediment basin locations**

6.4.4 Temporary haul roads, creek crossings and access roads

A number of temporary haul roads, creek crossings and access roads would be required for the project. These temporary works would be located in areas of low ecological and heritage conservation value, as far as practicable.

A temporary haul road would be constructed along the length of the project. Other minor temporary haul roads would be required to access certain key areas of the project. Generally the temporary roads would be all weather access and would be up to 15 metres in width.

Temporary access roads, including the provision of side tracks, would likely be required for the construction of northern tie-in to the existing highway, Anderson's Lane, the intersection of Wagga Wagga Road, Tip Road, Culcairn Road and the southern interchange. In addition, temporary or alternative property access may be required to ensure that property access is maintained for the duration of construction.

Two temporary creek crossings would be required over Ten Mile Creek. These crossings would be located on either side of the bridge construction area and would be up to 15 metres in width to cater for a two-way heavy haul road.

The temporary creek crossings would be designed in accordance with Department of Industry and Investment's *Policy and Guidelines for Fish Friendly Waterway Crossings* (Fairfull and Witheridge, 2003) and in consultation with the Department of Industry and Investment. The crossings would be designed to ensure that sedimentation and erosion impacts would be minimised. They would accommodate a 10 year flood event, and the roads would be designed and constructed to allow water to safely overtop in a larger flood event and to prevent erosion of the road surface.

6.4.5 Rehabilitation of ancillary facilities

Following completion of construction, ancillary facilities not required for operation would be revegetated to their pre-existing condition, in consultation with the relevant landowner(s).

6.5 Workforce and working hours

6.5.1 Construction workforce

The construction workforce would vary depending on the phase of construction and associated activities. The workforce would include construction and design personnel. An on site workforce of up to 300 persons could be engaged at any given time during the construction period.

6.5.2 Construction working hours

In accordance with the *Environmental Noise Control Manual* (ENCM) (EPA 1994), construction works are typically restricted to the hours of:

- 7am and 6pm Monday to Friday.
- 8am to 1pm Saturday.
- No work on Sundays or public holidays.

However, it is proposed that the construction hours for this project would be extended to maximise productivity and reduce the overall project delivery timeframe. Construction activities would take place from 6am to 7pm, Monday to Friday and 7am to 4pm Saturday (the daytime period), with no work on Sundays or public holidays.

By using available daylight and increasing the productivity of the working day, several positive benefits would be realised. Early completion of the project would deliver the project sooner and provide safer travel to road users in a shorter timeframe. Also, by shortening the total project duration, impacts on residents would be reduced proportionally, whilst resulting in minimal adverse impact on residents.

The proposed working hours and associated activities are outlined in Table 6-3.

Table 6-3 Proposed working hours and associated activities

Working hours	Activity
Monday to Friday (6am to 7pm)	▪ Compound operation. ▪ Earthworks. ▪ Structures. ▪ Drainage. ▪ Ancillary/finishing work. ▪ Paving. ▪ Concrete saw cutting. ▪ Concrete batch plant operation. ▪ Maintenance activities. ▪ Blasting activities (would only occur between 9am and 5pm and be limited to two blasts per day).
Saturday (7am to 4pm)	▪ Compound operation. ▪ Deliveries. ▪ Earthworks. ▪ Structures. ▪ Drainage. ▪ Ancillary/finishing works. ▪ Paving. ▪ Concrete saw cutting. ▪ Concrete batch plant deliveries. ▪ Batch plant operation. ▪ Maintenance activities.
Sunday and public holiday	No scheduled work.

Construction activities not identified above would be undertaken during the daytime. Exceptions to this would be limited to:

- Works that do not cause construction noise to be audible at any sensitive receiver; or
- Delivery of materials required by the Police or other authorities for safety reasons; or
- Work that is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or
- A case-by-case or activity specific basis, which would be subject to consultation with the DECCW and affected sensitive receivers (refer below).

6.5.3 Out of hours works

There is some potential for evening and night-time works to be required due to:

- Technical considerations (such as the need to meet particular quality specifications for the placement of concrete pavement).
- The climatic environment (cold winters and hot summers).

Table 6-4 identifies these likely evening and night-time activities. The justification for these evening and night-time activities is outlined below.

Table 6-4 Activities likely to take place in the evening and night-time periods

Day	Activity
Monday to Friday Evening (7pm – 10pm) and Night-time (10pm – 6am)	▪ Concrete paving. ▪ Concrete saw cutting. ▪ Concrete batch plant deliveries ▪ Concrete batch plant operation. ▪ Maintenance activities. ▪ Compound operation.

Concrete paving

The RTA has specifications for placement of concrete pavement that relate to temperature and rainfall. For jointed concrete base, the specifications prohibit the placement of concrete during rain or when the ambient air temperature is below 5°C or above 32°C. As hot weather affects the quality of concrete pavement, paving in the early evening and into the night is recommended as it takes advantage of night-time cooling. For cold weather concreting, early morning paving is recommended, to take advantage of daytime solar radiation and heat generation to promote concrete strength.

It is highly likely that concrete paving would need to be carried out during summer. Due to the climatic conditions experienced in the region during summer months, where daytime ambient temperatures often exceed the maximum temperature threshold of 32°C, concrete paving would need to occur during the day, evening and night-time periods.

Concrete saw cutting

The project would most likely use plain concrete pavement, which is an unreinforced pavement. To manage cracking associated with drying shrinkage, saw cutters would be used to cut the pavement (usually in 4.2 metre sections). The timing of concrete cutting is governed by the hydration rate of the pavement, and may require cutting at any time within four and 24 hours after paving, with a 'cutting window' as short as 30 minutes. As the timing of cutting is critical to the quality of the pavement and acceptance of the finished product, concrete saw cutting may be undertaken at any time, including outside normal construction hours. Concrete saw cutting is a construction activity that is transient in nature, and each 'saw cut' would be of a short duration.

As mentioned above, concrete paving is highly likely to be carried out during summer months. Following concrete paving, concrete saw cutting would take place within a four and 24 hour period, during the day, evening and night-time periods.

Concrete batch plant

Section 6.6.1 identifies that a concrete batch plant(s) is proposed for the construction of this project. In addition to normal daytime operation for concrete products (drainage structures etc.), the concrete batch plant may need to operate in conjunction with concrete paving works during the evening and night-time periods as indicated above.

To keep up with materials demand during these peak periods of concrete production, the batch plant may require materials deliveries outside of normal working hours. Due to the regional location of the project, the timing of deliveries may be determined by the pattern of supplier fleet movements (ie at night).

The number of deliveries would be dependent on the size of the batch plant and its storage capabilities. There is potential for up to three (approximate one hour) deliveries per night during peak periods.

Maintenance activities and site compound operation

Maintenance and operation of the site compound would be required to support the activities described above.

Management of impacts

An assessment of likely noise impacts resulting from these activities has been undertaken and is presented in Section 9.3. Specifically, Section 9.3.6 identifies the management measures that would be implemented to minimise these impacts. As outlined above, evening and night-time works would be considered on a case-by-case or activity specific basis, which would be subject to consultation with DECCW and affected sensitive receivers.