8.4 Landscape character and visual impacts

8.4.1 Existing environment

The landscape type within the study area can be described as undulating lands, which are lands that are transitional areas between the ridges and plains of the region, consisting of rolling hills of gentle gradient. The undulating landscape through which the proposed upgrade route passes comprises state forest. The forest is composed of groundcover, understorey and canopy vegetation, creating a strong sense of enclosure. The character of the state forest through this stretch, as seen from the Pacific Highway, is illustrated on **Figure 8-4-1**. A key feature of the wider surrounding landscape is Glenugie Peak(also known as Mt Elaine), which has a height of 316 m and is located approximately one kilometre east of the project. A summary of the landscape character of the study area is provided in **Table 8-4-1**.

- **Figure 8-4-1 The existing Pacific Highway through Glenugie State Forest**

■ **Table 8-4-1 Landscape character**

Landscape elements	Description
Planning	The project is located in the Clarence Valley local government area and is subject to the *Mid North Coast Regional Strategy* (DoP 2009) and *Ulmarra Local Environmental Plan* 1992*. The Mid North Coast Regional Strategy* does not identify any regionally significant farmland, proposed urban areas, or proposed employment lands in the project area. The project is located in Glenugie State Forest.
Topography	The project area comprises undulating topography.
Drainage	The project is located within the catchment of Glenugie Creek. The project involves a crossing of Glenugie Creek and several other ephemeral. The area is not flood prone.
Geology	The subsurface geology of the project area falls within the 'Grafton' geological unit classification. The Grafton unit comprises residual soils and weathered rock of siltstone, claystone, mudstone and sandstone origin. This is occasionally interrupted by alluvium creek based soils along creeklines.
Ecological characteristics	The area of state forest through which the proposed upgrade passes comprises a mix of dry sclerophyll forest and Mixed Floodplain Forest. The area is known to contain a number of threatened species and an endangered ecological community. Glenugie Creek is considered to provide Class 2-3 (minimum to moderate quality) fish habitat. Further information on ecology is provided in Section 7.1.
Agricultural context	No agricultural land would be impacted by the project. Beef cattle grazing and dairy farming occur in the wider surrounding landscape.
Settlements	The project is located in a sparsely populated rural area. The nearest town is Grafton.
Culture and recreation	There are no significant cultural or recreation activities carried out within the project footprint. A range of recreational and cultural activities are provided for in the surrounding area. Nearby Glenugie Peak (Mt Elaine) is a significant dreamtime place for Aboriginal stakeholders consulted on the project. Glenugie Peak is located approximately one kilometre east of the project. Neither Glenugie Peak nor its associated cultural areas are impacted by the project.
Architecture	The project area is dominated by state forest and the existing Pacific Highway. There are no significant architectural features within or adjacent to the project.
Spatial qualities	The surrounding area displays minimal intrusion from the built form. The landscape is a rural mosaic of gently rolling forest clad hills and scattered beef and dairy farms.

Landscape elements	Description
Infrastructure	Existing infrastructure within the project footprint is limited to the existing Pacific Highway and connecting local roads. There is a Telstra telecommunications tower near Lookout Road outside the project area.
Economic/ industrial	The project area comprises state forest land, with scattered. Forestry is the predominant economic activity in the vicinity of the project. Tourism and mixed agricultural land uses are the predominant economic activities in the wider surrounding area.

8.4.2 Potential impacts of the project

Nature of potential impacts

The project would represent a new element in the landscape. The effect of the project on the landscape would be to add a second linear tract of cleared and developed land through a forested area. There would be one major cutting, about 14 m deep, near Lookout Road. The remainder of the cuts are anticipated to be less than five metres deep. It is expected that revegetation of all cuttings would be possible. In accordance with the objectives of the *Pacific Highway Urban Design Framework* (RTA 2005b), the landscape strategy employed would integrate new landscape treatments of similar character to the existing within the altered topography.

The visual impact of the project would be contained within Glenugie State Forest. The only direct view of the proposed upgrade would be from the existing highway. In some locations, the upgrade would be elevated relative to the existing highway and sometimes vice-versa.

The driver's perspective from the existing highway is of enclosure by forest on the eastern side. The project would change the current view where the forest would in places open out and again enclose. Proposed landscape works would, to the maximum extent possible, re-establish the forest plant communities within disturbed areas. After vegetation has matured, the occasional widening of the view from the highway is not likely to diminish the driver's visual experience.

For the motorway style upgrade an overpass bridge would be constructed to connect Franklins Road to the old Pacific Highway. This would alter the driver's view in this location. While the addition of the overpass would constitute an impact on the immediate landscape and modify existing views in its vicinity, the landscape's capacity to absorb such change is considered to be good. The project is anticipated to have a low to medium landscape character impact.

The houses located to the west of the existing highway would experience little if any change to views. These houses are at least 200 m from the project. Views of the project would be shielded by both a strip of forest retained within the existing road reserve and a significant forested corridor to be retained between the existing highway and the upgrade. Any visual impact on these adjoining properties would be low.

Assessment of significance of impacts

Landscape character and visual impacts are assessed in terms of the affected area's sensitivity to change and the magnitude of the project. The methodology used for assessing landscape character and visual impacts is described in the RTA's *Environmental Assessment Guidance Note: Guidelines for landscape character and visual impact assessment* (RTA 2009e). The character of the landscape in the project locality is described in Section 8.4.1.

The landscape in the project area is dominated by Glenugie State Forest and the existing highway. Views to the wider surrounding landscape along the project route are minimal. Given the enclosing nature of the forest and the presence of the existing highway, the visual sensitivity of the project would be low.

The project passes through state forest and would generally be enclosed by forest on both sides. The visibility of the project would generally be limited to occasional views from the existing highway and would be most apparent to users of the existing highway at the Franklins Road overpass. For the state forest area and the existing Pacific Highway, the magnitude of the project is relatively minor, with the project affecting about a seven kilometre stretch of state forest in close proximity to the existing highway. Given the enclosing nature of the surrounding forest and the relative flatness of the landform, the project would not affect the visual character of the wider surrounding landscape. The overall visual impact of the project would be low.

8.4.3 Impact mitigation and management measures

The following impact mitigation and management measures would be implemented:

- A landscape strategy would be developed in accordance with the *Pacific Highway Urban Design Framework (*RTA 2005b).
- Endemic species of local provenance would be used for landscaping where appropriate.

8.5 Air quality

8.5.1 Existing environment

There is limited information about air quality in the vicinity of the project. Long-term monitoring is not usually undertaken outside metropolitan and/or industrial areas because pollutants typically do not exist in concentrations that would cause adverse environmental or health effects.

There has been short-term air quality monitoring adjacent to a dual carriageway section of the Pacific Highway at Korora, which is located in an urban area approximately 70 km south of the project. A monitoring station was established at Korora to monitor the ambient air quality from October 2005 to January 2007. The speed limit at the monitoring point is signposted at

100 km/hr and the gradient of the road is approximately 5.2 per cent. The monitoring site is adjacent to one of the most trafficked sections of the Pacific Highway. Monitoring was conducted over the peak traffic period that coincides with the Christmas holidays from November to January. Due to the proximity of the monitoring site to the existing highway, the concentrations of air quality parameters measured are inclusive of vehicle emissions. Therefore, the concentrations detected are likely to be substantially higher than the ground level exposure for the local area and provide a worst case scenario of ambient air quality in the area. The air quality station was equipped to monitor the following air quality and meteorological parameters:

- Carbon monoxide (CO).
- Oxides of nitrogen (NO_x).
- Nitrogen dioxide (NO_2).
- Nitrogen monoxide (NO).
- Particulate matter less than 10 microns in diameter (PM_{10}).
- Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$).
- Wind speed.
- Wind direction.
- Air temperature.
- Relative humidity.

The Average Annual Daily Traffic (AADT) count at Korora was about 19,700 vehicles per day over the monitoring period, which is over double the current AADT for the Pacific Highway at Glenugie. The AADT volume on the Glenugie section of the Pacific Highway is currently 8,200 vehicles per day based on traffic counts undertaken by the RTA in May 2009.

In setting air quality goals for NSW, the Department of Environment and Climate Change (DECC) has adopted the National Environment Protection Council of Australia's air quality standards, which are part of the National Environment Protection Measures (NEPM). While goals have been established for carbon monoxide, nitrogen dioxide and PM_{10}, advisory reporting goals only have been identified for $PM_{2.5}$.

Table 8-5-1 identifies the maximum concentrations detected during the monitoring period and compares the readings with the maximum NEPM recommendations. Pollutant concentration in **Table 8-5-1** are given in parts per million (ppm), milligrams per cubic metre (mg/m^3), or micrograms per cubic metre ($\mu g/m^3$).

▪ **Table 8-5-1 Korora air quality monitoring results**

Pollutant	Averaging period	NEPM goals		Korora monitoring results	
		Maximum concentration	10-year goal (max allowable exceedence)	Maximum recorded concentration	Average recorded concentration
National standards and goals for ambient air quality					
Carbon monoxide	8 hours	9.0 ppm (10 mg/m^3)	1 day a year	0.2 ppm (0.3 mg/m^3)	0.03 ppm (0.04 mg/m^3)
Nitrogen dioxide	1 hour	0.12 ppm (246 µg/m^3)	1 day a year	0.036 ppm (73.8 µg/m^3)	0.004 ppm (9.2 µg/m^3)
Particles as PM_{10}	1 day	50 µg/m^3	5 days a year	37.8 µg/m^3	20.3 µg/m^3
Advisory reporting goals					
Particles as $PM_{2.5}$	1 day	25 µg/m^3	Gather data to facilitate review of goal	15.4 µg/m^3	7.7 µg/m^3

Results obtained from the Korora monitoring station were:

- The maximum 8-hour average carbon monoxide concentration was 0.3 milligrams per cubic metre, compared with the goal of 10 milligrams per cubic metre.
- The maximum 1-hour average nitrogen dioxide concentration was 73.8 micrograms per cubic metre compared with the goal of 246 micrograms per cubic metre.
- The maximum 24-hour average PM_{10} concentration was 37.8 micrograms per cubic metre compared with the goal of 50 micrograms per cubic metre.

The non-regulated $PM_{2.5}$ was also measured and levels peaked at 15.4 micro grams per cubic metre, compared to the advisory NEPM reporting goal of 25 micro grams per cubic metre.

The NEPM goals are ambient air quality goals that are intended to be applied at locations away from the influence of significant emission sources. Dispersion would reduce the pollutant levels significantly as the distance from the road increases. For example, compared with the above levels measured at 20 m from the highway (**Table 8-5-1**), levels 100 m from the highway would be closer to ambient levels and would be approximately one tenth of the levels provided in **Table 8-5-1**.

Given the characteristics of the surrounding environment (predominately state forest), existing air quality in the vicinity of the project is considered to be generally good, with air quality parameters well below the levels recorded at Korora.

8.5.2 Potential impacts of the project

Construction

Air emissions during the construction of the project would generally comprise dust and vehicular emissions. Dust would be generated as a result of various construction phase activities including:

- Clearing of vegetation and moving topsoil.
- Earthworks including embankments and cuttings.
- Wind erosion of stockpiles and unsealed haul roads and light vehicle access tracks.

Typically large particulate matter emitted into the air would return to the surface closer to the emission source than smaller particulates.

The dust levels (total suspended particulates) experienced on any given construction day would relate to the extent of earthmoving activities (including blasting) being undertaken and the area of soil exposed.

Any construction dust plumes are not expected to be visible, and would not impact houses closest to the project. Vehicle and equipment emissions during construction are expected to be minor. Overall construction air quality impacts are expected to be minor.

Operation

Predicted annual average daily operational traffic volumes, including heavy vehicle traffic, were presented in Section 7.3. The predictions indicate that ten years after the estimated opening of the project (2012), the total annual average daily traffic volume would be about 11,500.

The affect of projected increase in vehicle traffic volumes on air quality would be offset to a point by the continual improvement in average emission performance of vehicles, with newer more efficient vehicles replacing older less efficient vehicles. Emissions would also be reduced due to more efficient traffic movement and slightly reduced travel times.

Vehicle emission controls were introduced in the early 1970s and emission limits have been progressively tightened over the past 30 years. These controls have resulted, particularly over the last 10 years, in improvements in a number of air quality indicators and it is accepted that vehicles meeting tighter emission standards have played a major part in the improvement.

It is considered that, given the comparatively low traffic volume on the project, air quality could be expected to meet DECC guidelines. Pollutants would further diminish with distance from the project, resulting in negligible operational impacts.

8.5.3 Impact mitigation and management measures

Apart from dust control measures during project construction, no other mitigation measures are required.

8.6 Hazards and risks

8.6.1 Construction hazards and risks

Hazards and risks associated with construction of the project would include:

- Environmental and occupational health and safety hazards, including environmental and social impacts (if spills of hazardous materials occur) and dangers to construction workers and the public.
- Transport of hazardous materials.
- Handling and storage of hazardous materials.

Sensitive environmental receivers, such as watercourses and water bodies, threatened species, and endangered ecological communities may be impacted by hazardous materials during construction of the project if appropriate environmental management measures are not implemented.

Dangerous goods and hazardous materials that may be used during construction include, but may not be limited to, diesel fuels, oils, greases and lubricants, petrol, gases (oxy-Acetylene), bitumen, paints and epoxies, curing compounds, herbicides and hydrated lime. Some of these hazardous materials would be stored at the construction work sites. The storage, handling and use of the materials would be undertaken in accordance with the *Occupational Health and Safety Act* 2000 and the WorkCover guideline *Storage and Handling of Dangerous Goods* (2005). The quantities required are not expected to pose a significant off-site risk. Potential risks would be further mitigated by placing restrictions on storage of hazardous materials.

Occupational health and safety hazards have the potential to occur between the construction workforce and members of the public. The standard mitigation measures identified in Section 8.6.3 would reduce the risks to members of the public during construction.

8.6.2 Operation hazards and risk

During operation there is the potential for contaminants arising from normal operation of the highway (tyre and brake wear, engine oil leaks, litter), or chemicals from accidental spillages to adversely affect the quality of the local environment. The main route for these contaminants to the environment would be via run-off from both paved and unpaved surfaces. The installation of permanent water quality controls would reduce the risk to the environment.

Risks to members of the public during operation would relate to incidents involving the release of dangerous goods. The Pacific Highway is a designated dangerous goods route. Dangerous goods that might be transported in significant quantities on the Pacific Highway include flammable and combustible petroleum products (petrol and diesel); liquefied petroleum gas and toxic gases (e.g. ammonia and chlorine); corrosive materials (acids and alkalis); other toxic materials (e.g. pesticides); and nitrogen-based fertilisers or bulk explosives.

Crashes involving vehicles transporting chemicals and/or other dangerous goods would generally affect only a small area, with hazards relating to toxic effects, fire and explosions. The project is located within a sparsely populated area such that most incidents would have limited potential to affect those not directly involved in a crash or incident. The project has been designed to meet relevant design guidelines for highways and would contribute to an overall improvement in driving conditions. The proposed bypass would reduce the likelihood of hazardous goods incidents and serious head-on collisions through separation of the carriageways.

8.6.3 Management of hazards and risk

Construction

During construction, potential hazards and risks would be identified and managed using standard management measures such as:

- Securing bunded areas for storage of oils and other hazardous liquids, and for activities with the potential for spillage and contamination.
- Temporary sediment basins for the duration of construction.
- Regular maintenance and inspection for construction controls.
- Prepare and implement a site-specific safety management plan and safe work methods statements for the project. Identify hazards associated with work on the site and hazard control measures to ensure that people are adequately protected from risk of injury or illness.

Operation

During operation, management measures would include:

- Installing permanent spill containment basins, designed to capture accidental spillage, along the project.
- Incorporate operational spill control measures/facilities for incidents near sensitive environments into the detailed design.

8.7 Waste management

Various waste streams would be generated during the construction of the project, including construction and demolition waste, vegetation waste, packaging materials and liquid wastes.

8.7.1 Waste streams

The following potential waste streams have been identified for the project:

- Demolition wastes from existing structures that need to be demolished for the project, including pipe work and pavements.
- Excavation wastes (although the detailed design of the project would aim to achieve a cut/fill balance, it may not be possible to reuse all excavated material within the project).
- Vegetation from removal of shrubs and trees (where possible, this would be mulched for re-use on site as part of the landscaping works).

- Packaging materials associated with items delivered to site, such as pallets, crates, cartons, plastics and wrapping materials, all of which need to be disposed of once the product has been used. Minimisation of packaging of raw materials would be strongly encouraged. Components of this waste stream could be recycled or reused.
- Wastes produced from the maintenance of various heavy construction equipment including liquid wastes from cleaning, repairing and maintenance. Likewise leakage or spillage of fuels/oils during construction would need to be managed and disposed of appropriately. Sewage wastes would be generated through the use of worker's facilities such as toilets.
- General office wastes, such as paper, cardboard, beverage containers and food wastes.

8.7.2 Mitigation and management measures

All wastes would be managed and disposed of in accordance with relevant state legislation and government policies including the *Waste Avoidance and Resource Recovery Act* 2001 (WARR Act), the *Waste Avoidance and Resource Recovery Strategy 2007* and the RTA's *Waste Reduction and Purchasing Policy* (WRAPP). The Department of Environment and Conservation (DECC) *Waste Classification Guidelines* (DECC 2008b) would be used to classify the different types of waste.

Sites wastes would generally be managed using the following principles (moving from most desirable to least desirable):

- Avoiding unnecessary resource consumption.
- Recovering resources for reuse.
- Recovering resources for recycling or reprocessing.
- Disposing of residual waste (as a last resort).

Avoidance of waste can be accomplished for the project by providing realistic predictions on the quantities of resources such as construction materials. The potential to re-use waste materials either on-site or off-site including re-use of topsoil and fill material would be identified during detailed design. Trees and plant material could be mulched or chipped on-site and used for landscaping. Where possible, waste would be segregated and recycled and recycling facilities would be provided for paper, plastic, glass, aluminium cans and other recyclable materials. Waste disposal would only occur where there are no other options for waste avoidance, reuse and recycling. All waste disposal would occur in accordance with the DECC *Waste Classification Guidelines* (DECC 2008b).

The RTA's contractors are required to propose recycled content construction materials where they are cost competitive and performance competitive. The cost competitiveness of materials is assessed on a project life-cycle basis considering issues such as impacts on construction practices and disposal requirements. The RTA's contractors are also required to report waste minimisation quantities, initiatives and barriers. In addition, the RTA has allowed for recycled and recovered materials procurement for road construction and maintenance works. The use of these products with recycled content and products that produce low waste quantities would reduce demand on resources. Opportunities to reduce the demand on resources, where reasonable and feasible, include using secondary waste materials such as fly ash, slag and silica within concrete mixes.

Standard site specific waste management measures would therefore include requirements for:

- The application of the waste minimisation hierarchy principles of avoid/reduce /re-use/recycle/dispose.
- Waste handling, storage and disposal.
- Any waste material that is unable to be re-used, re-processed or recycled would be disposed at a facility approved to receive that type of waste.
- Secondary waste materials, such as fly ash and steel slags would be used in construction materials where reasonable and feasible.
- Waste management impacts during construction are expected to be low, given the management and disposal activities outlined above.