



4. The Route Identification Process



4 The Route Identification Process

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The following section describes the various activities and investigations undertaken to identify the preferred route.

The route identification process adopted for this study provided the study team with the scope to identify, refine, and adjust route options in response to issues raised through community feedback and other technical investigations during the initial phase of the study.

This approach was specifically developed to allow the study team to progress quickly and with certainty from the initial investigation area to a preferred route, whilst providing fair and equitable opportunities for community input to be considered throughout the process.

4.1 Methodology

4.1.1 Review of Baseline Conditions

The first step of the study process was a review of the existing conditions (the 'baseline conditions') within the original (22 km x 3 km) study area. This process included the following:

- A review of previous work
- Site visits and field survey work
- Consultation with local government, state government and service providers to gather updated relevant spatial information in GIS format.

This step of the study examined the characteristics, issues and constraints identified within the original study area. In some cases the broader region surrounding the original study area was also reviewed, particularly from the land use, social, and economic perspectives.

Constraints and issues that were considered likely to have some bearing on the identification of the study focus area were then broadly classified. This process involved ranking key constraints into categories of low, medium and high, based on evaluations of their significance to future decision making.

Areas of high constraints were considered to have a significant bearing in alignment location and assessment of route options, whereas medium and low constraint areas would be considered to have a lesser bearing on the identification and assessment of routes.

4.1.2 Study Focus Area Refinement

The refinement of the study focus area was a two step process. An initial study focus area was identified on the basis of project objectives and the constraints classification process described above. This information was then re-evaluated after a round of community consultation (the Community Values and Transportation Survey) and further technical investigations.

4.1.3 Study Focus Area Consultation and Investigations

Consultation with the community during the community information sessions in November and December 2007 also helped the study team to further understand the constraints and issues within the study focus area. This also included consultation with local government officers and the Environmental Protection Agency.

The investigations undertaken during the review of the baseline conditions also identified some key areas where further detailed review would be required, in particular, ecological aspects. Additional ecological fieldwork has been undertaken in some areas to confirm assessments and assumptions based on existing available ecological information.

4.1.4 Route Option Identification

Indicative routes that had been identified as feasible during the scoping study work were reviewed and refined against:

- Technical design objectives
- Updated topographical information, cadastre and aerial photography.

Refinements were undertaken to respond to new constraints identified through community feedback and technical investigations, provide straights for stations, adjust to updated topographical data, and identify constructability and vertical alignment issues.

A number of new routes were also identified in response to these objectives and constraints. A route option submitted through the community consultation process outlined above was also taken through the design process to allow for comparison with other route options.

4.1.5 Route Option Evaluation

The study focus area was divided into five segments, to assist in the route evaluation process. These were:

- Landsborough: Segment A
- Mooloolah: Segment B

- Eudlo: Segment C
- Palmwoods to Woombye: Segment D
- Nambour: Segment E

The segments were defined at points where it was considered possible to interchange between route options, and therefore allow the study team to assess each individual route segment and identify a preference for each segment.

Constraints and issues within each segment were reviewed and documented, which provided the basis for the evaluation of route options within each segment.

The relative performance of the route options were then compared on a segment by segment basis. That is, all route options within segment A were compared against each other on the basis of environmental, social, transport, land use and planning, economic, and engineering criteria to identify the best performing route for segment A. This process was then repeated for segments B through E.

4.1.6 Identification of the Preferred Route

The route options that were considered to perform the best against the criteria outlined above were then selected and combined to form the preferred route. Some refinement and adjustment was necessary at the interface between segments.

4.2 Technical Investigations

The various approaches for the technical investigations undertaken as part of this route identification and evaluation process are described in the following section.

4.2.1 Ecology

The ecological features of the study area and study focus area were identified utilising a combination of desktop analysis, consultation with State and local government and community groups, and field studies. In the initial stages of the study, desktop analysis was conducted utilising the following sources of information:

- Aerial photography (June 2007)
- Regional Ecosystem Mapping (Queensland Herbarium v5 2003 with updates)
- Biodiversity Planning and Assessment Mapping (EPA v3.4 2005)
- Essential Habitat Mapping (EPA v5 with updates)
- *Nature Conservation (Koala Conservation) Plan and Management Program 2006*
- WildNet (EPA's flora and fauna records database)
- EPBC database search for significant species listed under the *Environment Protection & Biodiversity Act 1999* (EPBC Act 1999)
- Caloundra City Plan 2004
- Caloundra City Biodiversity Strategy 2006
- Maroochy Plan 2000
- Maroochy Biodiversity Strategy 2006.

From this information a series of Geographical Information Systems (GIS) analyses were undertaken to create mapping that was reflective of the ecological values within the study area. As this is a fairly high level process, it is unlikely to detect all ecologically significant features (especially with regards to significant species) or those features that may be significant on a smaller, local scale. Information that was gained during the consultation process was also added to the GIS mapping analysis. Where the desktop analysis or consultation process had indicated significant ecological features to be present, specialist members of the study team (including ecologists and botanists) undertook ground-truthing field surveys.

Various surveys were undertaken at many sites within the study focus area. These field surveys include:

- Vegetation survey – these surveys were undertaken in early February 2008. The main aim of the vegetation surveys is to confirm the status of regional ecosystems that had been identified by Queensland Herbarium mapping. These surveys also aim to locate significant flora species listed under the *Nature Conservation (Wildlife) Regulation 2006* and *Environment Protection and Biodiversity Conservation Act 1999*.
- Terrestrial fauna survey – there were two episodes of terrestrial fauna survey. The first episode was undertaken in early September 2007 to capture Winter – Spring. The second episode was undertaken in late January 2008 to capture Summer. Various methods of terrestrial fauna survey were utilised to develop a species list for the study area. These included: Elliott and cage trapping, harp nets (microbats), pit fall traps, diurnal survey (birds), spot-lighting and call playback. Targeted surveys were undertaken to ascertain further information about the distribution and population of Giant Barred Frogs (*Mixophyes iteratus*), which are a federally listed significant species. Please note that all surveys were undertaken by suitably qualified professionals under the appropriate Scientific Use Permit (NCA 1992). As some species are rare and cryptic it is not possible to observe all significant flora and fauna within an area during field survey. Hence, at the time of survey a habitat assessment was undertaken to identify locations where significant species are likely given the type and condition of the natural habitat.

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- Aquatic fauna survey – there were two episodes of aquatic fauna survey. The first episode was undertaken in early September 2007 to capture Winter – Spring. The second episode was undertaken in late January 2008 to capture Summer. Various methods of aquatic fauna survey were utilised to develop a species list and information pertaining to the aquatic ecosystems within the study area. These included: riparian habitat assessment, water quality sampling, fish traps, gill nets, seine nets, and dip nets. Please note that all surveys were undertaken by suitably qualified professionals under the appropriate Scientific Use Permit (NCA 1992).
- Habitat assessment – as it is not possible to observe all significant flora and fauna within an area at the time of survey, a habitat assessment was conducted to identify locations where significant species were considered likely given the type and condition of the natural habitat.

For detailed information regarding ecological field surveys, refer to Appendix C.

4.3 Land use and Planning

4.3.1 Planning Framework

The planning framework within the study area was reviewed to determine objectives and constraints relevant to the decision making process for this project. The review included consideration of the following documents:

- State Planning Policies (SPP), with a particular focus on recent SPPs that are not reflected in local government planning schemes, namely State Planning Policy 2/07 Protection of Extractive Resources which took effect from 3 September 2007 and State Planning Policy 1/07 Housing and Residential Development
- The *South East Queensland Regional Plan*
- The Caloundra City Local Growth Management Strategy
- Draft Nambour MDA Structure Plan
- Draft Maroochy Shire Local Growth Management Strategy
- The Maroochy Plan 2000 and Caloundra City Plan 2004.

A key outcome of the review was mapping of the State, Regional and Local planning framework for the study area, in particular:

- State planning matters, specifically the location of land affected by matters requiring special management (e.g. acid sulfate soils, good quality agricultural land, etc.)
- The regional land use categories identified by the Regional Plan

- Zoning of all lands under the Maroochy Plan 2000 and the Caloundra City Plan 2004.

Strategic objectives were also identified and reviewed for all planning documents to determine opportunities, constraints and potential planning conflicts within the study area.

Commonwealth and State legislation and planning policies are also discussed in other sections of this report where the content is directly related to particular pieces of legislation or planning policies. This includes legislation and planning policies to protect cultural heritage, vegetation, significant habitats and water quality, and to mitigate against impacts such as fire, flooding, landslide and acid sulfate soils.

It is important to note that the planning framework has not been a key determinant for route identification. The need for improved public transport in the region, including an upgraded rail service is identified at a strategic level in the planning framework but provision of infrastructure to achieve this outcome is not addressed at a land use level in any of the planning documents. As this project requires consideration of planning beyond 2026 which exceeds the life span of the current Regional Plan and local government planning schemes (typically a seven year life) it is intended that these plans will, in time, be amended to reflect the opportunities and constraints arising from the proposed route.

4.3.2 Land Use and Tenure

The review of land use and tenure factors relevant to the route identification involved:

- Review of existing information
- Physical inspections to ground-truth mapping and data
- Interviews with key stakeholders and community members.

A desk-top review of the following data was undertaken to document and map the existing land uses and identify planning information for future land uses:

- Local government and Department of Natural Resources and Water GIS data, including zoning, cadastre and tenure information overlays
- Aerial photography
- *South East Queensland Regional Plan (2005)*
- Statutory and non-statutory plans prepared by the local governments.

The data was used to determine the existing broad land use and tenure patterns of the study area, in particular the:

- Location and boundaries of land tenures, in place or proposed, to which the study area is or may be subject to
- Location of existing dwellings/buildings
- Zoning of all lands under the Maroochy Plan 2000 or the Caloundra City Plan 2004
- Location of areas of good quality agricultural land, or land utilised for agricultural pursuits.

The data was validated and expanded through site inspections, particularly in the townships, and discussions with council officers, major land holders and other key stakeholders. Further detail was also collected through community consultation processes.

4.4 Cultural Heritage

4.4.1 Scope

A preliminary list of heritage sites and places identified through literature and desktop research (including relevant heritage registers) was identified during the scoping study phase of the project. This information was reviewed and then further focused cultural heritage assessment relevant to this stage of route identification and evaluation. The assessment is necessary to determine the nature of cultural heritage sites and places relevant to the study area and identify those sites which are likely to be impacted directly or indirectly by the project.

As heritage registers and inventories are not an exhaustive representation of heritage sites likely to exist within the study area, this review completed further targeted research and field survey to confirm not only the location of known sites and places within the study area but a further list of cultural heritage sites and places within the study area, which are possibly not identified on heritage registers.

This process also identified contact and discussions that will be required with the current Indigenous stakeholders associated with the study area during the later stages of assessment. As prescribed by the *Aboriginal Cultural Heritage Act 2003*, in order to facilitate consultation to provide effective recognition, protection and conservation of Aboriginal cultural heritage and compliance with the duty of care under the Act, it is vital that the appropriate Aboriginal Party for land within the study area be accurately identified and notified at the time of the development proposal.

The purpose of this assessment is to qualify the presence of cultural heritage items within the study focus area, their proximity with the proposed rail alignment options and identify a preferred route option for each of the five sections of the railway corridor. A cultural heritage report presenting the results of the contextual cultural heritage research and field survey within the proximity of the study area has been prepared which includes:

- Searches of registers, databases and associated reports relevant to the study area
- Consultation with key stakeholders
- Review of community feedback relating to the location of potential heritage sites
- Additional sites located as a result of the cultural heritage field survey and community feedback
- The nature of potential impacts, both directly and indirectly, of the project in relation to the study area
- Management recommendations related to the route evaluation process and cultural heritage.

The cultural heritage report prepared for this phase of the study does not constitute an Archaeological Assessment and as such, is purely indicative. Without a systematic survey, it is impossible to say with authority where potential archaeological features may and may not exist. However, a review of the contextual information, including aerial photographs and visual assessment of the site has confirmed archaeological potential may exist in some areas.

4.4.2 Methodology

On-line searches of the National and Commonwealth Heritage Lists, Register of the National Estate, and the Queensland Heritage Register were conducted to identify places and sites of cultural heritage significance that may be impacted upon by the proposed development plans.

The National and Commonwealth Heritage Lists and Register of the National Estate is compiled by the Australian Heritage Council and provides an inventory of Australia's natural and cultural heritage places. Sites and places of historic (non-Indigenous) cultural heritage significance listed on the National Heritage List or Commonwealth Heritage List are protected under the *Environmental Protection and Biodiversity Conservation Act 2003*.

The Queensland Heritage Register is maintained by the Cultural Heritage Branch of the Environmental Protection Agency (EPA), with the aim of protecting historic cultural heritage for future generations. All sites and places of historic (non-Indigenous) cultural heritage significance listed on the register are protected under the *Queensland Heritage Act 1992*.

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Sites on the National and Commonwealth Heritage Lists, the Register of the National Estate and Queensland Heritage Register already have an established level of significance, given their entries onto these registers. As such, it is important to clarify where these sites and places are situated in relation to the study area. Looking at those sites and places that are already on the abovementioned heritage registers does not deny that there are other places and sites that may have levels of heritage significance. Rather, this section deals with those sites that are already assessed to have high levels of known significance.

Heritage documentation included in Caloundra and Maroochy planning schemes has also been considered during the preparation of this report.

4.5 Visual and Landscape Character

Visual amenity refers to the perception of viewers of the visual quality of their surrounding landscape. Impacts to visual amenity occur when there are changes in the views as a result of physical alterations to the landscape, to people's responses to these changes, and to the overall effects with respect to visual amenity.

For the purposes of this assessment, the term landscape also includes the character of towns or townscape. Townscape includes both cultural and physical characteristics or elements giving rise to patterns that are distinctive to particular localities and help define a sense of place. The assessment of townscape is different but closely related to the assessment of heritage and planning issues in relation to the towns in the study area.

An initial desk study examined previous reports, aerial photographs and topographic maps in order to identify potential key receptors and the broad characteristics of the landscape. The existing and proposed routes, landform and land cover (screening) were considered together. A site survey was undertaken by two landscape planners in January 2008 during conditions of good visibility. The survey verified the desk study, and provided more detailed information about the study area and likely impacts of the various route option segments.

4.6 Socio-economic Characteristics

The study area for the socio-economic component of the study is broader than the study area described above in section 2.2. This area was selected so as to take into account use of the rail by surrounding communities and businesses. This study area uses an aggregation of Census Collection Districts within an approximately 10 km radius of the rail corridor and takes in the Blackall Range tourist area. The study area includes communities along the existing rail corridor as well as communities that lie outside of the corridor. The socio-economic analysis compares data from the broader study area with both South East Queensland and Queensland. Figure 4.6 shows the extent of the broader study area. Feedback from initial community consultation was also reviewed as part of the socio-economic assessments.

Relevant local and regional economic strategy and policy documents have been reviewed to confirm the policy environment impacting upon the economic development of Brisbane's northern region and the Sunshine Coast as a result of the proposed rail corridor upgrade. In turn, these policy settings have been considered in broad terms for how they might influence potential (and preferred) transport solutions. Key regional documents reviewed and interpreted for their influence on the region's 'future economy' include:

- *The South East Queensland Regional Plan*
- *South East Queensland Infrastructure Plan and Program*
- Queensland Smart State Strategy 2005–2015
- The State Government's 'Leading Smart Regions' program
- Regional and Sub-Regional economic plans – Economic Vision Statement for NORSROC, the Sunshine Coast Regional Economic Development Strategy, and local economic development strategies (e.g. for Noosa Shire, Maroochy Shire and Caloundra City, etc.).

As part of this assessment, a review of a number of recent studies relating to rail development and associated benefits and impacts has been undertaken to ensure the full range of relevant and current issues are assessed.

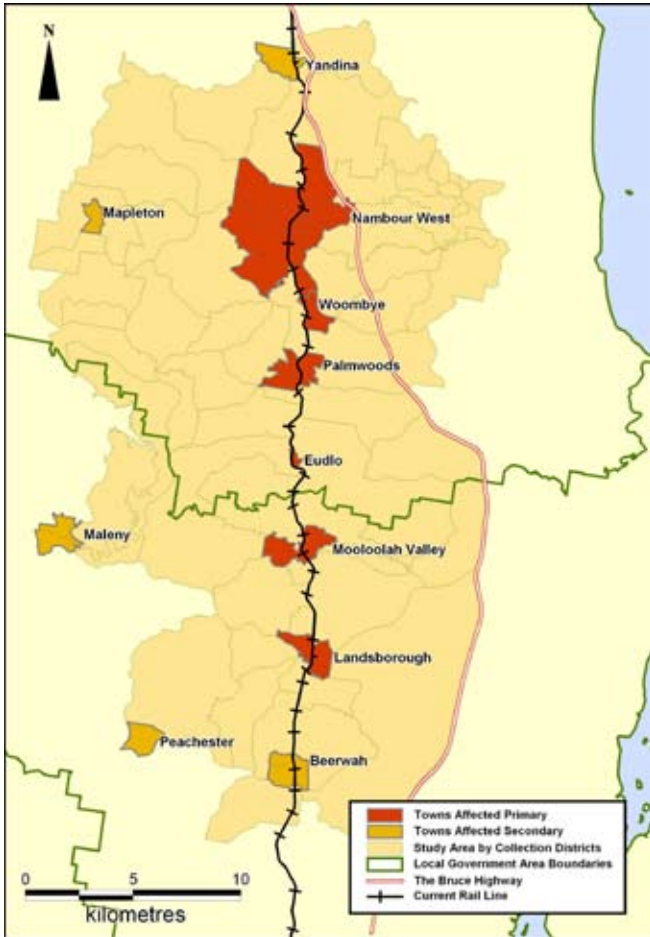


Figure 4.6 SGS Study Area (Source: Australian Bureau of Statistics, 2006 and CDATE, 2001).

4.7 Noise and Vibration

Noise and vibration investigations conducted for this route identification and evaluation process have included to date:

- A general description of existing noise conditions within the study focus area, including existing noise sources and receptors
- Community noise burden analysis of the noise impacts or ‘annoyance levels’.

The community noise burden approach was selected for this stage of the process as it allows comparison of potential route options aggregated across a nominal area surrounding the proposed infrastructure.

Noise modelling and the determination of specific noise mitigation requirements will be carried out during the preliminary design and EIS phase of the study.

4.7.1 Community Noise Burden Analysis

As described in section 4.1.5, the study area has been separated into five separate segments, labelled ‘A’ through to ‘E’. Within each of these segments a number of route options have been identified, with the existing route also included for comparison.

For all of these options a list of property numbers and their geographical proximity to the train line have been listed. Using source railway levels from Queensland Rail’s standard emission table, the reference values of maximum pass-by level (L_{Amax}) and single event exposure level (SEL) for the different types of trains at a distance of 25 m from the rail line and speed of 80 km/hr are used to calculate the following noise levels at each of the properties:

- L_{DN} dB(A) day/night equivalent sound level
- L_{Amax} dB(A) single event maximum pass-by level
- $L_{Aeq,24hr}$ dB(A) 24 hr equivalent level.

4.7.2 Assumptions

For the assessment of each of the options the following assumptions have been made when calculating the noise level at the receivers (properties):

- There are no barriers between the train line and the properties
- Between the train line and the properties the terrain is relatively flat
- Attenuation due to air and ground absorption is negligible
- A +2.5 dB correction has been applied to the calculated noise levels to account for façade reflections. The predicted noise level contours may therefore be compared directly to the criteria, which are measured at the building façade.

The following rail traffic schedules and day/night split of rail traffic have been assumed (Table 4.7.1a and 4.7.1b):

Table 4.7.1a – Assumed rail traffic schedules

Vehicle Type	2002- ‘Existing’		2026	
	Up [‡]	Down	Up	Down
SMU/IMU	6	7	46	47
ICE	7	6		
Freight	12	11	15	16

[‡] Up direction is towards Brisbane, Down direction is away from Brisbane.

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Table 4.7.1b – Assumed day/night split of rail traffic

Vehicle Type	2002- 'Existing'		2026	
	Day**	Night	Day	Night
SMU/IMU	13		80	13
ICE	13			
Freight	11	12	15	16

** Day period is 0700 – 2200 hrs, Night period is 2200 – 0700 hrs.

- To calculate an annoyance factor at each of the properties, the Community Annoyance due to Noise Curve below (Schultz) has been used to predict the proportion of households at each property that would be highly annoyed. For the purpose of this report, all annoyance values that equate to a day/night sound level of less than 50 dB(A) have been set to 0%, as this is the point at which the percentage of people highly annoyed reaches 1%, which is negligible.

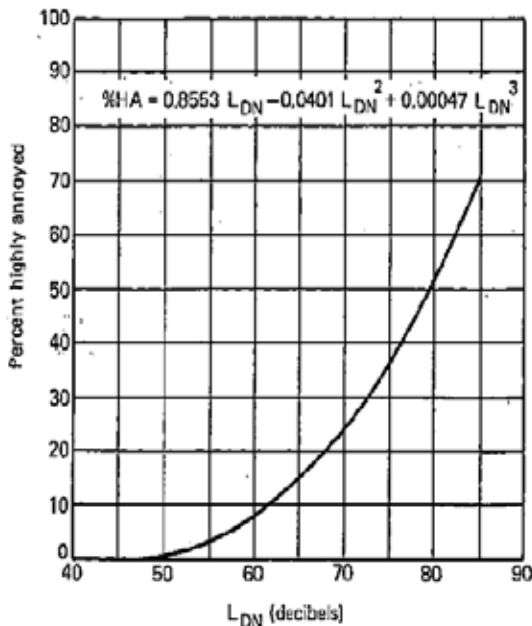


Figure 4.7.1 – Community Annoyance due to Noise Curve

Source railway noise levels have been derived from Queensland Rail’s standard emission table. This provides source values to account for the rail vehicle type, speed, and length. Emission from passenger vehicles on the existing line has been modelled as six-car SMU/IMU vehicles on jointed rail and four-car ICE vehicles. Freight has been modelled as double engine “Current Generation” rollingstock with a 625 m consist (i.e. Class 1500/1700/2100/2400 locomotives). Notch setting 6 has been assumed at all locations for engines.

4.7.3 Criteria

Airborne noise limits for railways operating in Queensland are given in Schedule 1 of the *Queensland Environmental Protection (Noise) Policy 1997*, which specifies noise limits relating to rail traffic for residential receivers in terms of a 24-hour LAeq noise level and a maximum pass-by level, LAmax. The following planning levels apply:

- 65 dB_{LAeq,24hr} and
- 87 dB_{LAmax} single event maximum level.

These limits have been adopted by Queensland Rail in their *Code of Practice, Railway Noise Management (December 1999)*.

4.8 Geology, Topography and Soils

Geotechnical constraints have been assessed on the basis of published geological information, the topographical survey, and a brief site walkover. Aerial photograph interpretation has also been carried out using a stereoscope to form a three dimensional image of the photographs.

4.9 Flooding/Hydrology

The study area includes four creek systems with significant floodplains and numerous local drainage paths. Any infrastructure constructed within a flow path has the potential to impact on natural flood levels, depths, velocities and flows. As a result, the Route Identification Study included a preliminary assessment of the existing flood conditions and an estimate of the dimensions of the structures required to adequately control the flood impacts.

For this study, the infrastructure cross-flow control is assumed to be achieved through hydraulic structures such as bridge or culverts. Separate preliminary design techniques were used depending on the nature of the flood flow (regional or local):

- Regional flooding from major creeks has previously been studied, and GIS layers of the 100 year ARI design flood are available from the Councils in the project area. These GIS layers are produced by hydraulic computer models, which accurately predict statistically based design flood events. Approximate design water levels, which the rail embankment must exceed, are extracted from the comparison of the lateral flood extents and the Digital Elevation Model (DEM). The spread of regional flooding in both urban and rural areas generally affects properties and businesses over a large area. As a preliminary assessment, the only consistent mean to prevent increasing damages is to bridge the entire floodplain at the location of the railway crossing. The Route

Identification Study therefore calculates the width of bridge required from the length of the route options crossing the major floodplains

- Local drainage flow paths cross the proposed route options alignment. They correspond to the runoff concentrated at the bottom of catchment gullies before they merge with downstream creek flows. All the crossing locations with a significant upstream catchment (> 1ha) were identified using the DEM. As a preliminary assessment, the crossing structures (pipes or culverts) at these locations are sized based solely on the peak flow and a proposed design afflux (0.3 m) using standard hydraulic equations for culverts flowing full. Design peak flows are derived using the Rational Method from the catchment characteristics determined from the DEM and aerial photographs. The proposed design afflux is assumed to be insignificant in most cases, as the location of existing buildings and the land steepness limit the afflux area of influence.

Although the assessment of the required flood structures is only preliminary, it provides a consistent means of comparison between the route options. Further and more advanced analyses, which could include hydraulic modelling, will be required at the preliminary design stage during the EIS to optimise the flood crossing structures.

4.10 Water Quality

Consideration of water quality has focused on waterways in the study area. The methodology adopted for this topic includes the following activities:

- Identification of waterways and catchments
- Review of water quality assessment information from the Ecosystem Health Monitoring Program (EHMP) undertaken by the South East Queensland Healthy Waterways Partnership
- Aquatic surveys of selected water quality parameters at four core sample sites that were selected on the basis that they are representative of different aquatic habitats and waterways to be affected by the proposed works, and/or contain features of high conservation significance from an aquatic ecology perspective (e.g. represent habitat for threatened fish species) (see below)
- Analysis of water quality monitoring data collected in late 2007 and early 2008 by BMT WBM through the aquatic surveys.

The aquatic surveys undertaken by BMT WBM's for this study involved the following water quality sampling regime.

- Deployment of a data-logger for two weeks to measure water temperature, electrical conductivity/salinity, pH, dissolved oxygen, and turbidity at 15 minute intervals.
- Four occasions of water quality sampling and laboratory analysis (two in the dry season and two in the wet season) to measure total and dissolved metals (aluminium, arsenic, chromium, copper, lead, nickel and zinc), Total Suspended Solids, and Nutrients (ammonia, nitrate, nitrite, organic nitrogen, total nitrogen, ortho-phosphate and total phosphorus).

The core sampling sites are located on South Mooloolah River (site 5), Eudlo Creek (site 7), Paynter Creek (site 11) and Petrie Creek (site 13). These sites are shown in Appendix G.

4.11 Transport Network

Assessment of transport patterns, demands and changing trends informed the previous scoping study work and was a factor influencing the decision to proceed with identifying a preferred route. During the process of identifying a preferred route, transport planning has focussed on the following issues:

- Vehicle access to and around train stations
- Pedestrian access to and around stations
- Improve the road network at rail crossing locations
- Maintain integrity of the road network
- Maintain access to properties.

We have assumed the public transport network could and would be modified in terms of routes and timetables as necessary to retain (and improve) connections between different modes of transport and so have not considered this in detail other than the need to accommodate bus movements and parking on roads around stations.

The assessment of the transport network in the context of a preferred route was undertaken by a combination of:

- Desk-top study of maps, aerial photos, and flooding maps
- Identified road hierarchies for each of the local government areas
- Consultation with residents, council officers and other stakeholders about road safety and access issues
- Reports of previous studies, including an OLC review
- Consideration of local government planning in relation to roads and transport
- Site visits.

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Consideration was given to:

- Open Level Crossings (OLCs)
- Road Network
- Emergency Services
- Bus Routes
- Pedestrian and Cyclist Facilities.

Each route option has been reviewed to determine impacts on the road network and possible solutions have been identified and briefly assessed. However further design and assessment work, including consultation with affected residents and communities, will be required to determine the best road network solutions when the preferred route is finalised.

4.12 Engineering and Infrastructure

A review of available information has been carried out to determine the characteristics of the existing rail corridor and the features within the study area which might impact on the various corridor options in terms of engineering design and constructability. Information reviewed includes:

- Queensland Rail *Standard Track Formation Corridor Widths* sheet 5 of 6 (drawing no. 2571) and *Standard Clearances for Proposed Structures* (drawing no. 2461)
- Digital Terrain Model - based on Airborne Laser Scanning (2007)
- Digital Cadastral Data Base (DCDB) for Caloundra and Maroochy Shires
- Various services plans provided by owners of public utility plant assets (including Telstra, Energex, Visionstream and Caloundra and Maroochy Shire Councils)
- Consideration of other infrastructure projects such as Northern Pipeline Interconnector Project.

To aid the planning and design process, and to help ensure that adequate land requirements are identified, each service authority was requested to provide copies of all plans or other relevant information indicating any existing utilities and any approved major works that may be provided in the foreseeable future.

4.13 Operational Analysis

High level operational analysis was undertaken to provide the study team with an understanding of the infrastructure elements that would be required to allow the proposed upgrade to support future operations. This included consideration of:

- Station and platform configuration in Nambour

- Platform configuration at the intermediate stations
- Stabling provision and location
- Provision and location of crossovers and turnouts
- Future scheduling capacity
- Recommendations for signalling.

The high level operational analysis identified possible issues and constraints that could affect the future performance of the proposed upgrade. This analysis was conducted on the basis of a conceptual upgrade corridor, and will be refined in future stages of the study.

4.14 Cost Considerations

Comparative cost estimates have been prepared as part of the route identification and evaluation process. The cost estimates for each route option are high level, and have been used comparatively to inform the route evaluation process. These cost estimates can not yet be used as a construction cost estimate for this project. More detailed costs will be prepared as an outcome of the preliminary design and EIS process. Elements considered include:

- Clearing and vegetation removal
- Topsoil stripping
- Earthworks
- Drainage
- Sub-ballast
- Fencing
- Bridge structures
- Track crossings
- Viaduct
- Two track tunnel
- Tunnel portals
- Stations
- Trackwork
- Electrification
- Signalling
- Road realignments
- Noise mitigation.