INLAND RAIL

# CHAPTER 4

# Assessment Methodology

**GOWRIE TO HELIDON** ENVIRONMENTAL IMPACT STATEMENT

IR_1536

ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

# Contents



# Figures



# Tables

# 4. Assessment Methodology

## 4.1 Introduction

This chapter outlines the assessment methodology used to assess potential impacts and opportunities as a result of the Gowrie to Helidon (G2H) Project (the Project) in accordance with the final Terms of Reference (ToR). The methodology was designed to provide a structured and objective approach to identifying environmental, social and economic impacts and opportunities, develop effective mitigation and management measures and maximise the benefits of the Project.

As outlined in Chapter 2: Project Rationale, Australian Rail Track Corporation (ARTC) undertook several studies to identify a preferred route for the Inland Rail Program. As a result of these studies it was determined that the Gowrie to Grandchester future passenger rail corridor (currently referred to as the Gowrie to Grandchester future state transport corridor) protected under the *Transport and Planning Coordination Act 1994* (Qld) in 2005, subject to minor amendments, was a suitable alignment for the G2H section of Inland Rail (Inland Rail Implementation Group (IRIG), 2015). This is discussed further in Chapter 2: Project Rationale.

During the design process, multi-criteria analyses (MCAs) and comparative cost estimates were used to determine the preferred design option, which generally follows the existing Gowrie to Grandchester future state transport corridor and is the subject of this Environmental Impact Statement (EIS) (refer to Chapter 6: Project Description).

Additionally, stakeholder and community engagement activities were undertaken during development of the design and the preparation of the EIS as discussed in Chapter 5: Stakeholder Engagement.

## 4.2 Approach

The first step in the impact assessment process was to prepare a description of the Project. Chapter 6: Project Description includes information on the scale, type, duration and location of Project elements to be assessed in the EIS.

Then, for each environmental aspect to be assessed (e.g. surface water, flora and fauna, air, etc.):

- The study area was defined. The study area is specific to the environmental aspect being assessed. The study area is defined based on the nature of the environmental aspect, and the scale, type and duration of Project elements that may impact on that aspect.
- The impact assessment method was selected (refer Section 4.4)
- A desktop review of existing reports, studies and spatial datasets was undertaken to establish existing conditions and sensitive receptors (i.e. environmental values) relevant to the environmental aspect being assessed.

If the desktop review revealed significant data gaps, fieldwork was undertaken to identify and/or ground truth existing environmental conditions and sensitive receptors. Further detail on desktop reviews and fieldwork is provided where relevant in Chapters 8 to 21.

Potential impacts, benefits and opportunities were identified and assessed in accordance with the selected impact assessment method, using criteria set out in legislation, statutes, guidelines or policies. Where such criteria do not exist, the assessment was based on industry standards and professional judgement. In each instance, the impact assessment was conducted as follows:

- The impact assessment considered the construction, commissioning and operation phases
- The impact assessment considered short-term, long-term and cumulative impacts
- Mitigation measures inherent to the design (i.e. steps taken during the design to avoid or minimise potential impacts) were factored into the initial impact assessment
- Additional mitigation and management measures were then proposed to further avoid or minimise impacts and enhance potential benefits (refer Section 4.5). These mitigation measures were then factored into the assessment of residual impacts (i.e. after all reasonable avoidance and mitigation measure have been taken, there is still a residual impact on an aspect)
- The need for environmental offsets to compensate for significant adverse residual impacts was assessed, where relevant (refer Chapter 11: Flora and Fauna).

Mitigation and management measures are documented in the relevant Chapters 8 to 21 (refer Section 4.5) and technical reports, with the Draft Outline Environmental Management Plan (Draft Outline EMP) provided in Chapter 23: Draft Outline Environmental Management Plan (refer Section 4.6). Proponent commitments are documented in Appendix F: Proponent Commitments, which expand on those mitigation and management measures that have been proposed as part of the impact assessment process.

The EIS has undertaken a conservative and 'worst case' approach to identifying the potential impacts of the Project, including cumulative impacts. Where environmental impacts have been identified through the assessment process, efforts have, in the first instance, been made, where practicable, to avoid or minimise impacts through development of the design. Where attempts to avoid or minimise impacts through the design have been of limited effect, further mitigation measures have been nominated for implementation during future phases of the Project. Those measures will be refined and, where applicable, implemented as the Project transitions through the future phases of development, such as detailed design.

Opportunities have also been identified through the assessment to maximise the potentially significant economic and social benefits of the Project, through local employment, local industry participation and opportunities for complementary investment that provides for continued community benefit.

The approach to the selection of impact assessment methods, identification of mitigation and management measures and compilation of the Draft Outline EMP is discussed in the following sections. The role of community and stakeholder consultation in the impact assessment process is discussed in Section 4.7.

### 4.2.1 Sensitive receptors

Sensitive receptors can be a place, natural feature, structure, person or organism that is susceptible to impact. Throughout this EIS, sensitive receptors are identified for the purpose of establishing the likelihood and consequences of potential impacts. Sensitive receptors differ between technical aspects. For example, a sensitive receptor to noise impacts will be different to a sensitive receptor for groundwater impacts. Consequently, sensitive receptors have been identified for each relevant environmental aspect, where relevant, and are discussed in the corresponding chapters of this EIS.

The number of sensitive receptors may vary between the environmental aspect being assessed, due to how a sensitive receptor is defined under the relevant guidelines and the approach used to identify sensitive receptors. For example, the construction noise assessment and the operational noise assessment varied in the way they approached identifying sensitive receptors:

- A total of 3,811 sensitive receptors were identified within the noise and vibration study area for the construction nose assessment. The sensitive receptors were identified using a combination of land property information (Queensland Property Database) and interrogation of high-resolution aerial imagery, with sensitive receptor defined using *Transport Noise Management Code of Practice: Volume 2—Construction Noise and Vibration* (DTMR, 2015a).
- A total of 3,910 sensitive receptors were identified within the noise and vibration study area for the operational rail noise assessment. All structures more than 9 $m^2$ were initially identified and considered to be sensitive receptors, as defined in *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure Versions 2*, (DTMR, 2013e) and *Transport Noise Management Code of Practice Volume 3: Interim Guideline, Operational Railway Noise and Vibration, Government Supported Infrastructure* (DTMR, 2019e).

Most of the sensitive receptors are residential dwellings predominantly associated with suburbs of Toowoomba, with the number of sensitive receptors in the Lockyer Valley significantly fewer, reflecting local settlement patterns. Other sensitive receptors include schools, childcare facilities, places of worship, social and recreational facilities and Baillie Henderson Hospital.

## 4.3 Study area

Specific study areas were identified as for each environmental aspect being assessed (refer Section 4.4). These study areas are differentiated in Table 4.1. The study area of each environmental aspect is described in detail and mapped within each chapter (Chapters 8 to 21) and the relevant technical reports within the appendices.

For each environmental aspect, the study area incorporated the following areas:

- Project disturbance footprint, comprising:
  - Permanent (or operational) disturbance footprint (approximately 354 hectares (ha)):
    - Within the greenfield corridor (excluding the tunnel), the rail corridor, which is approximately 16.2 km (excluding the tunnel) in length, with a minimum width of 62.5 m, which is of a sufficient width to allow operation and maintenance of the Project, including drainage structures and fencing, along with additional land required for infrastructure at the western and eastern tunnel portal areas, and the intermediate ventilation shaft at Cranley. The width and footprint also considers future proofing with the area sufficient to allow any upgrades to the three 2,200 m long crossing loops for the proposed 3,600 m trains in the future without acquiring additional land.

      Preservation of an underground corridor approximately 50 m wide and approximately 28 ha in area for the 6.24 km long Toowoomba Range Tunnel has also been considered where applicable (i.e. disturbance calculations for land use, agricultural land and vegetation communities do not include this area as there is no surface disturbance proposed).
    - The brownfield corridor is where the Project is co-located with the existing Queensland Rail West Moreton System rail corridor for 5.6 km. This includes 4.8 km with the Western Line at Gowrie and approximately 0.8 km with the Main Line at Helidon. Reasonable endeavours have been made to remain within the rail corridor, widening the corridor only where required to allow for relocation or reinstatement of existing rail infrastructure (e.g. rail maintenance access roads) and to accommodate safe operation of the Project and existing QR operations.

      The Project has also considered land requirements for the proposed road network changes required to facilitate the Project.
  - Temporary (or construction) disturbance footprint (approximately 100 ha in size), which includes the following temporary areas required for construction purposes:
    - 5 m buffer areas outside the rail corridor for fencing construction
    - Laydown areas and site offices
    - Construction access roads where these lie outside the permanent disturbance footprint
    - Utilities works due to relocation/removal of services crossing the rail corridor
    - Erosion and sediment controls including sediment ponds
    - Works associated with local road realignments and/or the construction of new roads.

The land requirements will be confirmed during the detailed design of the Project, with further details provided in Chapter 6: Project Description, Chapter 8: Land Use and Tenure and Appendix V: Impacted Properties.

Some environmental aspects used the EIS investigation corridor to define the study area, while others extended outside the EIS investigation corridor (e.g. air quality, noise, social, landscape and visual amenity, economics (refer Table 4.1). The EIS investigation corridor comprises the Project disturbance footprint, including the temporary construction disturbance footprint and the permanent disturbance footprint, with a buffer zone of approximately 1 km either side of the proposed rail alignment. The EIS investigation corridor is slightly wider around Chainage (Ch) 5 km to Ch 15 km to accommodate the options analysis undertaken for the Toowoomba Range crossing and to allow for the varied topography. The maximum width of the EIS investigation corridor from the alignment is 3.4 km through this section.

**TABLE 4.1: DISCIPLINE STUDY AREAS**

| Environmental aspect | Study area extent adopted |
|---|---|
| Flora and fauna (including Matters of National Environmental Significance)<br>Surface water quality<br>Traffic, transport and access<br>Land resources<br>Groundwater^<br>Land use and tenure | These environmental aspects adopted the EIS investigation corridor as the discipline study area. |
| Cultural heritage | Project disturbance footprint plus a 50 m buffer on each side. Register searches and historical mapping analysis were undertaken for the area within a 1 km buffer of the Project disturbance footprint. |
| Non-operational noise and vibration | Project disturbance footprint plus a 2 km buffer on each side. |
| Air quality<br>Operational railway noise and vibration | A 4 km wide study area, 2 km either side of the proposed rail alignment. |
| Flooding and hydrology | This discipline adopted the following study area:<br>▸ Project disturbance footprint<br>▸ Catchment extents relevant to the Project, including the Lockyer Creek catchment (specifically the Gatton Creek and Upper Lockyer Creek sub-catchments) and the Condamine River Basin (specifically the Upper Oakey Creek sub-catchment). |
| Landscape and visual amenity | A 20 km wide study area, 10 km either side of the proposed rail alignment. |
| Social | This discipline adopted the following study area:<br>▸ Project disturbance footprint<br>▸ Potentially affected communities, which include Kingsthorpe, Charlton, Gowrie Junction, Cranley, Cotswold Hills, Wilsonton Heights, Rockville, Harlaxton, Mount Kynoch, Ballard, Mount Lofty, Withcott, Postmans Ridge, Lockyer, Helidon Spa, and Helidon<br>▸ Project region, which refers to the Toowoomba and Lockyer Valley local government areas (LGAs). |
| Economics | The study area for this discipline includes the LGAs of Toowoomba and Lockyer Valley. For the regional impact analysis, the Greater Toowoomba labour market region is used. |
| Hazard and risk | This discipline adopted the following study area:<br>▸ Project disturbance footprint<br>▸ Natural environment of which the Project may directly or indirectly impact. |
| Waste and resource management | This discipline adopted the following study area:<br>▸ Project disturbance footprint<br>▸ Environmental aspects and sensitive receptors (including existing waste management facilities) relevant to waste and resource management for the Project. |

**Table notes:**
^ Impacts were considered outside of this area, dependent on the groundwater modelling results.

## 4.4 Impact assessment methods

Three different methods were used to assess potential impacts and opportunities:

- Compliance assessment (quantitative)
- Risk assessment (qualitative)
- Significance assessment (qualitative).

A general explanation of each assessment method and how it was applied is provided in Sections 4.4.1 to 4.4.3, with further details specific to each environmental aspect included in Chapters 8 to 21.

For each environmental aspect, the decision tree shown in Figure 4.1 was used to select an appropriate impact assessment method. Note that where no impact was likely to occur, this was stated and no further assessment was undertaken or mitigation identified.

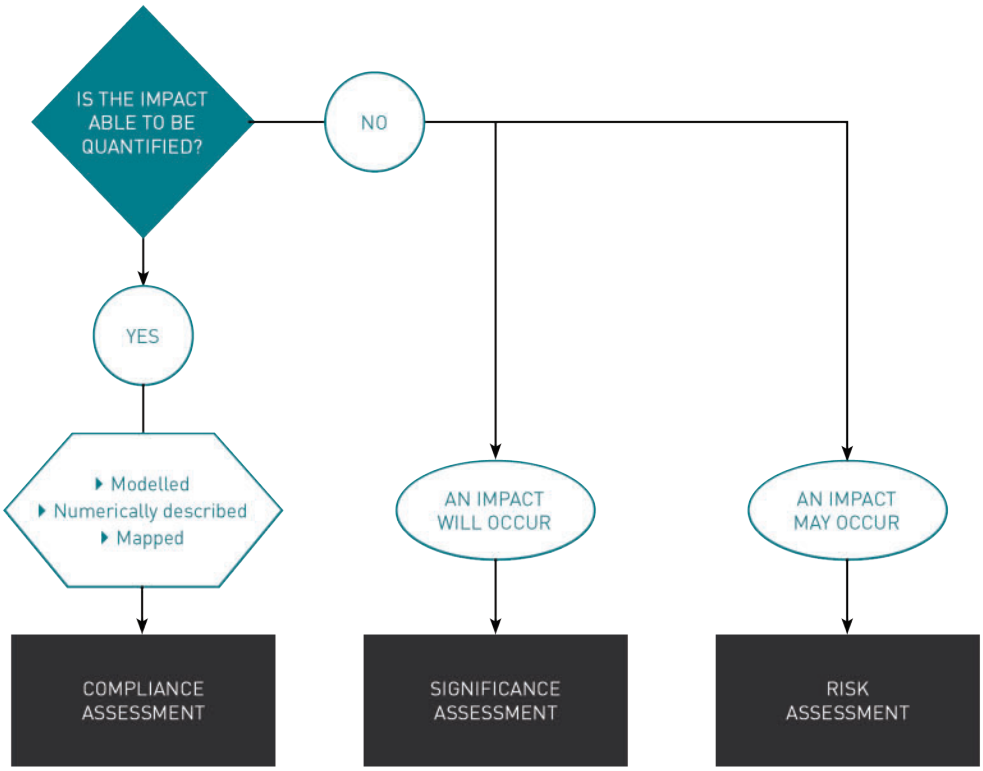


**FIGURE 4.1: ASSESSMENT METHOD DECISION PROCESS**

The particular methodology used depended on the nature of the regulatory regime that applied to the particular environmental aspect, the sensitivity or vulnerability of the environmental values associated with each aspect and the nature of the potential impacts. The relevant methodology and the environmental aspects to which they applied are summarised in Table 4.2:.

Note that in some cases, the assessment method was adapted to meet the needs of a particular environmental aspect. For example, land resources were assessed using both compliance assessment methods (quantitative assessment of soil properties) and risk assessment methods (assessment of the likelihood and consequence of contamination or erosion). While social and landscape and visual amenity used bespoke methodologies.

**TABLE 4.2: ASSESSMENT METHODOLOGIES**

| Methodology | Type | Relevance | Environmental aspects |
|---|---|---|---|
| Compliance assessment | Quantitative | Used where compliance with a known guideline or standard (e.g. published limits or thresholds) can be quantitatively assessed | Flora and fauna<br>Land resources (soil properties)<br>Land use and tenure<br>Hydrology and flooding<br>Air quality (operation)<br>Noise and vibration<br>Traffic, transport and access<br>Sustainability |
| Risk assessment | Qualitative | Used where there are no relevant quantified guidelines, an impact may occur, and the impact depends on how aspects or materials are managed | Air quality (construction)<br>Economics<br>Hazard and risk (climate)<br>Land resources (contaminated land/erosion)<br>Social<br>Waste and resource management |
| Significance assessment | Qualitative | Used where an impact will occur to assess the sensitivity or the vulnerability of the environmental value to the impact | Flora and fauna<br>Groundwater<br>Surface water quality<br>Landscape and visual amenity<br>Cultural heritage |

This EIS also includes a cumulative impact assessment. The cumulative impact assessment considers the combined effects of the Project, and relevant nearby proposed developments on environmental aspects. The cumulative impact assessment method is described in Section 4.4.4 and Chapter 22: Cumulative Impacts.

### 4.4.1 Compliance assessment

The compliance assessment method was applied to environmental aspects with quantifiable impacts (e.g. emissions and discharges from Project infrastructure and activities). Mapping, modelling and data (publicly available and field verified) were used to describe the existing baseline conditions, including against performance criteria adopted from legislation, statutes, guidelines or policies. The baseline conditions will be used to develop site-specific objectives, where applicable, and to quantify changes to environmental values, including in terms of compliance with the relevant performance criteria.

Compliance with the adopted performance criteria was initially assessed based on the application of design mitigation measures. Additional mitigation and management measures were then proposed for implementation in future phases of the Project. These proposed mitigation and management measures were nominated to:

- Achieve compliance with the adopted performance criteria, if required
- Demonstrate ARTC's commitment to avoiding or minimising potential impacts, as far as reasonably practicable.

### 4.4.2 Risk assessment

For those environmental aspects that might be impacted by the Project, but for which there are no relevant quantified guidelines to measure potential impacts, a qualitative risk assessment was undertaken.

Likelihood and consequence criteria, and the resulting ARTC risk matrix are set out in Table 4.3, Table 4.4, and Table 4.5. The criteria are consistent with AS/NZ 31000:2009 *Risk Management – Principles and Guidelines* (Standards Australia, 2009a). Risk assessments have been documented in tabular form in the relevant EIS chapters and technical reports.

**TABLE 4.3 LIKELIHOOD CRITERIA**

| Likelihood | Description | Frequency of occurrence |
|---|---|---|
| Almost certain | Is expected to occur in most circumstances | Once per month |
| Likely | Will probably occur in most circumstances | Between once a month and once a year |
| Possible | Might occur at some time | Between once a year and once in five years |
| Unlikely | Could occur at some time | Between once in 5 years and once in 20 years |
| Rare | May occur in exceptional circumstances | Once in more than 20 years |

**TABLE 4.4 CONSEQUENCE CRITERIA**

| Risk category | | Consequence | | | | |
|---|---|---|---|---|---|---|
| | | Not significant | Minor | Moderate | Major | Extreme |
| Safety | Impact to people | No medical treatment required | Lost Time Injury or medical treatment required | Serious injury | Single fatality | Multiple but localised fatalities |
| Assets | Engineering impacts and satisfying objectives | Up to 6 hours of track closure | >6 to 24 hours of track closure | >24 to 48 hours of track closure | >48 hours to 5 days of track closure | >5 days of track closure |
| Financial | Total out-turn cost impact | Up to 0.05% of Program budget (i.e. up to $5 million (m) in $10 billion (b)) | >0.05% to 0.5% of Program budget (i.e.>$5 m to $50 m in $10 b) | >0.5% to 1.5% of Program budget (i.e.>$50 m to $150 m in $10 b) | >1.5% to 5% of Program budget (i.e. >$150 m to $500 m in $10 b) | >5% of Program budget (i.e. > $500 m in $10 b) |
| | | Up to 0.1% of Project budget (i.e. up to $100 thousand (k) in $100 m) | >0.1% to 0.5% of Project budget (e.g. >$100 k–$500 k in $100 m) | >0.5% to 2.5% of Project budget (e.g. >$500 k–$2.5 m in $100 m) | >2.5% to 10% of Project budget (e.g. >$2.5 m+-$10 m in $100 m) | >10% of Project budget (e.g. >$10 m in $100 m) |
| Environment | Environment impact, heritage, flora and fauna, archaeology and Indigenous, pollution and amenity (public) | Contained environmental damage—fully recoverable, no cost or action required | Isolated environmental damage—minimal remediation required | Localised/clustered environmental damage—requiring remediation | Considerable environmental damage—requiring remediation | Widespread long-term or permanent environmental damage—remediation required |
| Regulatory | Regulatory/legislation exposure, non-compliance and Licence to Operate | Minimal or no regulatory involvement | Notice to produce information | Improvement notice or threatened action | Prohibition notice or fines | Prosecution of the company and/or its office holders |
| Reputation | Reputational exposure, customer dissatisfaction, stakeholder support, service, quality and reliability, public image and stakeholder attitudes | Isolated event able to be resolved (up to 7 days) | Management intervention required (>7 days to 3 months) | Tactical (Business Unit/Divisional intervention required (>3 to 18 months) | Strategic intervention required (>18 months to 3 years) | Corporate loss of shareholder and/or customer support—tangible business impact lasting > 3 years |
| Schedule | Time-based impacts | Influences schedule up to 1% of Program or approved schedule period | Influences schedule >1% to 2.5% of Program approved schedule period | Influences schedule >2.5% to 5% of Program approved schedule period | Influences schedule >5% to 10% of Program approved schedule period | Influences schedule >10% of Program approved schedule period |
| | | Influences schedule up to 2% of Project or approved schedule period | Influences schedule >2% to 5% of Project approved schedule period | Influences schedule >5% to 10% of Project approved schedule period | Influences schedule >10% to 20% of Project approved schedule period | Influences schedule >20% of Project approved schedule period |

**TABLE 4.5 RISK MATRIX**

| Likelihood/consequence | Not significant | Minor | Moderate | Major | Extreme |
|---|---|---|---|---|---|
| Almost certain | Medium | Medium | High | Very high | Very high |
| Likely | Low | Medium | High | Very high | Very high |
| Possible | Low | Low | Medium | High | High |
| Unlikely | Low | Low | Low | Medium | Medium |
| Rare | Low | Low | Low | Low | Medium |

### 4.4.3 Significance assessment

The significance assessment method was applied to environmental aspects where impacts from the Project cannot be quantified.

As opposed to the risk assessment methodology, which considers likelihood and consequence, the significance assessment considers the importance of the sensitivity or vulnerability of the environmental aspect, and the magnitude of the impact. The sensitivity criteria, magnitude criteria and significance matrix adopted for this EIS are presented in Table 4.6, Table 4.7 and Table 4.8. Table 4.9 contains the definitions of significance assessments based on their sensitivity and magnitude characteristics.

**TABLE 4.6: SENSITIVITY CRITERIA**

| Sensitivity | Description |
|---|---|
| Major | ▸ The environmental value is listed on a recognised or statutory state, national or international register as being of conservation significance.<br>▸ The environmental value is entirely intact and wholly retains its intrinsic value.<br>▸ The environmental value is unique to the environment in which it occurs. It is isolated to the affected system/area, which is poorly represented in the region, state, country or the world.<br>▸ It has not been exposed to threatening processes, or they have not had a noticeable impact on the integrity of the environmental value.<br>▸ Project activities would have an adverse effect on the value. |
| High | ▸ The environmental value is listed on a recognised or statutory state, national or international register as being of conservation significance.<br>▸ The environmental value is intact and retains its intrinsic value.<br>▸ The environmental value is unique to the environment in which it occurs. It is isolated to the affected system/area, which is poorly represented in the region.<br>▸ It has not been exposed to threatening processes, or they have not had a noticeable impact on the integrity of the environmental value.<br>▸ Project activities would have an adverse effect on the value. |
| Moderate | ▸ The environmental value is recorded as being important at a regional level and may have been nominated for listing on recognised or statutory registers.<br>▸ The environmental value is in a moderate to good condition despite it being exposed to threatening processes. It retains many of its intrinsic characteristics and structural elements.<br>▸ It is relatively well represented in the systems/areas in which it occurs but its abundance and distribution are exposed to threatening processes.<br>▸ Threatening processes have reduced its resilience to change. Consequently, changes resulting from Project activities may lead to degradation of the prescribed value.<br>▸ Replacement of unavoidable losses is possible due to its abundance and distribution. |
| Low | ▸ The environmental value is not listed on any recognised or statutory register. It might be recognised locally by relevant suitably qualified experts or organisations (e.g. historical societies).<br>▸ The environmental value is in a poor to moderate condition as a result of threatening processes, which have degraded its intrinsic value.<br>▸ It is not unique or rare and numerous representative examples exist throughout the system/area.<br>▸ It is abundant and widely distributed throughout the host systems/areas.<br>▸ There is no detectable response to change or change does not result in further degradation of the environmental value.<br>▸ The abundance and wide distribution of the environmental value ensures replacement of unavoidable losses is achieved. |

| Sensitivity | Description |
|---|---|
| Negligible | ▸ The environmental value is not listed on any recognised or statutory register and it not recognised locally by relevant suitable qualified experts or organisations.<br>▸ It is not unique or rare and numerous representative examples exist throughout the system/area.<br>▸ There is no detectable response to change or change does not result in further degradation of the environmental value. |

**TABLE 4.7: MAGNITUDE CRITERIA**

| Magnitude | Description |
|---|---|
| Major | An impact that is widespread, permanent and results in substantial irreversible change to the environmental value. Avoidance through appropriate design responses or the implementation of environmental management controls are required to address the impact. |
| High | An impact that is widespread, long lasting and results in substantial and possibly irreversible change to the environmental value. Avoidance through appropriate design responses or the implementation of site-specific environmental management controls are required to address the impact. |
| Moderate | An impact that extends beyond the area of disturbance to the surrounding area but is contained within the region where the Project is being developed. The impacts are short term and result in changes that can be ameliorated with specific environmental management controls. |
| Low | A localised impact that is temporary or short term and either unlikely to be detectable or could be effectively mitigated through standard environmental management controls. |
| Negligible | An extremely localised impact that is barely discernible and is effectively mitigated through standard environmental management controls. |

**TABLE 4.8: SIGNIFICANCE MATRIX**

| Magnitude/sensitivity | Major | High | Moderate | Low | Negligible |
|---|---|---|---|---|---|
| Major | Major | Major | High | Moderate | Low |
| High | Major | Major | High | Moderate | Low |
| Moderate | High | High | Moderate | Low | Low |
| Low | Moderate | Moderate | Low | Negligible | Negligible |
| Negligible | Moderate | Low | Low | Negligible | Negligible |

**TABLE 4.9: SIGNIFICANCE CLASSIFICATIONS**

| Magnitude | Description |
|---|---|
| Major | Arises when an impact will potentially cause irreversible or widespread harm to an environmental value that is irreplaceable because of its uniqueness or rarity. Avoidance through appropriate design responses is the only effective mitigation. |
| High | Occurs when the proposed activities are likely to exacerbate threatening processes affecting the intrinsic characteristics and structural elements of the environmental value. While replacement of unavoidable losses is possible, avoidance through appropriate design responses is preferred to preserve its intactness or conservation status. |
| Moderate | Results in degradation of the environmental value due to the scale of the impact or its susceptibility to further change even though it may be reasonably resilient to change. The abundance of the environmental value ensures it is adequately represented in the region, and that replacement, if required, is achievable. |
| Low | Occurs where an environmental value is of local importance and temporary or transient changes will not adversely affect its viability, provided standard environmental management controls are implemented. |
| Negligible | Does not result in any noticeable change and hence the proposed activities will have negligible effect on environmental values. This typically occurs where the activities are located in already disturbed areas. |

### 4.4.4 Cumulative impact assessment

Chapters 8 to 21 of this EIS each include a cumulative impact assessment for the particular environmental aspect of the Project they are addressing, for both the construction and operational phases. These assessments have then been summarised in Chapter 22: Cumulative Impacts.

The approach used to identify and assess potential cumulative impacts of the Project was as follows:

- A review of the potential impacts identified within the EIS assessments. The environment at the time of the ToR is the notional baseline, prior impacts from past land use have been considered where relevant to the environmental aspect reviewed.
- A register of assessable projects has been collated with timelines to demonstrate the temporal relationship between projects. This has included:
  - The other separate Inland Rail projects; in particular, the NSW/Queensland Border to Gowrie and Helidon to Calvert projects, which have been determined to be coordinated projects for which an EIS is required under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act) and are currently being assessed under the bilateral agreement between the Queensland Government and the Australian Government
  - Coordinated projects under the SDPWO Act that are in the public domain as being planned and/or constructed, and in some instances operational at the time of the ToR
  - Additional projects have been considered, where they have been deemed to be of local significance, as occurring through consultation with community groups and stakeholders. These included:
    - Projects listed in Lockyer Valley Regional Council and Toowoomba Regional Council Development Application databases
    - Development within Priority Development Areas and State Development Areas
    - Economic Development Queensland development projects
    - Community Infrastructure Designation projects
    - Projects within the public register of environmental authorities
    - Department of Transport and Main Roads infrastructure projects
    - Private infrastructure facilities
    - Development in accordance with Regional Planning Interests.
- Identification and mapping of the assessable projects and the areas of influence (AoI) of the aspect being considered. Current operational projects and commercial or agricultural operations that are in the AoI around the Project are accounted for in the corresponding technical baseline studies (e.g. air, noise, social, economic). The AoI types considered in the assessment were the following:
  - Derived by assessment—the AoI is determined for each environmental value by the corresponding impact assessment, as undertaken to address the relevant component of the ToR
  - Administrative—the AoI is determined by recognised administrative boundaries (e.g. local government areas, localities)
  - Designated area—the AoI is determined by the recognised physical extent of the Project during construction and operation.
- Where there is a potential overlap in impacts (either spatially or temporally), a cumulative impact assessment has been undertaken to determine the nature of the cumulative impact. This includes:
  - Where possible, the assessment method has been quantitative in nature; however, qualitative assessment has also been undertaken for certain environmental values
  - Where quantitative assessment has been possible, the significance of impact has been assessed in comparison to the same criteria or guidelines as adopted by the relevant technical impact assessments
  - Where impacts are expressed qualitatively, the probability, duration and magnitude/intensity of the impacts have been considered, as well as the sensitivity and value of the receiving environmental conditions.
- An assessment matrix method (further detailed in Table 4.10) has been used to determine the significance of cumulative impacts, with respect to beneficial or detrimental effects.
- Where cumulative impacts are deemed to be of 'medium' or 'high' significance, additional mitigation measures are proposed, beyond those already proposed by the relevant technical impact assessments.

Following the identification of each potential cumulative impact, a relevance factor score of low, medium and high has been determined in consideration of the impacts, in accordance with the assessment matrix given in Table 4.10.

The significance of the impact has been determined by using professional judgement to select the most appropriate relevance factor for each aspect in Table 4.10. The sum of the relevance factors determines the impact significance and consequence, which are summarised in Table 4.11. For example, if an environmental value such as groundwater is considered to have a probability of impact of 2, duration of impact of 3, magnitude/intensity of impact of 1 and a sensitivity of receiving environment of 1, the significance of impact would be medium (2+3+1+1 = 7).

**TABLE 4.10: ASSESSMENT MATRIX**

| | Relevance factor | | |
|---|---|---|---|
| **Aspect** | **Low** | **Medium** | **High** |
| Probability of impact | 1 | 2 | 3 |
| Duration of impact | 1 | 2 | 3 |
| Magnitude/intensity of impact | 1 | 2 | 3 |
| Sensitivity of receiving environment | 1 | 2 | 3 |

**TABLE 4.11: IMPACT SIGNIFICANCE**

| Impact significance | Sum of relevant factors | Consequence |
|---|---|---|
| Low | 1–6 | Negative impacts need to be managed by standard environmental management practices. Monitoring to be part of general Project monitoring program. |
| Medium | 7–9 | Mitigation measures likely to be necessary and specific management practices to be applied. Targeted monitoring program required, where appropriate. |
| High | 10–12 | Alternative actions should be considered and/or mitigation measures applied to demonstrate improvement. Targeted monitoring program necessary, where appropriate. |

Full details of the cumulative impact assessment, including projects considered as part of the assessment, are presented in Chapter 22: Cumulative Impacts.

## 4.5 Mitigation and management measures

Mitigation and management measures are designed to protect environmental values and sensitive receptors, achieve established environmental performance objectives, and enhance any positive impacts as a result of the Project. Initial and proposed mitigation measures have been incorporated into all three assessment methods, as summarised in Figure 4.2.

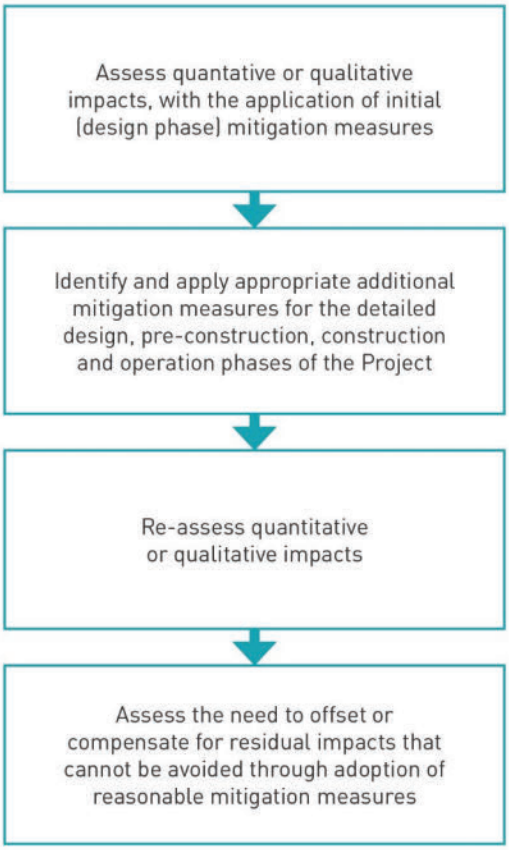


**FIGURE 4.2: PROCESS FOR THE ASSESSMENT OF IMPACTS AND THE STAGED APPLICATION OF MITIGATION MEASURES**

Initial mitigation measures are steps taken during the planning and design phases to avoid or minimise potential impacts. For example, the design includes a tunnel that will avoid direct impacts (and most cases indirect impacts) to overlying environmental aspects such as land use and ecology.

Proposed mitigation measures are in addition to initial measures considered during design to further avoid or minimise impacts through future Project phases, being:

- Detailed design
- Pre-construction
- Construction and commissioning
- Operation.

In some instances, significant residual impacts are anticipated after the application of additional mitigation and management measures. In these cases, the need for environmental offsets to compensate for significant adverse residual impacts have been assessed:

- For Matters of State Environmental Significance (MSES) defined under the Environmental Offsets Regulation 2014 (Qld) and the *State Planning Policy* (Department of Infrastructure, Local Government and Planning, 2017b) the following guidelines were used to determine whether a prescribed activity will, or is likely to, have a significant residual impact:
  - *Significant Residual Impact Guideline—for matters of state environmental significance and prescribed activities assessable under the Sustainable Planning Act 2009* (Department of State Development, Infrastructure and Planning, 2014)
  - *Queensland Environmental Offsets Policy: Significant Residual Impact Guideline* under the *Nature Conservation Act 1992* (Qld), *Environmental Protection Act 1994* (Qld), *Marine Parks Act 2004* (Qld) (Department of Environment and Heritage Protection, 2014a)
- For Matters of National Environmental Significance (MNES), significant residual impacts were determined in accordance with the *Significant Impact Guidelines 1.1—Matters of National Environmental Significance* (Department of the Environment, 2013).

Significant residual impacts on MSES and MNES are discussed in Chapter 11: Flora and Fauna, with a detailed assessment on MSES and MNES provided in Appendix I: Terrestrial and Aquatic Ecology and Appendix J: Matters of National Environmental Significance, respectively.

Mitigation and management measures (initial and proposed) have been documented in tabular form in the relevant EIS chapters. The combined detailed design, pre-construction, and construction and commissioning mitigation measures for the Project are documented in the Draft Outline EMP (refer Chapter 23: Draft Outline Environmental Management Plan).

Potential mitigation measures for the operational phase of the Project are documented in the relevant EIS chapters and reflect ARTC's current procedures, policies and plans implemented across the over 8,500 km of existing network managed by ARTC. Furthermore, Network Operators will develop and implement management measures to operate on the ARTC network, with some of the key measures outlined in the EIS where applicable.

## 4.6 Draft Outline Environmental Management Plan

The Project's Draft Outline EMP, which addresses the requirements of the ToR, and applicable legislation, statutes, guidelines and policies is provided in Chapter 23: Draft Outline Environmental Management Plan.

The Draft Outline EMP establishes how any adverse impacts as a result of the Project are proposed to be managed during the detailed design, pre-construction, and construction and commissioning phases. It also establishes environmental objectives, performance criteria and a framework for continuous management, monitoring, reporting and training of site personnel.

Mitigation measures proposed for each environmental aspect identified in Chapters 8 to 21 are documented in the Draft Outline EMP.

## 4.7 Community and stakeholder consultation

The assessment methodology adopted for the purpose of this EIS has been presented to, and discussed with, relevant regulatory agencies. A project of this size and significance requires a far-reaching communication and stakeholder engagement approach to provide opportunities for involvement at all levels. Furthermore, input from a variety of key stakeholders and community members is required to understand constraints, values and impacts, personally and at a community level, caused as a result the Project. Community and stakeholder consultation will be ongoing for the Project through the EIS public display period and post EIS, during the detailed design and construction phases.

The overarching purpose of the community and stakeholder engagement program was to:

- Raise awareness about the Project, including the need for the Project, its benefits and the process undertaken to develop the design and EIS
- Verify the appropriateness of assessment methodologies adopted for the EIS (refer Section 4.4)
- Provide stakeholders with opportunities to inform investigations being undertaken for the design and EIS about local values and issues, along with proposed mitigation measures
- Inform government agencies, stakeholders and the community about the progress of the Project and to seek their input into the development of the design and EIS
- Understand stakeholder and community issues and, where possible and practical, address any issues raised.

The consultation program was structured to inform individuals and groups directly and indirectly affected by the Project. The process was also structured to allow input from:

- Stakeholder groups with specific interests in the Project, such as Traditional Owners, community groups (via Community Consultative Committee/meetings (members and observers), and ARTC's online Social Pinpoint and CollabMap tools) and industry associations
- Queensland Government agencies, including those with either a regulatory or an advisory role in the design, construction or operation of the Project
- Toowoomba Regional Council and Lockyer Valley Regional Council.

Feedback and community enquiry channels established for the Project include:

- Freecall 1800 number (1800 732 761)
- Project email (**inlandrailenquiries@artc.com.au**)

- Postal addresses:
  - Australian Rail Track Corporation, Inland Rail, 65–67 Neil Street, PO Box 3093, Toowoomba QLD 4350
  - Australian Rail Track Corporation, Inland Rail, GPO Box 2462, Brisbane QLD 4001

Stakeholder and community feedback and comments received from the consultation process has informed the preparation of the EIS, including:

- Identification of community values and local conditions in proximity to the Project
- Assessment of potential benefits and impacts of the Project's construction and operation
- Identification of strategies to minimise or avoid potential impacts and maximise or enhance potential Project benefits.

Stakeholder and community engagement activities undertaken during development of the EIS are discussed in Chapter 5: Stakeholder Engagement.