2. Description of the project

2.1 Summary of comments

A summary of the comments received during the JRYUP EIS consultation process in relation to the description of the project are outlined below.

- More detailed identification of the quantity of new railway crossings, their location and design for Elizabeth and Willy Creeks.
- Specific details on the method of clearing.
- Clarifying the chosen option to move large volumes of fill from north of Elizabeth Creek to south of Willy Creek.
- Volumes of water to be used for the JRYUP to be specified.
- Identifying the options available to minimise the clearing of riparian vegetation and minimise disruption to the creek channel.
- Stormwater management system required.
- Identifying the chosen location for the JRYUP to traverse Elizabeth Creek with detailed maps/diagrams showing the position of bridges, vegetation to be cleared and revegetation areas involved.
- Further details on proposed operation of Pollution Treatment Plant.

A more detailed summary of the comments provided during the JRYUP EIS consultation process is included in Appendix A. The SEIS response and/or report reference location are also included in Appendix A.

2.2 Proposed method of crossing Willy and Elizabeth Creeks

2.2.1 Background

Willy and Elizabeth Creeks both cross the proposed rail alignments for the JRYUP. The catchments for these creeks include vegetated areas and land used for farming sugar cane.

The creeks are subject to a number of existing impediments upstream of the site, including culvert structures across:

- Bruce Highway
- North Coast Rail Line
- Goonyella Rail Line

These structures restrict the conveyance of flood waters and thus provide attenuation of flow into the Jilalan site.

Both creeks cross Gurnetts Road at a culvert and invert arrangement. The culvert cells for each crossing are twin 600 RCP. Capacity of the existing culverts is limited below a 1 year ARI. Although the confluence of the two creeks is located approximately 250 m downstream of Gurnetts Road, the 100 year ARI design event approaches the road as a single flood body (ie the creeks operate as a single floodway for large events).

2.2.2 Hydrologic and hydraulic modelling

The hydrologic assessment of flows was undertaken using a RORB model of the Willy Creek and Elizabeth Creek catchments. There are no stream gauges on these catchments and the models were not able to be calibrated to historic events. Model parameters were therefore based on the recommendations contained in Australian Rainfall and Runoff (ARR 87).

Initial hydraulic modelling was undertaken using the US Army Corps of Engineers HEC-RAS model, in a steady-state mode. This model limited the ability to assess the impacts of attenuation due to upstream Goonyella Rail Line structures and the assessment of interrelated flow characteristics between the two streams.

A quasi-2D model was then developed using the Danish Hydraulic Institute's MIKE-11 model. This was developed and run in an unsteady mode to incorporate the attenuation and diversion of flows, upstream of the existing yard. The resultant attenuation has been presented in Table 2.1 for Willy and Elizabeth Creeks.

Table 2.1 Peak discharge at the existing Goonyella Rail Line

Creek	Peak Discharge Upstream (m^3/s)	Peak Discharge Downstream (m^3/s)	Decrease in Peak Discharge (%)
Elizabeth	72	52	27
Willy	156	128	18

Table 2.1 illustrates that existing culverts provide a significant degree of attenuation. The model does not include additional attenuation upstream of the site at the North Coast Line and Bruce Highway. The flows adopted for this model should therefore be considered conservative as they are greater than the expected flows.

2.2.3 Crossing requirements

At the time of issue of the EIS, the proposed method of crossing the two creeks had not been determined and a number of potential options were included. The proposed method of crossing the creeks has now been determined and is detailed in Section 2.2.4 and SK-G-000-120-0017 (refer Appendix B).

In assessing the method of crossing the creeks, a number of factors were considered, including:

- Rail operations
- Rail maintenance
- Safety
- Environmental factors
- Constructability and procurement

From a rail operations maintenance and safety perspective, the preference is for culvert structures. Culvert structures result in a surface profile that is similar to the rail embankment on each side of the crossing. Vehicles and pedestrian movements can be achieved with no interruptions or safety impediments.

From an environmental perspective, bridges (or similar) structures are the preferred crossing method. These provide maximum opportunities for fauna and fish passage and minimise disruption to the creek invert and adjacent corridor. These structures also provide more opportunities for natural light to pass under the crossing. However due to the skew of Elizabeth Creek to the rail alignment, combined with a limitation of 25 m in total bridge span will result in numerous steps in the creek embankment at bridge abutments, which have the potential to create eddy velocities in excess of the main channel velocities, therefore requiring protection of the embankment and creek invert. In stream protection measures are likely to involve the installation of concrete erosion protection structures (refer Section 2.2.4).

Bridges, however, provide the greatest obstacle to construction. The procurement of pre-cast bridge components is made extremely difficult due to the numerous other projects competing for the same resources. The project programme and procurement timeframes result in a need to reduce the amount of precast bridge components used on the Project.

2.2.4 The proposed crossings

The proposed temporary and permanent crossings for Elizabeth and Willy Creeks are shown in plan in Appendix B (refer SK-G-000-120-0017).

In addressing the proposed crossings, QR has made concessions to the operation of the yard in order to minimise the impact of the crossings on the creek system. The length of tracks extending from the southern side of the wagon maintenance facility has been shortened to reduce the number of wagon maintenance tracks crossing Willy Creek from five to one. The total five wagon maintenance tracks are still required to cross Elizabeth Creek.

The number of holding tracks, to be constructed across Willy and Elizabeth Creeks has been reduced from three to two.

The bypass and provisioning tracks (four total) will still require crossings at both creeks, however the spacing between these tracks has been reduced. This will reduced the impact of these structures on the waterway.

The rail crossings of Elizabeth Creek will consist of 2 x 1,800 mm diameter reinforced concrete pipes (refer Appendix B, SK-S-020-400-4016), which will accommodate the runoff from the 1 to 2 year ARI design storm event. The pipes will be located along the alignment of the existing creek invert.

Bridge structures were considered for Elizabeth Creek; however these were discarded on several grounds, including:

- Reduction of operational continuity.
- Safety implications with pedestrian and vehicle movements on the bridge approaches, particularly given the number of tracks at this crossing.
- Environmental considerations due to the skew of the creek to the rail alignment. This skew, combined with a 25 m limitation in total bridge span, will result in numerous steps in the creek embankment at the bridge abutments. These steps have the potential to create eddy velocities, well in excess of the main channel velocity. The protection of the embankment and creek invert due to these velocities would likely involve the installation of concrete erosion protection measures, which would tend to negate the benefits of maintaining the existing waterway.

Flows in excess of the culvert capacity will be conveyed overland to Willy Creek. This flow occurs in the existing case (ie prior to the proposed development); however the development will result in an increase to this bypass flow. Peak discharges and velocities estimated for the existing and proposed scenarios at this point are listed in Table 2.2.

Table 2.2 Hydraulic summary of Elizabeth Creek culvert area

Scenario	Approaching Culvert		Diverted to Willy Creek		Continuing through Elizabeth Creek	
	Peak Discharge (m^3/s)	Peak Velocity (m/s)	Peak Discharge (m^3/s)	Peak Velocity (m/s)	Peak Discharge (m^3/s)	Peak Velocity (m/s)
Existing	52	1.7	7	0.5	45	2.2
Proposed	52	1.7	33	0.9	18	0.9

Under the design event, the flow in the pipe culverts will result in pipe velocities of approximately 3.5 to 4 m/s. This will be mitigated at the outlet of the culverts by the formation of an hydraulic jump. The area will be further stabilised with appropriate rock protection. Hydraulic analysis indicates that stream velocities will return to the existing case, immediately downstream of the culvert.

The overland flow bypassing the Elizabeth Creek culvert will flow at approximately 0.9 m/s under the 100 year ARI design event. It is intended to provide a number of "pools" as fish respite areas. These pools will also serve to provide habitat for fish trapped between overflow events. It is acknowledged that these pools may run dry during extended periods of low rainfall, however it is also understood that this is reflective of natural overflow situations. The overland flowpath will be vegetated with species which complement the surrounding fauna corridors.

The bypass flow will discharge into Willy Creek, downstream of the existing yard and upstream of the proposed rail. The rail crossings across Willy Creek are proposed as bridge structures (refer Appendix B, SK-S-010-400-4003, 4004, 4013 and 4014). The exact configuration of the bridges will be the subject of detailed modelling and design; however the spans will be sized to avoid impacting on the existing creek invert. To this measure arched structures have been discounted. Analysis to date has indicated that the lesser sectional area of an arch (relative to bridge of similar span) increase peak velocities to an unacceptable level and would subsequently require excessive scour protection. Further design will also reduce the velocities through the structures to values which are manageable with rock protection. Bridge components will be optimised to suit the earliest delivery of pre-cast components.

Preliminary model results indicate that a peak velocity of approximately 2.3 m/s can be achieved through the bridge structures. This occurs within a hydraulic jump, immediately downstream of the bridge structures. The hydraulic jump is in the order of 0.3 m high and is drowned shortly downstream, where existing velocities of 1.5 m/s are generally maintained.

Preliminary model results also indicate that afflux at the downstream end of the site is expected to be in the order of 0.05 m. This will be confirmed during detailed design.

Flow characteristics of Willy Creek for the pre and post developed scenarios have been presented in Table 2.3.

Table 2.3 Flow characteristics of Willy Creek (between the Goonyella Rail Line and Gurnetts Road)

	Peak Discharge (m^3/s)	Peak Velocity (m/s)
Existing	154	1.8
Proposed	168	2.3

Hydraulic analysis of existing flood patterns to date has determined that the capacity of each creek in this area is exceeded by the design discharge. As a result, flood flows approaching Gurnetts Road present as a single flood body.

The developed scenario exhibits similar behaviour despite the diversion from Elizabeth Creek to Willy Creek. Immediately downstream of the proposed bridge crossings, peak flood levels exceed Willy Creek bank by and around 450 mm. This flow floods from the Willy Creek channel towards and into Elizabeth Creek. The resulting flood pattern is similar to that of the existing condition.

Due to the similar flow patterns immediately upstream of Gurnetts Road, flow crosses the road and is distributed into the downstream creek channels similarly to that in the existing scenario.

The negligible variation in flood patterns between the pre and post developed scenarios can be attributed to the minimal variation in peak discharges presenting to Gurnetts Road.

Flood characteristics immediately upstream of Gurnetts Road have been presented in Table 2.4.

Table 2.4 Flood characteristics immediately upstream of Gurnetts Road

	Peak Discharge (m^3/s)	Peak Velocity (m/s)	Peak Flood Level (mAHD)	Afflux (mm)
Pre Development	193	0.8	11.20	N/A
Post Development	183	0.77	11.19	-10

Table Note:
This flow is occurring as a single body of water

Table 2.4 illustrates that the peak discharge for the developed scenario is less than the developed scenario. This can be attributed to the Elizabeth Creek works where flow travel times for the diverted and culvert portions of flow are increased and decreased respectively.

In addition to the proposed rail crossings a number of temporary road crossings will be required to service construction vehicle movements. These vehicles will include large haulage vehicles as well as small road legal vehicles. For safety reasons these vehicle movements are required to be separated and individual crossings are proposed accordingly (refer SK-G-000-12-0017).

2.3 Method of clearing

General clearing of vegetation will be undertaken with dozers. Material will be pushed into piles and chipped or mulched for use on revegetated areas of the site. Clearing of timber from within the creek systems will be undertaken by chainsaw and excavators. Timber from the creeks will be disposed in the same way as timber from general clearing.

2.4 Road and rail drainage

Where possible, discharges into the creek systems will be located adjacent to proposed crossing structures. The scour protection at these structures will be utilised to minimise erosion from the discharging water. This will minimise the need for additional scour protection. Where water is required to discharge into the creeks and is not able to be co-located with structure scour protection, additional rock protection will be provided at these locations. Large quantities of rock can be sourced from the site and will be sized to accommodate the expected velocities. Details of the quantity, size and depth of rock protection will be determined during detailed design.

2.5 Operational stormwater management

All stormwater generated on the site will be separated depending on the location in which it is generated. All process areas, including the internal areas within the shed will be directed to the pollution plant. Apron areas adjacent to these process areas will be fitted with a first flush diversion system to re-direct the first 25 mm of rainfall to the pollution plant. Surplus water from the roofs will be directed into rainwater tanks for re-use, with surplus water and flows from all other areas directed to stormwater channels running through the site.

2.6 Pollution treatment plant

A proposed pollution treatment plant will be designed and operated in conjunction with the existing pollution treatment system. Both plants will be connected by a rising main to provide a level of redundancy in the event of plant failure. Wastewater treated in the proposed pollution plant will be to Class-A+ standard, suitable for reuse as process wash water, toilet flushing and irrigation.

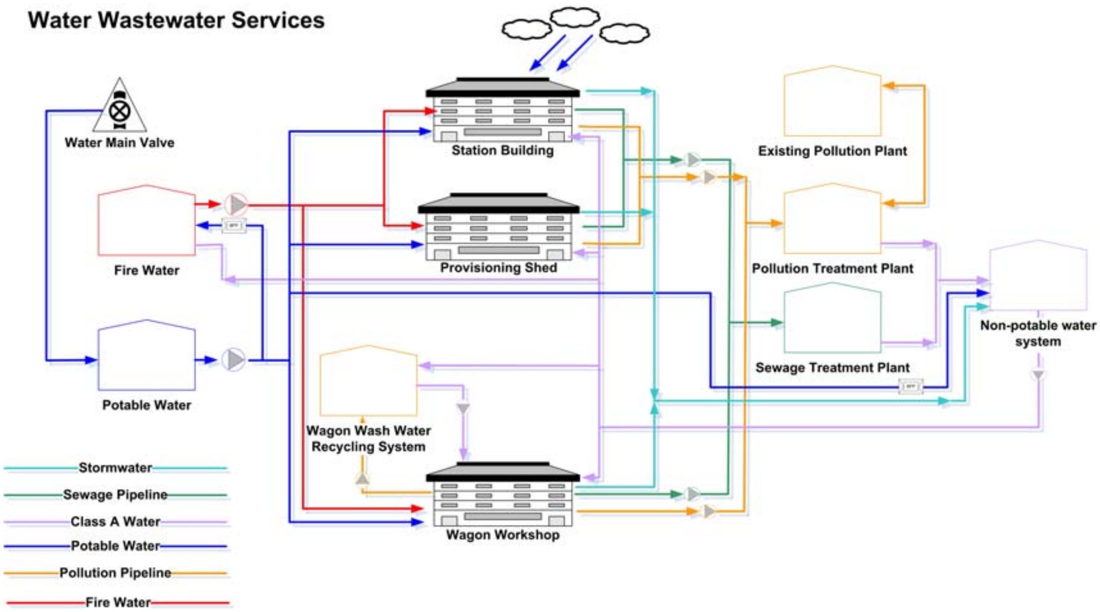
Wastewater generated from the existing facilities and treated in the existing pollution treatment plant will not change, with flows treated and discharged to Elizabeth Creek.

Queensland Rail has an agreement in place with the EPA to upgrade their existing pollution treatment plant to ensure compliance with the current license conditions.

The proposed pollution treatment plant will receive and treat wastewater from:

- Wagon maintenance facility
- Wagon wash bays (wagon wash water will be recycled via a dedicated water recycling system (closed system). Overflows from this system will be directed to the proposed pollution treatment plant)
- Provisioning shed
- Existing pollution treatment plant if the existing plant is out of service

The following flow diagram details the proposed "operational" pollution treatment plant.



The plant specification will be based on the existing pollution treatment plant influent, which is typically high in suspended solids, copper and hydrocarbons (including oil and grease). Table 2.5 outlines the design criteria for the proposed pollution treatment plant.

Table 2.5 Proposed pollution treatment plant's design capacity

Treatment process	Pollutant
Primary settling	Coarse suspended solids
Oil/grease/water separation	Oils/grease and hydrocarbons
Chemical dosing for pH correction	Metals precipitation (including copper)
Chemical dosing for oxidation	Hydrocarbon and grease
Chemical dosing for flocculation	Fine suspended solids, metals and hydrocarbons
Secondary settling/dissolved air flotation	Fine suspended solids, metals and hydrocarbons
Filtration	Fine suspended solids
Disinfection	Pathogens

The proposed pollution treatment plant will be designed to treat wastewater to Class A+ for effluent reuse for operational purposes. The release characteristics outlined in Table 2.6 are in line with the existing environmental authority, which will be maintained with the installation of the proposed plant. These release limits are consistent with the existing and upgraded Development Application Licence Conditions (EPA Licence No. NM0029, Queensland Rail).

Table 2.6 Release quality characteristic limits

Quality characteristics	Release limit
BOD_5	20 mg/L
Suspended solids	30 mg/L
pH	6.5 - 8.5
Dissolved oxygen	> 2 mg/L
Anionic surfactants	1.0 mg/L
Oil and grease	10 mg/L
Total Copper	0.1 mg/L
Free residual chlorine	0.3 - 0.7 mg/L
Turbidity	< 2 (95%ile); 5 (maximum) NTU
TDS	< 1000 mg/L

The existing environmental licence conditions will be amended and consolidated to accommodate the proposed pollution treatment plant. It is not intended that effluent from the proposed pollution treatment plant will be discharged to creeks and/or aquatic ecosystems. A storage facility for effluent reuse within the site will be constructed for the storage of treated effluent, which will be separate to the clean water storage from roof water collection.

2.7 Operational sewage treatment plant

The existing sewage treatment plant will continue to operate and service the site. New buildings will be serviced by a proposed wastewater treatment plant of similar design with final effluent treated to Class-A+ standard, suitable for process wash water, toilet flushing and irrigation purposes. Wastewater generated by the existing facilities and treated in the existing wastewater treatment plant will not change, with flows treated and discharged to Elizabeth Creek.

2.8 Capability of Armstrong Beach Road

A dilapidation assessment of Armstrong Beach Road pavement will be undertaken prior to commencement of construction. Depending on the outcome of this assessment, the Project may undertake the following or other appropriate measures:

- Rehabilitate the existing pavement
- Provide an asphalt overlay over the existing pavement
- Nothing (if the pavement will not be adversely impacted by the construction traffic)

Based on the recommendations of the dilapidation assessment, these measures may be undertaken prior to, during or following the project construction.

2.9 Potential downstream impacts of Willy and Elizabeth Creeks

Coal Stream Alliance is in the process of finalising a MIKE 11 model of the Willy and Elizabeth Creeks system to confirm existing and developed case hydraulic behaviour. MIKE 11 is considered an appropriate tool for this purpose, because of its ability to account for divergent and convergent flows and to operate with unsteady flow conditions and flow attenuation.

While the confluence of Willy and Elizabeth Creeks occurs downstream of Gurnetts Road, under the design event (ie 100 year ARI) preliminary modelling indicates that the flows converge upstream of Gurnetts Road.

The final model results obtained during detailed design will be used to confirm this behaviour under the developed condition and will enable the assessment of potential impacts to downstream properties.

Table 2.4 indicates that impacts of the development wil result in lower flood levels.

2.10 Rolling time delays

The delays at the Oonooie Road level crossing due to roll-by inspections will be eliminated by constructing a grade separated road overpass.

Delays at the Smyths Road crossing will be similarly eliminated by a grade separated road underpass.

All other occupational crossings throughout the extent of the site will be removed. Due to changes to land ownership, these crossings are no longer required.

Based on the above, delays to the road networks due to rail traffic are negated.

2.11 Potential construction traffic impacts

A dilapidation assessment of roads adjacent to the site will be undertaken prior to commencement of construction. Where additional damage is shown to be directly attributable to construction traffic, appropriate repairs will be made.

2.12 Local road upgrades

2.12.1 Gurnetts Road

A haul road will be constructed within the project area for use by construction traffic. It is not intended that construction traffic will routinely use Gurnetts Road. It is therefore not intended to seal Gurnetts Road, beyond the proposed access to the site or to Soto Road, whichever is greater.

2.12.2 Smyths Road

Sealing of Smyths Road between Plane Creek and the existing railway could be undertaken. Further discussions will be carried out with Council’s Director of Works and Services to ascertain if this will increase Council’s maintenance liability following cleanup after flood events.

It is not intended that the existing Plane Creek causeway will be used for construction traffic. It is therefore not intended to upgrade the crossing from one to two lanes.

Smyths Road will be sealed for the length of the ramp down from Armstrong Beach Road.

2.12.3 Oonooie Road

The new section of Oonooie Road will be sealed for its entire length, including the intersection with Gurnetts Road.

2.12.4 Summary

The roads to be modified (ie relocated, upgraded or deleted) as part of this Project are:

- Oonooie Road
- Armstrong Beach Road
- Gurnetts Road

- Smyths Road
- Soto Road

2.13 Construction water demand

It is expected that the peak daily construction water demand (typically including water for compaction and dust suppression) will be in the order of 2 – 2.5 ML/d, during the bulk earthworks phase of the project. This demand equates to an approximate total (for earthworks) of 692 ML, for the project duration. A spreadsheet of the estimated construction water demand is included as Appendix C. Note that this spreadsheet does not include the potable water demand required for the accommodation village and site office.

The maximum daily quantity required for the proposed accommodation village and site office is estimated to be 75 kL/d. This is based on an estimated demand of approximately 200 L/person/d for the accommodation village and 40 L/person/d for the site office. The peak construction workforce is estimated to be 300 personnel. Based on this workforce estimate, the estimated total potable water demand equates to 28 ML, for the project duration. Potable water will be sourced from the existing town supply (water main) in Armstrong Beach Road.

Therefore, the total estimated construction water demand (earthworks plus potable) is approximately 720 ML for the Project during construction. This quantity does not take into account the reuse of treated effluent from the proposed WWTP and effluent irrigation system, which equates to an approximate saving of 75 kL/d. Furthermore, the Project may also augment and supplement the construction water demand from other sources, including sediment and existing pollution treatment plant storages. The quantity of water from these additional sources is however unlikely to contribute significantly to the amount of construction water required.

It is anticipated that the bulk of construction water supply will be from groundwater (excluding potable water sourced from the town water supply). There are two existing bores in the project area (81402 and 20774), both of which, in their current configuration are unlikely to satisfy the required demand for construction water.

In line with project commitments to minimise impact, investigations are currently underway to determine if a redevelopment of these bores is feasible (increasing depth and diameter to improve yield) as this is seen as the lowest impact option. To supplement this supply the Project is also considering entering into agreement with owners of bores on adjacent properties to supply part of the project water demands. Should these options prove insufficient, then new bores will be developed (possibly three to four locations) spaced along the length of the Project. It is recognised that there are permitting issues associated with developing new bores and they would be addressed (if required) once the investigation has been completed.

The existing potable water demand on the site is approximately 30 kL/d. It is proposed that the Project will harvest rainwater for various functions and reuse site water for washdown activities. This will provide a net reduction to the future operational water demand on the potable supply to 25 kL/d.