4 Description of the project

This chapter describes the project. It describes the proposed scope of work, including the route alignment, corridor width, project elements, design standards and construction activities.

Director General's requirements	Where addressed
The Environmental Assessment must include ... a **description** of the project including:	
route alignment of the project, including an indication of areas for widened or new carriageways, on/ off ramps, breakdown lanes and associated and ancillary facilities;	Section 4.1, Section 4.2
key design elements of the project, including carriageway, bridging works and connections with existing road infrastructure; and	Section 4.3
construction facilities, including construction compounds, lay-down areas and spoil stockpiling/ management areas.	Section 4.4

4.1 Project scope

4.1.1 The project

The project for which approval is being sought comprises the upgrade of a section of the Pacific Highway, about seven kilometres in length, between Franklins Road and Eight Mile Lane at Glenugie. The upgrade involves constructing a new section of road parallel to the existing highway to create a dual carriageway highway. It also involves improvements to the existing highway and constructing a forestry access track in Glenugie State Forest. Further details of the upgrade are provided in Section 4.1.3.

4.1.2 Route alignment

The proposed route for the upgrade is located on the eastern side of the existing Pacific Highway within Glenugie State Forest, between Franklins Road and Eight Mile Lane (**Figure 1-2**, **Figure 1-3**, and **Figure 4-1a-c**). It crosses the upper reaches of Glenugie Creek and a number of unnamed, intermittent streams. The route alignment is described in detail in the following sections.

4.1.3 The upgrade proposal

The RTA is seeking approval for a full motorway style (class M) upgrade. Approval is also being sought to stage the construction and operation of the upgrade. The likely initial staging would involve a combination of arterial and motorway style road.

The motorway style upgrade proposal

The motorway style upgrade would run parallel to the existing Pacific Highway between Franklins Road and Eight Mile Lane (**Figure 1-2** and **Figure 4-1a-c**). It would comprise a dual carriageway road, about seven kilometres

in length, with two lanes in each direction and a 110 km per hour posted speed limit. The road median would be wide enough to accommodate future upgrading to three lanes in each direction if required.

At its southern end, the new road would tie into the existing highway just to the south of Franklins Road. At its northern end, the new road would tie into the existing highway just south of Eight Mile Lane. The existing highway would be retained as a local access road.

As part of the project, a new forestry service road would be constructed to maintain operational access to Glenugie State Forest. The new service road would run from Eight Mile Lane to Lookout Road, parallel to the new section of highway and just outside the highway road reserve corridor (**Figure 1-2** and **Figure 4-1a-c**).

Likely initial staging

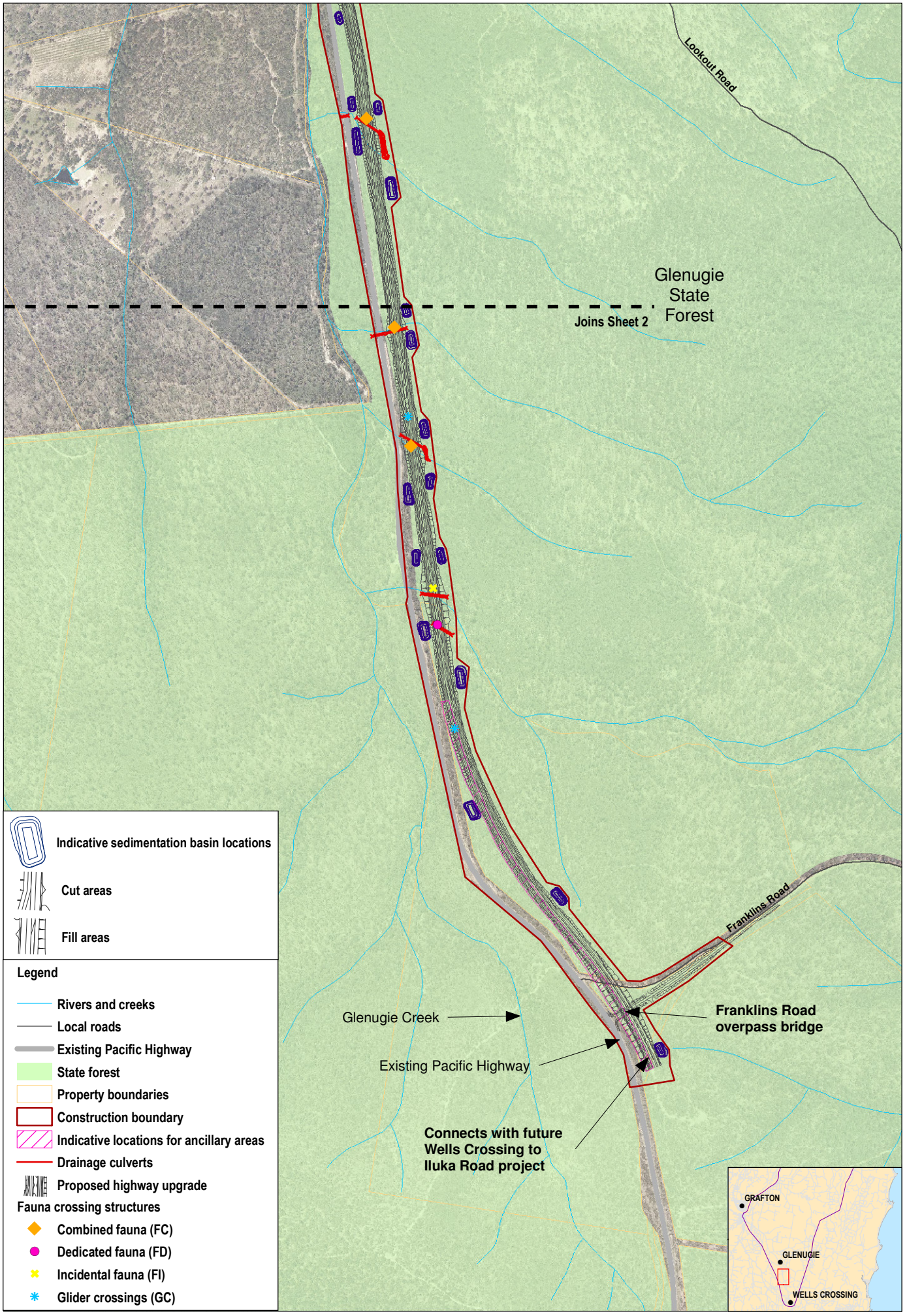
The likely initial staging would comprise a combination of arterial and motorway style highway as shown in **Figure 1-3**. This would include:

- A section of motorway style road, about 2.5 km in length, at the northern end of the proposed upgrade route. In this section, the existing highway would become a local access road.
- A section of arterial style road, about four kilometres in length, at the southern end of the proposed upgrade route, to carry southbound traffic. In this section, the existing highway would become the northbound carriageway.
- Connection of the northern end of the upgrade to the existing highway via a section of two lane road, about 1.5 km in length.
- Connection of the southbound carriageway to the existing highway near Franklins Road.

The proposed forestry service road (as described above for the motorway style upgrade) would be constructed as part of the initial staging. It is also possible that some work may be required on the existing highway when used as the northbound carriageway. These works would be confined to the eastern side of the existing highway (refer to **Figure 1-3**) and have been assessed as part of the project.

4.1.4 Scope of the environmental assessment

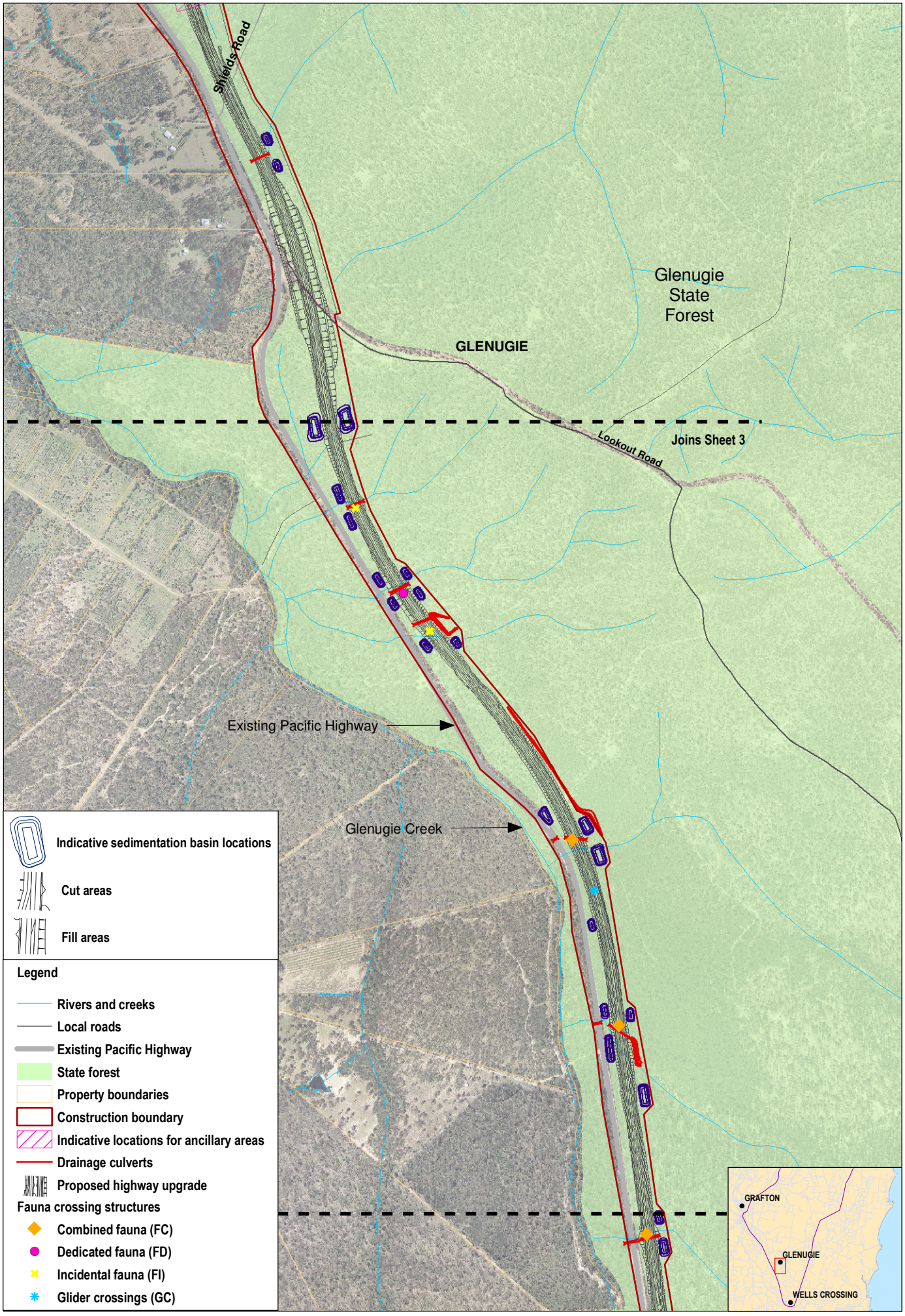
This environmental assessment addresses the potential impacts of both the full motorway style upgrade and the likely initial staging. As the construction footprint and associated environmental impacts of the full motorway style upgrade would be greater than those of the likely initial staging, the environmental assessment focuses on the full motorway proposal. Additional consideration is given to the potential impacts of the likely initial staging where these impacts differ substantially from those of the full motorway. Where environmental protection and impact mitigation measures are proposed, they would be applied to both the initial staging and full motorway upgrade.



Data Sources
Streetworks, LPI 2008
Aerial: 2007

Figure 4-1a: Full motorway style upgrade – Sheet 1

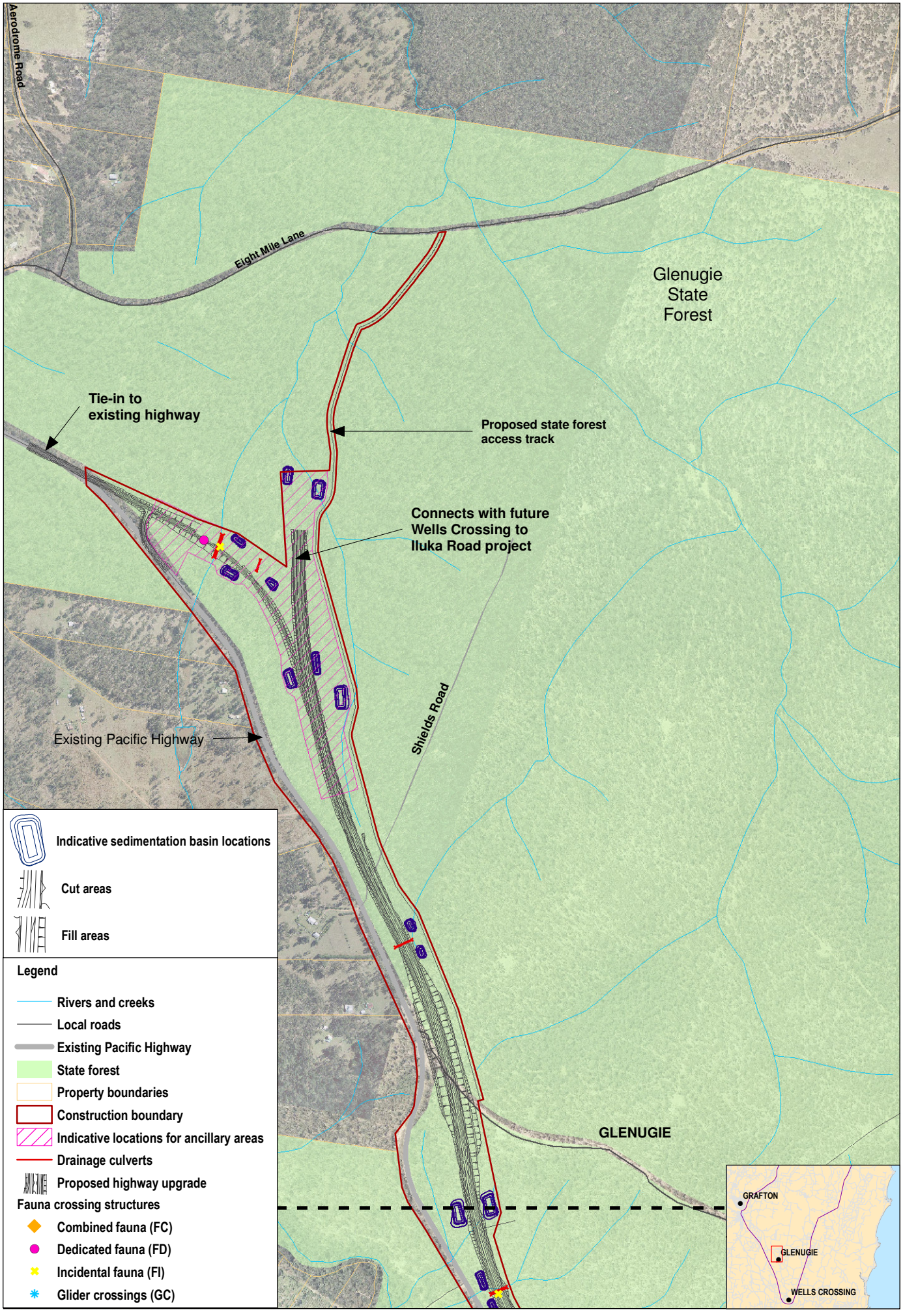
0 500
A4 1:15,000 Metres



Data Sources
Streetworks, LPI 2008
Aerial: 2007

Figure 4-1b: Full motorway style upgrade – Sheet 2

0 500
A4 1:15,000 Metres



Data Sources
Streetworks, LPI 2008
Aerial: 2007

Figure 4-1c: Full motorway style upgrade – Sheet 3

0 500
A4 1:15,000 Metres

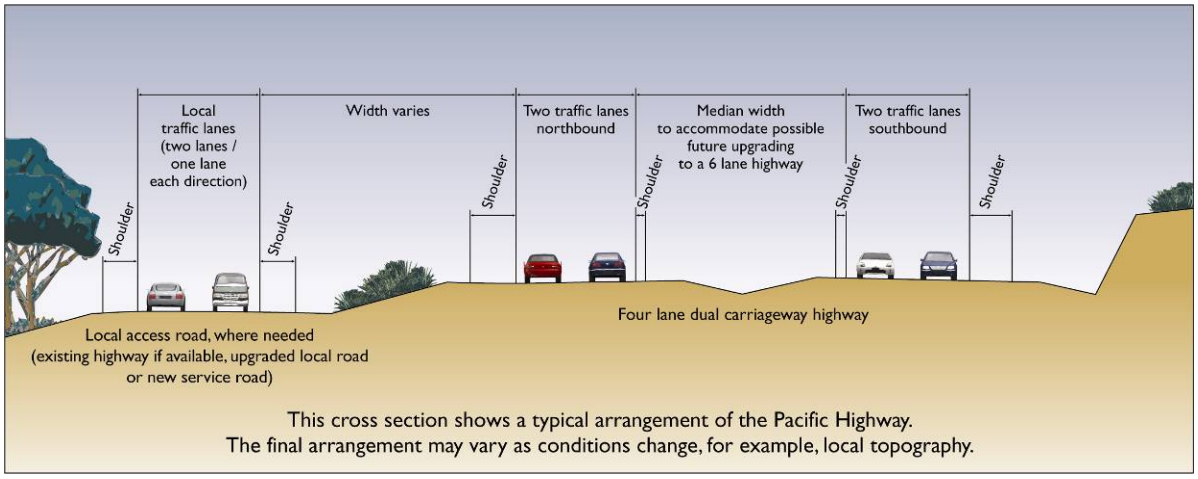
4.2 Details of project elements

4.2.1 Road grade and lane widths

The project would be constructed in accordance with the RTA's *Pacific Highway Design Guidelines* and *Road Design Guidelines*. A typical cross section for a motorway style upgrade is shown in **Figure 4-2**. The typical lane width adopted for the project is 3.5 m with 2.5 m outside shoulders and 0.5 m inside shoulders. The median is generally 12 m wide. The cross section, including crossfall, batter slopes, and drainage channels, is in accordance with the RTA's *Pacific Highway Design Guidelines*.

Motorway style upgrade would be designed to allow it to operate at a posted speed limit of 110 km/hr. The posted speed limit for the likely initial staging is likely to be 100 km/hr. A decision on the sign posted speed limit would be made at a time closer to construction.

- **Figure 4-2 Typical cross section for a motorway style upgrade**



4.2.2 Corridor width and project footprint

The project corridor (or boundary) has been defined for the full length motorway style upgrade. This represents the maximum land take requirements for the project.

The total project corridor varies along its length and encompasses:

- The carriageways and road reserves of the both the existing highway and the upgrade.
- The area between the existing highway and the upgrade.
- Areas for construction facilities and erosion and sedimentation controls.

The corridor width is up to 300m wide in some locations as the area between the project and the existing highway is included in the road reserve. The corridor is shown in **Figure 4.1a-c**.

While the total project corridor (road reserve) is up to 300 m wide in some

places, the project footprint (area of impact or disturbance) is much less than this. The footprint width varies between about 40 m and 160 m, depending on the location of sedimentation basins and the cut and fill heights. The maximum width corresponds to areas where sedimentation basins are located on either side of the alignment. The total clearing to be carried out for the project is about 85 hectares.

For both the full motorway style upgrade and the likely initial staging, part of the area between the existing highway and the proposed new roadway section may be used, as required, for temporary construction facilities and sediment basins. For the likely initial staging, an alternate location for these facilities would be under the future motorway footprint, which would not be initially required. The proposed indicative locations of temporary construction facilities and sediment detention basins are shown in **Figure 4-1a-c**. Further details of these facilities are provided in Section 4.4.

4.2.3 Intersections

Intersections would be provided to facilitate access to the local road network and existing Pacific Highway as described below.

Franklins Road intersection

For the likely initial staging, an at-grade intersection would be constructed at Franklins Road to give direct local access to the upgraded section of highway. This intersection would operate as follows:

- Access to and from the southbound carriageway would be via a left-in, left-out arrangement with acceleration and deceleration lanes provided on the southbound carriageway.
- Access to and from the northbound carriageway would be via a right-in, right-out arrangement with acceleration and deceleration lanes provided on the northbound carriageway as part of the project. The median width at Franklins Road is sufficient for the storage of vehicles between the northbound and southbound carriageways such that the access to and from the northbound carriageway would be made in a two step process (for example, turning right out of Franklins Road, a vehicle would give way to vehicles on the southbound carriageway and once clear would cross the southbound carriageway to the median. From here they would turn right into the northbound acceleration lane and merge left into the northbound carriageway, when safe.)

For the full motorway style upgrade, the Franklins Road intersection would be removed and replaced with a bridge across the new highway to the existing highway. Local traffic would then be able to travel north or south on the existing highway, as required.

Additional intersections

For both the full motorway style upgrade and the likely initial staging, an at-grade intersection would be provided at the tie-in point of the northern end of the upgrade and the existing Pacific Highway..

An at-grade intersection would be constructed to connect the proposed forestry service road (see Section 4.2.7) with Eight Mile Lane. This would be constructed as part of the likely initial staging and would remain in place for the full motorway upgrade.

4.2.4 Bridging works

For the motorway style upgrade, a bridge across the upgrade connecting Franklins Road to the existing highway would be required. The bridge will cater for two way traffic and is likely to be approximately 60 m long and 10 m wide. A minimum clearance of 5.3 m will be provided from the upgrade pavement surface to the underside of the bridge. The bridge design will be finalised as part of the detailed design of the motorway style upgrade in accordance with any commitments made in this environmental assessment.

No bridge works would be required for the likely initial staging.

4.2.5 Drainage culverts and fauna crossing structures

The project incorporates 11 drainage culverts, including five box culverts and six pipe culverts, to allow passage of a one in 100 year flood. Preliminary details of these culverts are provided in **Table 4-1**. Details will be finalised in the detailed design phase of the project. The drainage structures form part of both the full motorway upgrade proposal and the likely initial staging. All structures would be constructed as part of the likely initial staging.

Eight of the proposed drainage culverts are located within fauna movement corridors and have been designed to facilitate fauna passage under the new highway (**Table 4-1**). Four of these eight culverts are combined drainage and fauna crossing structures, incorporating specific design features to facilitate fauna passage. The remaining four of these eight culverts would provide for incidental fauna passage.

In addition to the fauna crossing points provided through drainage structures, the project incorporates six dedicated fauna crossing structures, namely:

- Three dedicated underpass structures
- Three overhead rope crossings.

Preliminary details of these fauna crossings are provided in **Table 4-2** and **Table 4-3**. The requirements for these crossings will be confirmed during detailed design. The structures form part of both the full motorway upgrade proposal and the likely initial staging. All structures would be constructed as part of the likely initial staging.

With the proposed combination of drainage structures and dedicated fauna crossings, there would be a total of 14 fauna crossing structures along the length of the project. Further details of fauna crossings are provided in Section 7-1 and Appendix D.

- **Table 4-1 Proposed drainage structures and associated fauna passage**

Chainage	Structure[1]	Fauna crossing provision
4415	2 x 2.4 m high x 2.4 m wide box culverts with a ledge (0.6 m wide and 0.12 m high) in one culvert to allow passage for during wet periods.	Incidental fauna passage
4890	2 x ϕ2.4 pipe culvert	Combined fauna passage
5225	2.4 m high x 2.4 m wide box culvert	Combined fauna passage
5865	2.4 m high x 2.4 m wide box culvert with lowered central floor and raised sides (bench) to facilitate fauna movements	Combined fauna passage
6465	2 x 2.4 m high x 2.4 m wide box culvert with lowered central floor and raised sides (bench) to facilitate fauna movements	Combined fauna passage
7270	3 x ϕ1.050 pipe culvert	Incidental fauna passage
7395	3 x ϕ1.2 pipe culvert	No fauna passage
7680	3 x ϕ1.2 pipe culvert. Install 0.1 m lip upstream of one cell to make one cell dry	Incidental fauna passage
8780	3 x ϕ0.6 pipe culvert	No fauna passage
9990	3 x ϕ0.525 pipe culvert	No fauna passage
10040	4 x ϕ1.2 pipe culvert (on ramp)	Incidental Fauna passage (FI)

1. Details of drainage structures and fauna crossings are indicative only. Details including culvert size, location and cost effectiveness will be finalised in the detailed design phase of the project in consultation with the DECC and DPI.

- **Table 4-2 Proposed dedicated fauna underpass structures**

Chainage	Structure[1]	Fauna crossing provision
4300	1.2 m high x 2.4 m wide box culvert style fauna crossing.	Dedicated fauna passage
7395	1 x ϕ1.2 pipe culvert with invert raised above that of adjacent drainage structure.	Dedicated fauna passage
10050	1 x ϕ1.2 pipe culvert	Dedicated fauna passage

1. Details of fauna crossings are indicative only. Details including culvert size, location and cost effectiveness will be finalised in the detailed design phase of the project in consultation with the DECC and DPI.

- **Table 4-3 Proposed overhead (rope) fauna crossings**

Chainage	Structure[1]	Fauna crossing provision
4000	Canopy rope crossing extended over the north bound carriageway linked to Glenugie Creek riparian habitat.	Dedicated fauna passage

Chainage	Structure[1]	Fauna crossing provision
4900	Canopy rope crossing extended over the north bound carriageway linked to Glenugie Creek riparian habitat. Extend canopy rope structure over the existing highway at this location.	Dedicated fauna passage
6300	Canopy rope crossing extended over the north bound carriageway linked to Glenugie Creek riparian habitat.	Dedicated fauna passage

1. Details of fauna crossings are indicative only. Details including culvert size, location and cost effectiveness will be finalised in the detailed design phase of the project. in consultation with the DECC and DPI.

4.2.6 Emergency facilities

An emergency U-turn facility, for use by emergency services vehicles, would be incorporated into the project. This facility would be confined entirely within the corridor of the new dual carriageway. The final location of this facility would be confirmed in detailed design.

The proposed 2.5 m road shoulder provides a 'pull-over' area for breakdowns and other emergencies.

4.2.7 Local access roads

A new service road would be constructed as part of the project to maintain operational access to Glenugie State Forest via Shields Road and Lookout Road. The new service road would run from Eight Mile Lane to Lookout Road, parallel to the new section of highway and just outside the highway road reserve corridor (**Figure 4-1a-c**). The service road would be constructed as an unsealed two wheel drive (2WD) standard track about six metres wide. It would be constructed as part of the likely initial staging and would remain in place for the full motorway upgrade.

Where the project is constructed as a motorway style road, the existing highway would become a local access road.

4.2.8 Road furniture and fencing

The project incorporates a variety of roadside furniture elements to provide for safety, delineation, directional guidance, fauna exclusion and security along the length of the new highway alignment. The location and design of these elements would be refined during the detailed design phase of the project. Preliminary, indicative details are provided in **Table 4-4**.

- **Table 4-4 Indicative details of road furniture and fencing**

Item	Indicative details[1]
Street lighting	A street lighting scheme would be implemented for the project in accordance with the *Pacific Highway Design Guidelines* (RTA 2006) for illumination of major highways.

Item	Indicative details[1]
Safety barriers	A range of safety barriers would be provided to protect vehicles from potential collision hazards. The barriers would be tailored for each location where they are required and would include appropriate fencing on fill embankments.
Line marking and signposting	Line marking would be in accordance with RTA standards and would include painted lines and reflective pavement markers. Additional delineation would be provided by way of standard reflectors on safety barriers and guideposts. The signposting scheme would be developed in accordance with RTA guidelines and in consultation with relevant stakeholders.
Headlight screens	Headlight screens may be required where highway traffic has the potential to be affected by headlight glare from traffic on local roads and vice versa. The need for headlight screens, will be determined in detailed design.
Fencing	Fencing would be provided on the boundary of the project and Glenugie State Forest in consultation with DPI Forests NSW. Fauna fencing would be provided at identified areas of high fauna activity to keep animals away from the roadway and direct animals to suitable fauna crossings. The location of fauna fencing will be confirmed at the detailed design phase.

1. Subject to detailed design.

4.2.9 Utility services

Existing services

There are very few existing utilities within the project corridor. The main utility service of note is a Telstra optical fibre cable running between the Telstra tower on Lookout Road and Eight Mile Lane. Preliminary discussions were held with Telstra during the concept design phase to obtain agreement on a suitable location for this cable to cross the upgrade, that being a location where the upgrade was located on a fill embankment. The details of any utility service relocations or protection will be finalised during detailed design.

Provision of new services

Provision for new services will be evaluated in consultation with the local service authorities and finalised during detailed design. New services will only be provided where they are required for or severed by the project within the road corridor or immediately adjacent to the corridor.

4.3 Design

4.3.1 Design standards

Components of the project are designed to be consistent with the RTA's *Pacific Highway Design Guidelines* (RTA 2006) and *Road Design Guide* (RTA 2000). Engineering concept design criteria for the project are summarised in **Table 4-5**.

- **Table 4-5 Concept design criteria**

Design parameters	Design criteria
Design speed[1]	110 km/h horizontal; 100 km/h vertical
Minimum "K" value	95 (crest) / 35 (sag)
Stopping sight distance Horizontal Vertical Reaction time	 210 m 210 m 2.5 sec
Number of lanes	Two lanes per carriageway[2]
Traffic lane width	3.5 m
Outside shoulder widths	2.5 m — with no safety barrier 3 m — with safety barrier
Inside shoulder widths	0.5 m
Median width	12 m
Clear zone	11 m
Formation, drainage and road reserve widths	In accordance with *Upgrading Program beyond 2006 — Design Guidelines*, July 2005, Issue 2.4 (RTA, 2006f).
Minimum horizontal radius	1200 m desirable; 750 m minimum
Maximum superelevation	3 %
Maximum vertical grade	4.5 % desirable; 6.0 % maximum[3]
Vertical clearance bridges to overhead	5.5 m desirable; 5.3 m minimum
Design vehicle	19.5 m semi-trailer / 25 m B-double
Flood immunity	One carriageway flood-free for the 20-year ARI event in designated areas, 100-year ARI elsewhere.

1. This refers to the full motorway style upgrade. The posted speed limit for the likely initial staging is likely to be 100 km/hr. A decision on the sign posted speed limit would be made at a time closer to construction.
2. Consideration has been made for future widening to 3 lanes in each direction, if required.
3. Desirable maximum length for 6 % grade is 500 m.

4.3.2 Urban design principles and objectives

Design principles and objectives have been considered throughout the development of the Wells Crossing to Iluka Road upgrade proposal, drawing on the RTA's *Pacific Highway Urban Design Framework* (PHUDF) (RTA 2005). The PHUDF provides guidelines for urban design considerations to be incorporated into all stages of the project development and emphasises the importance of considering urban design early in the project.

To ensure consistency with the PHUDF, design objectives were factored into the route selection and design development process for the project. These objectives are listed below.

- **Objective 1:** Provide a flowing road alignment that is responsive and

integrated with the landscape. To implement this objective, the design should seek to:

  - Achieve an aesthetically pleasing road alignment by following the edges of landscape units.
  - Integrate road embankments into the adjacent landscape through the use of variable batter slopes.
  - Integrate the road landscape into existing vegetation patterns. For example, avoid linear strip planting of trees and shrubs along the highway that do not fit into the landscape.

- **Objective 2:** Provide a well vegetated, natural road reserve. To implement this objective, the design should seek to:
  - Select vegetation that responds to that adjoining the road corridor.
  - Select planting that reflects the developed and cultural planting of the area to which the highway is connecting, where it passes through or connects to populated areas. Special landscape treatments may be appropriate at interchanges, where cultural or native plantings may be used.
  - Select median planting that is responsive to the vegetation community through which the road travels.
  - Highlight creek crossings by using plantings that reflect naturally-occurring species that distinguish them from other areas.
  - Use revegetation works that respond to ecological constraints and controls. Adjacent to traffic lanes, or where there are no fauna fences, plant species should be selected that do not attract fauna species that are prone to straying onto roads.
- **Objective 3:** Provide an enjoyable, interesting highway. To implement this objective, the design should seek to make the alignment responsive to the topography, with curves responding to topographic constraints and straight sections used sparingly and in harmony with terrain.
- **Objective 4:** Value the communities and towns along the road. To implement this objective, the design should seek to:
  - Provide distinctive planting at off-ramps leading to towns.
  - Consider local access to the highway alignment.
  - Consider access needs at a regional and local context, to facilitate easy movement of locals within their local region as well as connecting to the wider hinterland and beyond.
  - Avoid or minimise and mitigate against adverse visual impacts on towns and communities, where possible.
- **Objective 5:** Provide consistency-with-variety in road elements. To implement this objective, the design should seek to:
  - Consider the bridges as part of the same design family and part of the suite of unified elements.
  - Make the flood bridges slim in profile to minimise visual bulk and reduce their visual impact.

- **Objective 6:** Provide a simplified and unobtrusive road design. To implement this objective, the design should seek to:
  - Integrate the piers for bridges that cross over the highway into the overall design of the structure, either through the use of columns without pier caps (headstocks) or wall type piers.
  - Use spill-through 'open' abutments on bridges over the upgrade.
  - Design safety screens, where required, as an integral part of the bridge and site them in accordance with RTA policy.
  - Neatly integrate bridge barriers with road and safety barriers.

4.3.3 Landscape framework

A landscape framework has been developed for the project (see Section 8.4). This framework provides a structural layout for the future landscape design of the project and is responsive to the design objectives. The details of landscape treatments will be finalised during the detailed design phase.

4.3.4 Design refinement

The project description presented in this environmental assessment represents the project concept design. The concept design is based on part of the preferred route for the Wells Crossing to Iluka Road Pacific Highway upgrade and design refinements made in response to the technical specialist studies carried out for this environmental assessment. These design refinements have been made as part of the project development process with the aim of minimising the potential environmental and social impacts as far as practical.

The concept design is an initial functional layout of the proposed highway upgrade, addressing constraints and principles identified during the project development phase. The concept design is intended to define a highway development proposal that provides:

- A definition of property acquisition sufficient to allow the project to be implemented.
- A clear description of the design principles.
- An understanding of the nature and extent of the likely impacts and impact mitigation measures.
- A sound and clear basis for the development of the detailed design to support the construction of the project.

The detailed design process would consider the environmental constraints and impact mitigation measures identified in this environmental assessment, as well as submissions received following exhibition of the environmental assessment. The final design may therefore vary from the concept design described in this chapter**.**

This environmental assessment addresses and responds to all constraints and principles identified and established during route development. The concept design is intended to describe the sustainable outcomes of a design process that has integrated functional, environmental, social and cost considerations.

The detailed design may be further refined based on the outcomes of additional investigations, such as geotechnical or ecological surveys. The RTA would also finalise negotiations with DPI Forests NSW regarding property access and acquisition arrangements.

The proposed concept design and construction methods detailed in this chapter are presented as a functional solution to the project objectives and constraints. They may be refined by RTA and its construction contractor within the limits of any conditions of approval imposed and the design principles and standards presented in this environmental assessment. They may be refined, for example, in responses to submissions made. Sufficient flexibility has been provided in the design to allow for its refinement.

4.4 Construction

4.4.1 Overview of construction activities

Table 4-6 provides details of the potential pre-construction and construction activities to be undertaken. These potential activities are applicable to both the likely initial staging and the full motorway upgrade.

The methods used to construct the elements of the project would be conventional techniques employed on major road projects, adapted to account for project-specific environmental and social constraints. Local access requirements and the geotechnical conditions would influence the final choice of construction techniques to ensure the project was constructed in a safe and efficient manner. The types of equipment and plant requirements would be refined during detailed design and during the development of the construction methodology by the construction contractor.

Table 4-6 Potential pre-construction and construction activities

Component	Typical activities	Typical plant and equipment
Procurement, award and environmental management system set-up	• Tendering and award of contract • Identification of sensitive areas • Preparation/processing of construction environmental management plans, licenses and approvals	Not applicable
Obtain authorisation from DPI Forests NSW to occupy and use land	• Confirmation of property boundaries • Obtain written authorisation from DPI Forests NSW to occupy and use State Forest land for purposes of constructing the project	Not applicable

Component	Typical activities	Typical plant and equipment
Site establishment	• Fencing of corridor • Establishment of construction site facilities and access • Implementation of initial environmental safeguards • Pre-clearing and habitat surveys	Fences, portable sheds, portable toilets, fuel storage tanks, concrete and asphalt batching plants.
Relocation of services	• Identification of utility services and consultation with utility authorities • Relocation or protection of services as required	Trucks, cranes, excavators, elevated platform vehicle, backhoes, trenchers, small equipment.
Site preparation	• Harvestable timber felled and removed. This will be done by DPI Forests NSW. • Clearing and grubbing and processing (including recycling) of various materials for use in landscaping activities • Stripping and stockpiling of topsoil for reuse	Trucks, bulldozers, scrapers, excavators, backhoes, small equipment.
Earthworks	• Earthworks, including movement of materials along the alignment from cutting to fill embankment areas • Removal and stockpiling of spoil and unsuitable material • Batter treatments	Trucks, bulldozers, excavators, scrapers, graders, water carts, compactors, rollers, blasting equipment.
Drainage and fauna crossings	• Construction of diversion drainage and sediment basins • Construction of transverse drainage structures • Construction of subsurface and pavement drainage • Construction of drainage culverts and combined fauna crossings	Piling rigs, concrete pumps, cranes, excavators, trucks, small equipment, rope structures, elevated platform vehicle.
Pavements	• Construction of pavement layers including selected material, sub-base and base layers	Trucks, graders, water carts, compactors, asphalt paver, vibratory rollers, rubber-tyre rollers.
Improvements to existing highway (for initial staging)	• Earthworks • Construction of pavement layers including selected material, sub-base and base layers.	Graders, backhoes, trucks, water carts, vibratory compactors, bitumen sprayers, vibratory rollers, rubber-tyre rollers.

Component	Typical activities	Typical plant and equipment
Other works	• Installation of safety barriers, fencing and roadside furniture • Linemarking • Landscaping	Trucks, fencing and barrier materials, landscaping materials.
Finishing works	• Remove temporary works • Restore and landscape temporary sites	Trucks, landscaping materials.

4.4.2 Earthworks

Cut and fill batters would be provided where the outer extremities of the highway upgrade and/or the local access road are respectively below or above the natural ground level. Where the proposed highway would be below the existing ground level, a cut batter would be established in earthworks to meet desired pavement and sub-grade levels. Where the proposed highway would be on embankment (or fill), the earth formation would be initially wider and then progressively reduced as it is raised to meet the required level of the road surface.

In general terms both cut and fill batters would be sloped at 2:1 horizontal to vertical. The cut slope could be increased from the 2:1 horizontal to vertical subject to geotechnical investigation. Cut and fill batters would be revegetated with native trees, shrubs and groundcovers, consistent with clear zone and sight line requirements and in accordance with the planting and seeding scheme described in Section 8.4. The project has been designed to minimise cut and fill heights. The maximum cut depth is about 14 m at Lookout Road. The maximum fill depth is about 10 m.

4.4.3 Ancillary facilities and sediment basins

A number of ancillary facilities would need to be established during the construction period for both the initial staging and the full motorway upgrade. These facilities would include construction site compounds, asphalt or concrete batching plants, laydown areas and stockpile sites. The requirements for asphalt and concrete batching plants will be determined as part of the detailed design, in accordance with the commitments in this environmental assessment.

The locations of ancillary facilities must allow for efficient and cost-effective construction of the project while minimising biophysical and social impacts. Proposed potential locations for ancillary facilities are shown in **Figure 4-1a-c** for the full motorway upgrade. These potential locations for ancillary facilities are also applicable to the initial staging. While it is unlikely that all of these locations would be used for construction facilities, a range of potential sites have been identified to provide flexibility for the final site selection.

The final sites for construction facilities would be selected by the construction contractor. The sites selected by the construction contractor would be:

- At least 40 m distant from the nearest waterway.
- Of low ecological and heritage conservation significance.
- At least 100 m distant from residential dwellings and other land uses that may be sensitive to noise.

Security of the site would also be considered in finalising the preferred locations for construction facilities.

Figure 4-1a-c also shows preliminary potential locations for sediment basins for the full motorway style upgrade. The location and number of sediment basins required for the initial staging will generally be the same as the full motorway style upgrade. Where only one new carriageway is to be built as part of the initial staging, it is possible that the sediment basins may only be constructed on the eastern side of the upgrade, depending on the requirements determined during detailed design. As for construction facilities, the final number and locations of sediment basins will be determined at detailed design in accordance with relevant policy and procedure.

Construction site compounds

Construction of the project is anticipated to require one main construction site compound. A number of additional minor compounds, comprising workshops or crib sheds, may also be required along the length of the construction corridor. The main construction site compound would include portable offices and associated construction staff facilities, as well as areas for parking, delivery and storage. Compounds would be located on:

- Land owned by the RTA.
- Existing cleared areas or areas to be cleared for the project.
- Available land within the road reserve.
- Leased cleared land on private property or within State Forest.

Potential locations for construction site compounds, including major compounds and smaller facilities, are shown in **Figure 4-1a-c**. It is unlikely that all sites would be used, however the availability of options provides flexibility for the construction contractor. Three potential locations have been identified for stockpiling of materials (refer to **Figure 4.1a-c**):

- At the northern end of works, along the extension to the proposed alignment.
- At the northbound carriageway tie-in, located within the boundary of the future northbound carriageway.
- At Franklins Road, within the boundary of the future northbound carriageway.

Batching plants

It is possible that one or more concrete and/or an asphalt batching plants would be established on-site for bulk supply of pavement materials. This plant would be located within one or more of the proposed construction facility locations along the construction corridor. The batching plants would also require temporary buildings for staff offices and other facilities.

Stockpile sites and laydown areas

A number of temporary stockpile sites and laydown areas will need to be established for the construction period. These sites would be used to store, prepare and distribute aggregate and other bulk materials such as topsoil, unsuitable, sands, pre-cast culverts, drainage pipes and drainage pits. Materials such as topsoil, mulched timber and any unsuitable cut material would need to be stockpiled during construction prior to being re-used in the final landscaping.

4.4.4 Construction materials

The construction of the project would require the use of various types of materials including, but not limited to:

- Fill (of varying quality) for use in earthworks.
- Pavement materials, including verge material and road base.
- Materials for lining drainage channels.
- Aggregate for use in concrete batching.
- Sand for use as backfill around pipes and batching.
- Cement and concrete.
- Steel.
- Material to allow traffic to access soft areas.
- Safety barriers, signage and other road furniture.
- Lighting poles and lamps.
- Bridge and culverts.
- Pre-cast materials.
- Geotextiles and geofabrics.
- Fencing.
- Utilities.
- Water.

Availability of raw and manufactured materials and prefabricated components has the potential to delay the project delivery program. Preliminary estimates of raw material requirements have therefore been made as part of the concept design. A preliminary study was undertaken to identify existing and potential sources of materials in and around the project area and the effect of depletion of resources on the broader community, in particular in terms other construction projects in the region.

Materials for the selected fill may be sourced from the deeper cuttings throughout the project, although this is not expected to generate sufficient materials and the remainder will need to be imported. Based on the initial geotechnical investigations, pavement materials and concrete aggregates are not expected to be available from site materials.

Material removed from cuttings would be used to construct fill embankments unless it is found to be unsuitable for that purpose. Cut or other material that is

deemed unsuitable or is excess would be stockpiled until needed as part of the landscaping design or possibly used as visual screening or noise mounding during construction. The better quality material may be processed and stockpiled on-site for use in the construction of the pavements.

Materials are likely to be sourced from the local area (including Grafton), Woolgoolga, Coffs Harbour, Sydney, Newcastle or Brisbane, requiring transportation to site via road or rail. It is expected that storage silos would be constructed on-site adjacent to any temporary batch plants. Possible sources of quarry material include:

- Duncan's Pit, located on the Gwydir Highway, 30 km west of Grafton.
- Jones/ Thorleys Pit, located off Franklins Road, Glenugie.
- McLennons Pit, located on Old Glen Innes Road, Chanbigne.
- Woolgoolga Quarry, located on Morgans Road, Woolgoolga.

Additional sources of quarry materials may be used, as required. Glenugie Peak (Mount Elaine) is an important area to the Aboriginal community and is not a potential source of material for the project. Glenugie Peak currently has statutory protection as a flora reserve under s25A of the *Forestry Act* 1916.

Prefabricated items required for the project construction would include box culverts, drainage pipes, drainage pits and drainage headwalls. These could be sourced from various locations, including Grafton, Coffs Harbour, Sydney, Brisbane, Macksville, Kempsey and Tamworth.

4.4.5 Spoil and waste disposal

Specific requirements for waste minimisation and management during the construction of the project would be detailed in the waste management section of the construction environmental management plan. This would comply with relevant State Government legislation and policies and any conditions of approval. These include the *Waste Avoidance and Resource Recovery Strategy* 2007 (DECC 2007).

Where possible, materials would be re-used either on or off -site. These would include tree and plant material which would be mulched or chipped, and material from demolished structures, as well as any soil and rock material.

4.4.6 Natural resource consumption

The indicative quantities of raw materials required for project construction are identified in **Table 4-7**. Water requirements are identified in **Table 4-8**.

Table 4-7 Resources and indicative quantities required for construction

Resource	Indicative quantity
General fill (obtained from site)	615,000 cubic metres
Steel	250 tonnes
Pavement quality materials	60,000 cubic metres

Resource	Indicative quantity
Sand (asphalt)	13,000 cubic metres
Course aggregates (asphalt)	30,500 cubic metres
Bitumen	2,500 cubic metres

- **Table 4-8 Water volumes required for construction**

Activities and locations	Quantity
Compaction of earthworks	80 megalitres
Dust suppression 675 000	40 megalitres
Vegetation water	150 megalitres

Where possible, water used during construction would be sourced from sustainable sources. Construction water is generally sourced from local water resources, such as groundwater, streams, dams, recycled water sources (for some uses) and possibly treated water.

Energy consumption and the associated greenhouse gas emissions during construction and operation are detailed in Section 8.3.

4.4.7 Construction work hours

Construction will normally be limited to the following hours:

- Between 6am and 6pm Monday to Friday.
- Between 7am and 4pm Saturday.

There will be no works on Sundays or public holidays except:

a) Works that do not cause construction noise to be audible at any sensitive receivers.
b) For the delivery of materials required outside these hours by the Police or other authorities for safety reasons.
c) Where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.
d) Any other work as agreed through negotiations between the RTA and potentially affected sensitive receivers. Any such agreement must be recorded in writing and a copy kept on site for the duration of the works.
e) Where the work is identified in the Construction Noise and Vibration Management Plan (CNVMP) and approved as part of the Construction Environmental Management Plan.
f) As agreed by the DECC.

Local residents and the DECC must be informed of the timing and duration of work approved under items (d) and (e) at least 48 hours before that work commences. Hours of work would be addressed in the CNVMP, which would be finalised in consultation with the Department of Planning and the DECC.