3. River Crossing Options

There is currently no identified demand for the rail link to the Port of Bundaberg, and consequently, it is uncertain what type of end of rail facility may be required to deliver new types of freight to the Port.

As referred to in section 1.3.3, a number of options for getting bulk product, and/or freight, across the Burnett River, from a railway on the northern side of the river to the berth on the southern side of the river, were noted in developing the rail corridor. These options were examined in a preceding study, and the findings informed the corridor selection process.

Any future consideration of the options to transport goods to the port may include the feasibility of a new berth on the north bank of the river or the construction of a river crossing to the berth on the south bank. Accordingly, an analysis of all possible options will be completed, if and when a rail link to the port is deemed to be viable.

It is noted, the Port of Bundaberg currently owns 54 ha of land on the north bank of the Burnett River opposite the existing berth on the south bank that may be suitable for the construction of a new berth. No analysis has been undertaken to determine the suitability of port land on the north bank of the river for such a berth.

The balloon loop that terminates the corridor on the north bank of the river has been positioned within the rail corridor to enable utilisation of existing port land on the north bank of the river for possible future port operations.

4. Alignment Design

4.1 Design approach

The geospatial modelling outcome was the major input to the engineering process. With the balloon loop positioned adjacent to port land on the northbank, the two main outputs of the preceding process were

- The model route
- The suitability surface map

These two outputs respectively offered a path of least resistance to all the constraints determined, and showed areas of suitability for a rail corridor.

The general approach to determining a corridor that satisfies the engineering criteria (section 1.3.4) was to first establish an alignment that matched the model alignment as closely as practical. The 50m corridor was applied to the line outcome and then was reviewed from an engineering stance and refined where appropriate.

4.2 Design parameters

Further to those parameters specified above, the assumed operation of the railway is to consider loaded trains travelling to the loop (ie down the steep grade) and empty trains departing the loop (ie up the steep grade). It is assumed that there is no requirement for empty trains to arrive at the loop and depart loaded.

With the exception of the balloon loop, the proposed railway alignment has been designed for a maximum train speed of 80 km/h with cant and cant deficiency balanced equally. However, no traction performance modelling has been undertaken to validate train speeds against the proposed horizontal and vertical geometry. On the basis that the primary concern of this study is to define the corridor of the proposed alignment, the geometry of the railway is fixed. If, during feasibility or detailed design development, lesser train speeds are required, then it is suggested that the balance of cant and cant deficiency is adjusted accordingly. Simply stated, if curve radii are fixed, lesser speeds will result in the requirement for less cant.

4.3 Refinements of the model outcome

Modification 1: In order to reduce the curvature of the alignment and hence potential maintenance costs, the curves between approximate chainage 4400 and 8200 were replaced with a straight alignment. Whilst this represents a deviation from the model output of up to 80m in places it was considered that the simpler alignment would lead to lower operating and maintenance costs, and there was negligible loss of ‘performance’ or increase in impact within the model.

Modification 2: The original model output indicated a clash between the proposed alignment and a property located at 435844E, 7257972N (shown on drawing 21-17948-C008). Whilst it is unknown whether the property is occupied or not, the alignment was modified to eliminate the clash

4.4 Horizontal alignment

The proposed alignment of the railway generally runs in an east-north-easterly direction from the NCL to the proposed balloon loop adjacent to the Burnett River / Port of Bundaberg and has been designed to Queensland Rail Standard CETS 8 Track Alignment. In consideration of future design work associated with the proposed alignment it is important to note that the northern and southern links to the NCL represent the track centreline of the single-track connection to the existing railway, whilst the through-alignment represents the centreline of a double-track arrangement.

The final established alignment was defined as per the geometries given in Table 4

Table 4 Final Established Alignment Geometries

Section	Spur chainage [m]		Length [m]	Radius [m]
	From	To		
North link	359.723 km*	0	750	550
South link	358.597 km*	0	970	550
Spur	0	2350	2350	Tangent
Spur	2350	4420	2070	4000
Spur	4420	8200	3780	Tangent
Spur	8200	9280	1080	1000
Balloon loop	9280	9440	160	Tangent

* NCL chainage

4.5 Vertical alignment

The steepest grade adopted is nominally 1% between chainage 2700 and 4400 where there is a step down in natural surface levels of approximately 15m due to the railway traversing a steep natural escarpment. The subsequent profile of the track in this area requires significant earthworks or bridging. The vertical alignment has been conducted in order to balance removal of earth in any cuttings with the volume required for embankments.

4.6 Impacts on existing infrastructure

The proposed alignment is anticipated to have the following impacts upon the existing infrastructure in the area:

- Land Parcels – The proposed alignment crosses 20 land parcels as defined on the cadastral boundary;
- Existing roads – The proposed alignment crosses approximately 21 roads of different sizes. As much as possible, the proposed vertical alignment of the railway attempts to match the existing natural surface level in an attempt to minimise the

earthworks at these crossings. No studies have been conducted to try and determine whether any of the roads can be permanently closed.

- Waterways – The proposed alignment crosses 4 waterways. These would require local diversion works

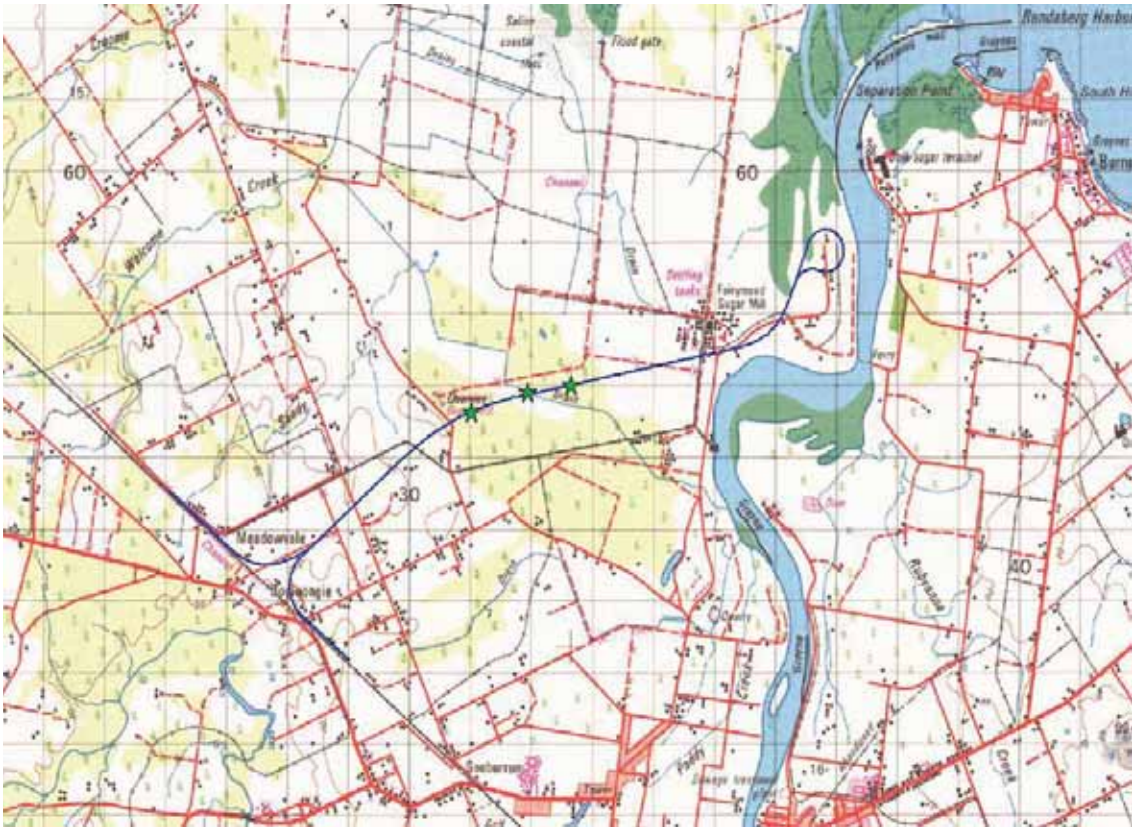
These impacts are examined in further detail, with recommended infrastructure modifications in section 5.3.

4.7 Hydrology

4.7.1 Local Flooding

The proposed railway alignment crosses a number of local flowpaths. It is recommended that cross drainage infrastructure be sized to cater for 100 year ARI design flows in these locations so that there is no increase in upstream flood levels or downstream erosion issues caused by high outlet velocities. The cross drainage infrastructure is also required to maintain the interconnectivity and environmental integrity of low-lying marshy areas. At minimum, cross drainage infrastructure should be placed in the locations indicated on Figure 6.

Figure 6 Potential locations for local cross drainage infrastructure



4.7.2 Regional Flooding

The proposed railway alignment lies within the Burnett River 100 year ARI design event flood inundation extent. Based on our understanding of the flooding dynamics associated with this event, the railway has the potential to increase upstream flood levels (afflux) and adversely impact development within the North Bundaberg floodplain.

In order to determine the level and extent of afflux caused by the alignment and to assess regional flood mitigation measures (e.g. cross drainage), it is recommended that a two-dimensional flood model of the Burnett River floodplain be developed. It is noted that GHD have previously developed a two-dimensional flood model of the Burnett River for Bundaberg City Council and that this model could be modified for this purpose.

4.8 Other Key issues

In the area of the link alignments that connect to the existing NCL the radii of the track is shown at R = 550 m such that trains entering or departing the existing railway can potentially do so at V = 80 kph. However, where the northern link ties in to the existing railway there is an existing occupation crossing (approximate kilometrage 355.277 km). In order to avoid such clash with this crossing it may be necessary to reduce the radius of the link alignment subsequently dropping the potential line speed. However, in adjusting the geometry of this alignment additional land may be required in the triangle area enclosed between the two link alignments.

In the area where the southern link ties in to the existing railway there is an existing open level crossing at Booloongie Road (approximate kilometrage 358.422 km). This is a significant level crossing with active protection. Further studies would be required to determine the impact of the proposed link alignment upon the configuration of the protection as well as to understand the risk associated with the proposed railway.

4.9 Conclusion

This technical desktop evaluation process has resulted in the identification of a freight rail corridor.

Drawings 21-17948-C001 to 21-17948-C09 are given in Appendix D and detail the proposed rail alignment based upon the initial corridor options highlighted in the above sections of the report. The drawings indicate three alignment strings being the northern and southern connections to the existing North Coast Line (NCL) and the main alignment of the rail link. The resulting rail corridor is also shown in Figure 5.

A detailed analysis anticipating the use of the road and cane tramway networks around the preferred alignment has been completed and is provided in Appendix F. It shows that the traffic and transportation infrastructure does not adversely affect the rail alignment.

5. Impact Assessment

5.1 Environmental Impact Assessment (IAR)

The full impact assessment phase was not undertaken. An Environmental Terms of Reference was prepared, however, and is given for possible future consideration in Appendix E.

5.2 Community Consultation

There was no community consultation undertaken as part of the project.

5.3 Traffic and Transport Infrastructure Impact Assessment

A traffic and transportation infrastructure assessment was conducted to assess the impact on existing traffic and transport infrastructure caused by the preferred alignment of the Bundaberg Port Rail Link. This report can be found in Appendix F, with pertinent findings summarised below.

5.3.1 Summary

To minimise impact to existing infrastructure, there are a number of modifications recommended to existing road and cane rail infrastructure together with underbridge crossings of the proposed railway. These are summarised below, and are also shown for completeness on the rail alignment drawings in Appendix D.

Generally, the proposed rail link to the Port of Bundaberg will not adversely affect the traffic flow on the road and cane rail network.

5.3.2 Infrastructure Requirements

All proposed works are to be constructed as part of the proposed rail link construction. These works include the following:

- CH:50 - Provide a track underpass under both proposed rail link lines
- CH:1400 - Provide a signal control level crossing at Moore Park Road
- CH: 2300 - Provide an appropriate cane rail / road crossing for the extension of Hoods Road
- CH: 2600 - Realign cane rail and provide a culvert crossing under proposed rail link at approximate CH:2900
- CH: 3300 – Close Gooburrum Road and extend Hoods Road to intersect with Gooburrum Road north of the proposed rail link
- CH:4250 – Provide a passive level control crossing for the farming track
- CH:4750 – Provide a culvert crossing under the proposed rail link for the farming tracks

- CH:6050 – Provide a culvert crossing under the proposed rail link for the farming tracks
- CH:6750 – Provide a culvert crossing under the proposed rail link for the farming tracks and realign the 5-ways intersection
- CH:7050 - Provide a culvert crossing under the proposed rail link for the irrigation channel
- CH: 7550 – Provide a culvert crossing under the proposed rail link for the cane rail
- CH: 7750 – Realign ramp Fairymead Road to proposed rail link to provide a signal controlled level crossing
- CH:7800 - Close Mills Road
- CH:8100 - Realign River Road from Fairymead Road to the south of the proposed rail link
- CH:8900 - Provide a culvert crossing under the proposed rail link and extend the cane rail under the proposed rail link to allow access to the shunting and carting facility via River Road
- CH:11400 - Realign Gahans Road around to the east of the proposed rail link

6. Order of Cost for Required Infrastructure

An order of cost of construction of the railway and associated infrastructure has been estimated. These costs are indicative only, do not account for future escalation and should not be used for budgetary purposes. The prices are based on 2009 dollars and have been derived without a detailed design.

A spreadsheet containing the calculation of the order of cost estimate can be found in Appendix G.

Table 5 Order of Cost Estimate

Cost Items	Quantity	Cost Estimate
Railway		
Track		$12,100,000
Capping		$7,300,000
Drainage		$3,600,000
Fencing		$600,000
Earthworks		$20,800,000
Underpass and culvert crossings[1]		$3,300,000
Road and cane rail realignment[1]		$3,600,000
Level crossings active	3	$2,600,000
Level crossings passive	1	$200,000
Subtotal		$54,100,000
Contingency	30%	$16,200,000
Total		$70,300,000

[1] Further detail is given in the Traffic and Transport Study found in Appendix F.

In considering options at the port the study team developed some orders of cost for a number of solutions, including the cost for construction of a new berth on the north (west) bank, and the associated materials handling equipment.

Table 6 Order of Cost Estimate

Option	Cost
North bank berth[2]	$42 M
Materials handling	$82 M

[2] This value is given in the Order of Cost Estimate found in Appendix G.

7. Conclusions

A preferred alignment and corridor for a rail link to the Port of Bundaberg has been defined.

A preliminary design has been prepared and is given in Appendix D.

There is no current economic justification for constructing the link.

Should a future need arise for the corridor to be identified in the local government planning scheme, there are a number of activities that would be required.

For reference, and for possible future consideration, these activities are broadly summarised here.

Impact Assessment Report

- Conduct Environmental Impact Assessment (The proposed Terms of Reference are given in Appendix E)
- Comply with the provisions of the Community Infrastructure Designation process

Community and Stakeholder Engagement

- Distribution of the first Study Update to stakeholders in the vicinity of the proposed corridor and to identified community groups and organisations
- Advertisements in the Bundaberg NewsMail to promote the upcoming community information sessions and to invite submissions for the Community Reference Group
- Meetings with directly affected landowners
- Establishment of a Community Reference Group which will continue into the Impact Assessment phase and
- Facilitation of Community Information Sessions where community members can ‘drop in’ over a four hour period to view the report and ask questions of the Study Team

Document Final Preferred Corridor

- Action any alignment amendments following Phase 2 processes
- Prepare and issue Final Corridor Report