AURIZON NETWORK

FY20 Capital Expenditure Report

31 July 2020

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1.0 Executive Summary

The Queensland Competition Authority (**QCA**) has approved a Regulatory Asset Base (**RAB**) for the Central Queensland Coal Network (**CQCN**). The 2017 Access Undertaking (**UT5**) outlines the process to seek QCA approval of any additions to the RAB. This approval process involves the annual assessment of Aurizon Network's Capital Expenditure submission in accordance with Schedule E of UT5.

In the financial year 1 July 2019 to 30 June 2020 (**FY20**), Aurizon Network commissioned capital projects representing a total investment of **$236,195,183** excluding Interest During Construction (**IDC**), (**$238,215,220** including IDC). This value encompasses **40** projects across the CQCN, details of which are outlined in *Appendix A: Capital Expenditure Project List*.

This report details Aurizon Network's submission for capital expenditure to be assessed and accepted by the QCA into the RAB in accordance with clause 2 of Schedule E of UT5.

The purpose of this submission is to provide evidence to support the QCA's assessment of whether the capital expenditure is prudent and efficient in accordance with clause 2 of Schedule E of UT5, and in particular, to provide clarity about the circumstances relevant at the time of making the decision to incur the capital expenditure.

2.0 Delineating Between Capital and Operating Expenditure

For the purposes of delineating between capital expenditure and operating expenditure, the criteria applied by Aurizon Network to define scope of works as capital expenditure is in accordance with Australian Accounting Standard AASB 116 Property, Plant and Equipment.

Those costs which have been categorised as capital expenditure for work commissioned in FY20 are contained within this submission for inclusion in the RAB. For the purpose of this claim, commissioned assets refer to assets that have been installed and were ready for use on or before 30 June 2020.

3.0 Investment Framework

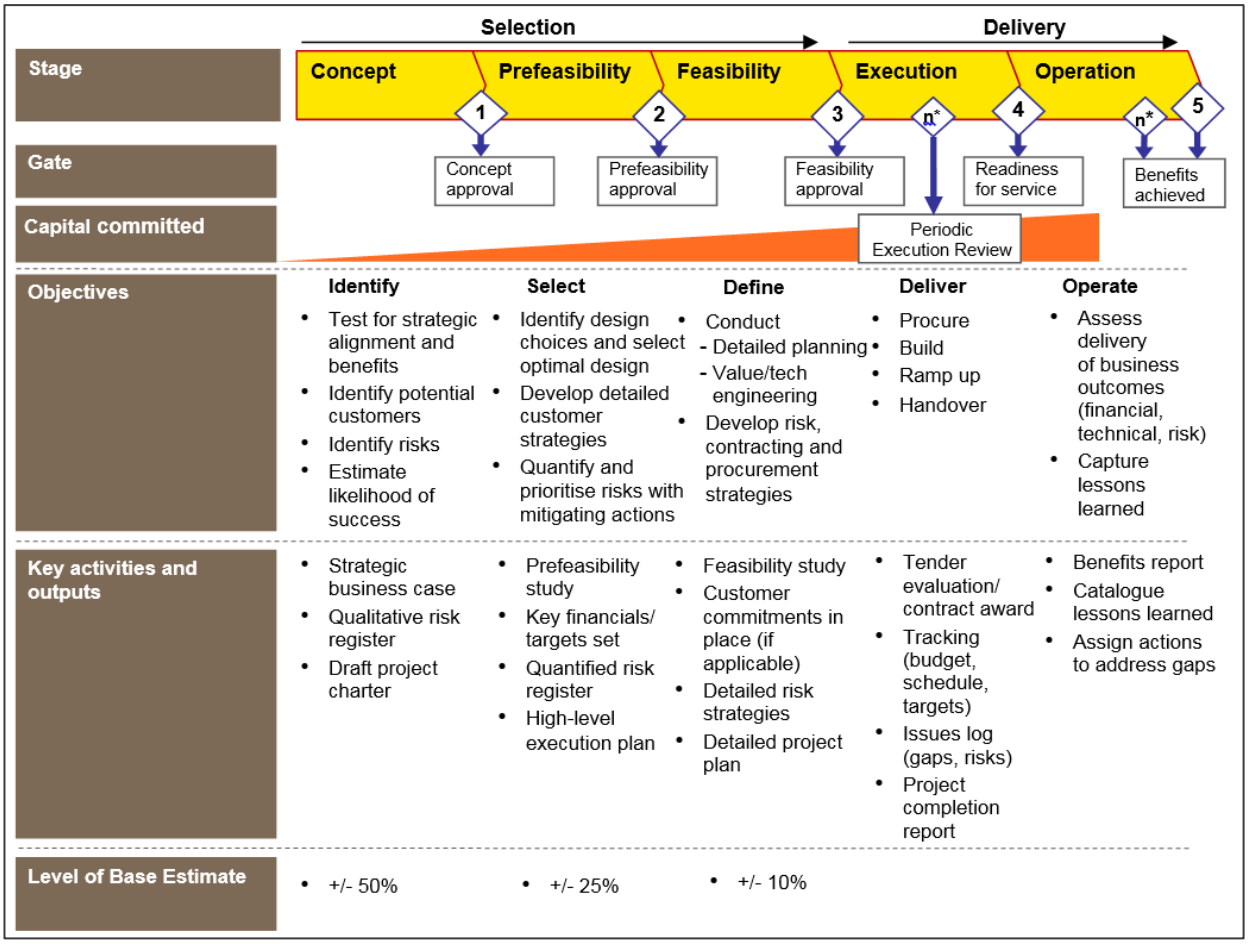
Aurizon Network follows a rigorous approval process prior to the commitment of capital investments. This process is governed by the Aurizon Investment Framework (**Framework**). The purpose of the Framework is to facilitate sound investment decisions and to ensure that:

- Investments have a high degree of success;
- Investment decisions are made on a consistent basis;
- Capital is optimised; and
- Learnings from past investments are recorded and taken into consideration as part of Aurizon Network's commitment to continuous improvement.

The Framework is informed by the requirements of UT5 by promoting prudency and efficiency of scope, standard and cost for capital expenditure. *Figure 1* provides an overview of the capital investment stage gates that Aurizon Network utilises for its capital projects.

The structure of Aurizon Network's Framework provides a robust methodology for assessing the potential scope of projects presented for investment approvals and ensures the costs which are then committed to the projects are viable. This framework aids in the delivery of sufficient supporting evidence to determine the prudency and efficiency of the capital expenditure in accordance with clause 2 of Schedule E of UT5.

Figure 1. Capital Investment Stage Gates



Typically, Aurizon Network's capital expenditure submissions contain projects that relate to three general project categories (**Discipline Types**). *Table 1* below provides an overview of these Discipline Types.

Table 1. Capital Project Discipline Types

Discipline Type	Characteristics	Approval Process
Sustaining - Includes projects which relate to the renewal or replacement of infrastructure assets within specified disciplines.	> Strategically aligned > Routine/cyclical > Typically, non-discretionary i.e. to comply with safety, regulatory standards > Necessary to maintain existing operations and returns of the business	> Because of the ongoing and repeatable nature of Sustaining capital investments, a simplified version of the Capital Investment Stage Gate process is applied.
Growth - Includes projects that add capacity to the existing network through expansion or augmentation.	> Strategically aligned > Increase network capacity > Typically, medium to long lead time to execute and complete (> 12 months)	> Capital Investment Stage Gate Process
Transformation - Includes projects which do not fall within the Sustaining or Growth categories, and which often involve projects to improve operational efficiency and environmental or sustainability programs.	> Strategically aligned > Typically drive incremental returns and/or productivity improvement > Typically, medium to long lead time to execute and complete (> 12 months)	> Capital Investment Stage Gate Process

For the FY20 capital claim, no Transformation or Growth capital investments were commissioned and accordingly all projects within this submission are defined as Sustaining capital investments.

3.1 Sustaining Capital Investments

Given Sustaining capital investments are typically ongoing, repeatable programs of work, a simplified version of the Capital Investment Stage Gate process is followed, subject to the project's value, level of risk and complexity.

In order to avoid unnecessary administrative complexity and to streamline the approval process, routine Sustaining capital investments which meet the feasibility stage objectives (as outlined in *Figure 1* above) are not required to go through the full Capital Investment Stage Gate process. Instead, they can proceed straight to the feasibility stage gate and a simplified Investment Approval Request (**IAR**) will be submitted to the Chief Financial Officer, Chief Executive Officer and the Aurizon Investment Committee (**AIC)** for annual review and endorsement. Although the IAR is simpler, it still provides for an appropriate review of the proposed scope, standard and cost. Sustaining capital investments that are not classified as routine follow the Capital Investment Stage Gate process and require a more detailed IAR.

In certain instances, smaller independently managed projects of an immaterial nature which may be unrelated may be combined within a single IAR for ease of administration.

3.2 Sustaining Program Approval

A program is a collection of capital investment projects managed in a coordinated way in order to optimise the achievement of the program's objectives and provide benefits not available from managing the projects individually. Where an investment project forms part of a larger program, the program of work for all the underlying projects is submitted together to:

- enable review and approval at the appropriate holistic level, rather than in separate pieces;
- create scale benefits; and
- allow investment optimisation to occur prior to external commitments being made.

3.3 Multi-Year Sustaining Project / Program Approval

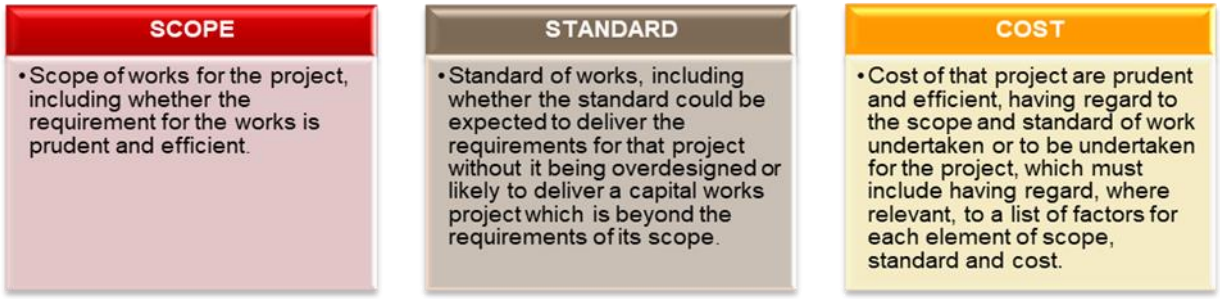
Certain Sustaining capital projects/programs benefit from better supply chain management, logistic planning and efficiency in execution when scoped as a multi-year project/program. An example would be the Structures Renewal program whereby a better rate may be negotiated with suppliers with the provision of a long-term order. For each year of the project/program, updated forecasts of cashflows are provided and submitted annually for approval in line with the Framework.

4.0 Regulatory Framework

Aurizon Network may provide the QCA with details of capital expenditure that Aurizon Network considers should be included in the RAB with sufficient supporting evidence to determine the prudency and efficiency of the capital expenditure in accordance with clause 2 of Schedule E of UT5.

The QCA must approve capital expenditure for inclusion into the RAB if that capital expenditure is for the prudent and efficient value of the assets that are used or intended to be used by Aurizon Network to provide the service taken to be declared under section 250(1)(a) of the Queensland Competition Authority Act 1997, namely *"the use of a coal system for providing transportation by rail".*

In determining the prudency and efficiency of capital expenditure, the QCA must have regard to the following:



The QCA must assess, in accordance with clause 2.2(b) of Schedule E of UT5, whether the capital expenditure is prudent and efficient and in doing so, must consider only the circumstances relevant at the time of making the decision to incur the capital expenditure (or in relation to assessing prudency of costs, at the time when the costs were incurred, or the capital expenditure project was undertaken, as applicable).

The FY20 Capital Expenditure Report provides the QCA with the details of capital expenditure that Aurizon Network considers should be included in the RAB in accordance with clause 2 of Schedule E of UT5.

Details of key supporting documentation available to support the prudency and efficiency in accordance with clause 2 of Schedule E of UT5 are outlined in *Section 5.0 Prudency and Efficiency*.

5.0 Prudency and Efficiency

This report demonstrates that Aurizon Network has sought to construct new infrastructure and undertake renewal works using existing rail standards developed by Aurizon Network or applicable Australian or industry standards.

Appendix A: Capital Expenditure Project List sets out the details for each of the FY20 capital expenditure projects. Supporting documentation is available for all 40 projects to demonstrate that the scope, standard and cost are prudent and efficient.

For each of the top 10 projects within this submission, Aurizon Network has provided 5 key documents in support of the capital expenditure claimed. For all other projects, Aurizon Network has provided a copy of the IAR. Aurizon Network requests that the QCA nor their appointed consultant publish these documents without the prior written consent of Aurizon Network.

The 5 key documents are as follows:

Scope

1. Investment Approval Request (IAR)

- Business Case for approval of the investment with a description and background
- Details forecast cost against historical costs

2. Project Management Plan

- Developed by the Project Manager responsible for the delivery of an approved project
- Identification and demonstration of the selection of scope for the project
- Details the proposed scope and standards to which the project is to be completed and the commissioning process.
- Details risk information

Standard

3. Asset Completion Certificates

- For each sub project within a renewal program a completion certificate will be provided (AKA: Inspection Test Plans (**ITP's**), Track Hand Back, Track Validation Certificate or Commissioning Certificates).
- These documents confirm that the sub project was built to the required standard and that the infrastructure renewed is fit for purpose

4. End of Year Status Report

- This report will identify the proposed scope at the start of the year, any scope changes and the final scope that was delivered

Cost

5. SAP Transaction Report

- The actual costs captured in SAP

Further information can be provided to the QCA and/or their consultant, if required, via a Request for Information (**RFI**).

6.0 Additional Information Available

6.1 Asset Management Plans

In determining the prudency and efficiency of Aurizon Network's capital expenditure, the QCA is required to have regard to the age and condition of existing assets and any Asset Management Plan which has been accepted by the QCA in accordance with clause 3 of Schedule E of UT5. Aurizon Network's Asset Maintenance and Sustaining Renewal Policy (**Policy**) was provided to the QCA as part of its UT5 investigation, which ultimately resulted in an approved Capital Indicator. The Policy clearly documents defined assumptions that sit behind plans for managing assets throughout the CQCN.

Aurizon Network's asset management documentation, including Condition Assessments and Prioritisation Models, further support the prudency and efficiency of the FY20 capital expenditure in accordance with clauses 2.2(b)(i)(D), 2.2(b)(ii)(D) and 2.2(b)(ii)(D) of Schedule E of UT5, where applicable.

6.2 Standards, Specifications and Policies

The QCA is required to have regard to the standard of works for the project, where relevant to Aurizon Network's design standards and relevant Australian design and construction standards, as detailed in clauses 2.2(b)(ii)(C) and (E) of Schedule E of UT5. In support of the QCA's decision, Aurizon Network's suite of standards, specifications and policies are available. This includes Aurizon Network's design standards arising from the Safety Management System.

The requirements contained in these documents are based on the relevant Australian Standard(s) and Aurizon Network's technical knowledge and experience. Any additional or non-standard requirements are outlined in project documentation such as Project Management Plans.

Aurizon Network's project completion processes include Project Commissioning Certificates (or similar) and Project Completion Reports to record that the specified standards were implemented. Where relevant, these are further supported by as-built drawings and quality management documentation including, Inspection and Test Plans, Track Validation Certifications, Practical Completion Certificates and photographs of completed works.

Further, these documents support Aurizon Network in meeting its legislative and tenure requirements, including those relating to rail safety, workplace health, safety and environmental requirements as required by clause 2.2(b)(i)(G) of Schedule E of UT5. In relation to this requirement, Aurizon Network has a fully integrated Safety, Health and Environment Management (**SHEM**) system that supports the management of incidents, hazards, near misses and safety interactions. This system and related documentation also support Aurizon Network's compliance with Laws and the requirements of Authorities, as required by clauses 2.2(b)(ii)(F) and 2.2(b)(iii)(E)(3) of Schedule E of UT5.

6.3 Interest During Construction (IDC)

The financing charges incurred by Aurizon Network during the creation of assets are capitalised into the RAB. Generally, this interest is capitalised where;

- expenditure has commenced on the capital project;
- the assets being delivered or renewed under the project are for Aurizon Network's use, and not for resale;
- there has been continuous construction or work on the project over the period (such that significant delays in construction, if any, are excluded); and
- there are actual financing costs in place with Aurizon Network's funding providers.

6.4 IDC Calculation Method

Aurizon Network's approach to calculating IDC is consistent with the methodology that has been approved by the QCA since 2010.

The regulatory model assumes that all capital expenditure is included in the RAB in the middle of the relevant financial year. IDC is therefore calculated up to and including the mid-point of the year in which the project was commissioned. For capital expenditure commissioned in FY20, the mid-point is 31 December 2019.

IDC is calculated using an S-curve methodology, whereby monthly cash flow values are multiplied by the applicable interest rate. The monthly cash flows for each project are extracted from Aurizon Network's financial accounting system (**SAP**). The applicable interest rate is the weighted average cost of capital (**WACC**) for the relevant year within the regulatory period.

Aurizon Network notes that the Report Date did not trigger during FY20 which ultimately means that Aurizon Network's WACC for the year remains at 5.9%. For the avoidance of doubt, Aurizon Network has applied the WACC of 5.9% for all IDC calculations within the FY20 Capital Expenditure Report.

7.0 Capital Project Discipline Types

As detailed in *Section 3.0 Investment Framework* all projects within this FY20 submission are classified as Sustaining capital investments. This includes projects which relate to the renewal or replacement of infrastructure assets within specified disciplines. These disciplines include civil, control systems and electrical.

In order to provide the safe and reliable operation of the CQCN, Aurizon Network undertakes the renewal of the assets used to deliver contractual obligations to access holders. Capital renewal projects are capital investment works that replace or upgrade life-expired infrastructure. Items are identified for renewal based on age, wear, condition and/or obsolescence. Given the extent of these works, they are generally undertaken and reported by project disciplines.

8.0 Capital Project Asset Types

8.1 Civil

Civil projects include those relating to rail formation, ballast, sleepers, rail, turnouts and structures. The details of these asset types are set out in *Table 2* below**.**

Table 2. Civil Projects by Asset Type

Asset Type	Description	Capital Expenditure (excluding IDC)
Rail	Renewal of end of life rail	26,477,731
Track	A combination of assets types in works, including ballast, sleepers and rail replacement	40,570,908
Sleepers	Renewal of end of life sleepers, upgrade of timber to concrete sleepers, and upgrade of sleeper fasteners	9,691,199
Structures	Replacement of culverts and concrete drains	17,302,943
Formation	Sub-formation and capping layer	10,841,539
Ballast Undercutting	Mechanised ballast undercutting activities	64,267,242
Bridge Ballast	Bridge ballast renewal	6,913,896
Turnouts	Turnouts and turnout components	10,696,893
Corridor Access	Projects within the Corridor discipline include those which impact on assets within the rail corridor, such as access points, access roads and corridor security including fencing	2,280,007
Total		**$189,042,358**

8.2 Control Systems

Control Systems projects include those relating to the assets that communicate with the Universal Traffic Control (**UTC**) system which allows train movements, identifies train locations, operates rail points, and activates level crossing protections. These systems are also required to monitor and protect below-rail assets from risk of derailment or infrastructure damage from rollingstock defects. Control Systems projects also includes telecommunications projects, relating to assets providing the data linkages between field equipment and network control, enabling Aurion Network to manage safe train operations.

The details of these asset types are set out in *Table 3* below.

Table 3. Control Systems Projects by Asset Type

Asset Type	Description	Capital Expenditure (excluding IDC)
Network Controls	Provides Network Control systems, digital and microwave radio systems and information technology system	28,494,513
Level Crossings	Road and rail interfaces and protection systems	4,886,909
Total		**$33,381,421**

8.3 Electrical

Electrical projects cover works associated with all elements of the supply and distribution of electricity for the utilisation of electric traction in the Blackwater and Goonyella Systems. The details of these projects by asset types are set out in *Table 4* below.

Table 4. Electrical Projects by Asset Type

Asset Type	Description	Capital Expenditure (excluding IDC)
Power Systems	Provides feeder stations, track section cabins and supply transformers	7,827,163
Electrical	Provides masts and wires of the distribution system	5,944,241
Total		**$13,771,404**

9.0 FY20 Top 10 Projects by value

Given the nature of the expenditure included in this submission, Aurizon Network has elected to provide a detailed summary in *Appendix B* for each of the top 10 projects listed below in *Table 5.*

Table 5. Summary of Top 10 Projects

Project Number	Project Name	Project Type	Capital Expenditure (excluding IDC)
IV.00605	FY20 Ballast Renewal Program	Sustaining	63,901,439
IV.00477	Track Renewal Package 2	Sustaining	32,154,636
IV.00426	Rail Renewal Program Package 2	Sustaining	25,763,731
IV.00447	Structures Renewal Package 2	Sustaining	15,103,232
IV.00456	Control Systems Renewal Package 2	Sustaining	14,542,832
IV.00455	Control Systems Renewal Package 1	Sustaining	12,340,378
IV.00462	Turnout Renewal Package 2	Sustaining	10,418,498
IV.00453	Formation Renewal Package 2	Sustaining	10,347,278
IV.00474	Sleeper Renewal Package 2	Sustaining	9,691,199
IV.00450	Bridge Ballast Renewal Package 2	Sustaining	6,633,982
Total			**$200,897,205**

10.0 FY20 Other Projects

The remaining projects, outside of the top 10, appear across various categories and in some instances include post-commissioning expenditure. These projects are considered other projects for the purpose of this report, and hence are dealt with by way of summary.

11.0 Projects with Prior Year Approvals

As detailed in *Section 3.3* several projects have been delivered as multi-year projects and as a result several projects in this Report have had claims in prior years approved by the QCA and included in the RAB.

Many projects have assets which are commissioned on a continuing basis, rather than a single commissioning point at the completion of the project. This is especially relevant for civil assets, where a project will often include multiple unrelated sites. Each of these sites will be commissioned as the works are performed.

The capital investments that have been approved by the QCA and included in the RAB have already been assessed against the regulatory framework (i.e. prudency of scope, standard and cost). These projects have already been deemed prudent in terms of scope and standard in prior years' capital expenditure submissions.

The details of the relevant projects subject to this submission for which Aurizon Network has had claims in prior years approved by the QCA and included in the RAB are detailed in *Table 6* below.

Table 6. Projects with Prior Year Approvals

Project Number	Project Name	Prior QCA Approved Expenditure	Capital Expenditure (excluding IDC)
IV.00517	FY19 Ballast Renewal Program	61,326,978	365,803
IV.00049	Radio System Replacement	26,960,992	627,449
IV.00425	Rail Renewal Program Package 1	26,572,373	714,001
IV.00329	Structures Renewal FY18	15,981,132	17,550
IV.00446	Structures Renewal Package 1	15,465,451	2,182,160
IV.00476	Track Renewal Package 1	15,193,594	96,555
IV.00461	Turnout Renewal Package 1	14,053,345	278,395
IV.00452	Formation Renewal Package 1	9,851,560	494,261
IV.00449	Bridge Ballast Renewal Package 1	8,509,462	279,914
IV.00347	Package 2 FY18 Control Systems Renewal	8,035,389	827,602
A.04313	Gauge Face Lubrication Asset Renewal	7,078,519	148,314
IV.00455	Control Systems Renewal Package 1	6,875,112	12,340,378
IV.00458	Level Crossing Renewal Package 1	4,048,374	39,364
IV.00283	Traction SCADA System	2,890,632	19,500
IV.00004	Traction Fault Locator Renewal	2,867,005	28,107
IV.00470	Corridor Security Package 1	1,381,137	1,690,267
IV.00555	FY19 Minerva Infrastructure Upgrade	1,379,635	21,025
IV.00376	FY18 Access Points	843,497	1,105
IV.00503	Power Systems Renewal Package 1	835,307	4,956,864
IV.00467	Access Roads Package 1	478,621	5,221
Total		**$230,628,112**	**$25,133,835**

12.0 Conclusion

Aurizon Network is seeking the QCA's approval to include FY20 Capital Expenditure in the RAB, in accordance with clause 2 of Schedule E of UT5. This report provides the QCA with details of this capital expenditure which amounts to **$236,195,183** (excluding IDC of **$2,020,037**) for a total of **$238,215,220** including IDC.

Appendix A: Capital Expenditure Project List

Project Number	Project Name	Project Type	Project Discipline	Asset Type	System	Claimable Expenditure (pre-escalation)
IV.00605	FY20 Ballast Renewal Program	Sustaining	Civil	Track	System Wide	63,901,439
IV.00477	Track Renewal Package 2	Sustaining	Civil	Track	System Wide	32,154,636
IV.00426	Rail Renewal Program Package 2	Sustaining	Civil	Rail	System Wide	25,763,731
IV.00447	Structures Renewal Package 2	Sustaining	Civil	Structures	System Wide	15,103,232
IV.00456	Control Systems Renewal Package 2	Sustaining	Systems	Network Controls	System Wide	14,542,832
IV.00455	Control Systems Renewal Package 1	Sustaining	Systems	Network Controls	System Wide	12,340,378
IV.00462	Turnout Renewal Package 2	Sustaining	Civil	Turnouts	System Wide	10,418,498
IV.00453	Formation Renewal Package 2	Sustaining	Civil	Formation	System Wide	10,347,278
IV.00474	Sleeper Renewal Package 2	Sustaining	Civil	Sleepers	System Wide	9,691,199
IV.00450	Bridge Ballast Renewal Package 2	Sustaining	Civil	Ballast	System Wide	6,633,982
IV.00503	Power Systems Renewal Package 1	Sustaining	Systems	Power Systems	System Wide	4,956,864
IV.00459	Level Crossing Renewal Package 2	Sustaining	Systems	Level Crossings	System Wide	4,847,545
IV.00506	Electrical Overhead Renewal Package 1	Sustaining	Electrical	Electrical	System Wide	4,545,732
IV.00613	FY19/20 Gregory Infrastructure Upgrade	Sustaining	Civil	Track	Blackwater	2,972,464
IV.00609	FY19 Kestrel Infrastructure Upgrade	Sustaining	Civil	Track	Blackwater	2,944,844
IV.00504	Power Systems Renewal Package 2	Sustaining	Systems	Power Systems	System Wide	2,870,298
IV.00446	Structures Renewal Package 1	Sustaining	Civil	Structures	System Wide	2,182,160
IV.00470	Corridor Security Package 1	Sustaining	Corridor	Corridor Access	System Wide	1,690,267
IV.00507	Electrical Overhead Renewal Package 2	Sustaining	Electrical	Electrical	System Wide	1,350,902
IV.00478	Track Renewal Package 3	Sustaining	Civil	Track	System Wide	1,230,623
IV.00606	Rail Lubrication FY20	Sustaining	Civil	Track	System Wide	1,002,447
IV.00347	Package 2 FY18 Control Systems Renewal	Sustaining	Systems	Network Controls	System Wide	827,602
IV.00425	Rail Renewal Program Package 1	Sustaining	Civil	Rail	System Wide	714,001
IV.00049	Radio System Replacement	Sustaining	Systems	Network Controls	System Wide	627,449
IV.00452	Formation Renewal Package 1	Sustaining	Civil	Formation	System Wide	494,261
IV.00468	Access Roads Package 2	Sustaining	Corridor	Corridor Access	System Wide	458,148
IV.00517	FY19 Ballast Renewal Program	Sustaining	Civil	Track	System Wide	365,803
IV.00449	Bridge Ballast Renewal Package 1	Sustaining	Civil	Ballast	System Wide	279,914

Project Number	Project Name	Project Type	Project Discipline	Asset Type	System	Claimable Expenditure (pre-escalation)
IV.00461	Turnout Renewal Package 1	Sustaining	Civil	Turnouts	System Wide	278,395
IV.00457	Control Systems Renewal Package 3	Sustaining	Systems	Network Controls	System Wide	156,252
A.04313	Gauge Face Lubrication Asset Renewal	Sustaining	Civil	Track	System Wide	148,314
IV.00465	Access Points Package 1	Sustaining	Corridor	Corridor Access	System Wide	125,266
IV.00476	Track Renewal Package 1	Sustaining	Civil	Track	System Wide	96,555
IV.00458	Level Crossing Renewal Package 1	Sustaining	Systems	Level Crossings	System Wide	39,364
IV.00004	Traction Fault Locator Renewal	Sustaining	Electrical	Electrical	System Wide	28,107
IV.00555	FY19 Minerva Infrastructure Upgrade	Sustaining	Civil	Track	Blackwater	21,025
IV.00283	Traction SCADA System	Sustaining	Electrical	Electrical	System Wide	19,500
IV.00329	Structures Renewal FY18	Sustaining	Civil	Structures	System Wide	17,550
IV.00467	Access Roads Package 1	Sustaining	Corridor	Corridor Access	System Wide	5,221
IV.00376	FY18 Access Points	Sustaining	Corridor	Corridor Access	System Wide	1,105
					Total	**$236,195,183**

Appendix B: Description of FY20 Top 10 Projects

IV.00605 FY20 Ballast Renewal Program

Aurizon Network conducts ballast undercutting on approximately 140km of track and 40 turnouts each year, with a mixture of owned and operated plant and through the management of external contractors.

Coal fouling and other contaminants impede the ballast's drainage functionality. As the ballast becomes increasingly fouled normal track maintenance techniques (i.e. resurfacing) are no longer effective and result in the increasing occurrence of track geometry anomalies and rail faults. These defects cause the track to settle unevenly resulting in a weakened track structure that requires regular and often reactive maintenance. It also increases the risk of derailment, train partings and broken rails. Typically, these risks are managed using speed and load restrictions.

Scope is determined from qualitative condition ratings provided by track inspectors across the CQCN, in conjunction with a semi-quantitative review of defect information and Ground Penetrating Radar (**GPR**) ratings. The below diagram provides an overview of the scope development process:

Qualitative Assessment *(Reliability & Availability Focus)*	
Objective	**Evidence**
Engage with ***Infrastructure Maintenance*** to understand their ***observations*** and identify track sections of current and future focus.	• Field-based observations (road patrols & detailed inspections) • Temporary Speed Restrictions (**TSR**) • Observable loss of track geometry (i.e. train crew reporting) and ballast degradation

Quantitative Assessment *(Asset Condition & Deterioration Focus)*	
Objective	**Evidence**
Prioritisation of scope by ***Network Assets*** through detailed engineering assessment of individual track segments (<100m) using quantifiable data.	• Ground Penetrating Radar (percentage void contamination) • Track geometry data retrieved from the on-track recording vehicle • Frequency of other mechanised intervention (i.e. number of resurfacing events) • Above data held within Network Data Management System (**NDMS**)

Early Scope Provided to Works Planning *(Logistics & Access Focus)*	
Objective	**Evidence**
Determine an operational strategy that seeks to balance the need to deliver contracted capacity/customer demand with the requirements of the rail infrastructure. Network Assets provides a list of prioritised Track Segments to ***Works Planning*** who apply and iterate the logistics 'criteria' considered in ballast cleaning against the critical backdrop of track access to achieve executable scope.	Logistics 'criteria' includes as a minimum; • Committed capacity (customer demand) • Safeworking requirements • Access to the site • Likely machine productivity • Material spoil and new material laydown locations • Direction the work activity will occur in • Ballast train and tamping machine stowage • Hours of continued operations and rosters.

Ballast undercutting is delivered using two distinct methods:

1. RM900

The RM900 is an efficient ballast undercutting machine that returns high quality ballast bed to track. It is used for long stretches of continuous, uninterrupted scope and not for smaller sections due to the complexity and inefficiency of cutting in and out of tracks. This machine can also complete work in areas of poor access such as track without adjacent access roads.

2. Off Track Solution

The off-track solution is delivered through a strategic partnership with external contractors using excavator mounted cutting chains. This method is used to complete ballast cleaning scope that cannot be completed practically or economically by the RM900. This includes turnouts, short sections of mainline scope and mainline sections around turnouts, signals and other constraints.

Ballast undercutting was previously included as part of Aurizon Network's maintenance allowance budget however in accordance with the UT5 Final Decision it was determined that ballast undercutting renewal activities were to be capitalised. Ballast undercutting activities classified as 'general track maintenance activities' as well as the depreciation costs associated with the relevant ballast undercutting plant will continue to be funded through Aurizon Network's maintenance allowance budget and have therefore not been included in this claim.

Given this is the first year that ballast undercutting has been included in the capital expenditure claim, Aurizon Network has taken a transitionary approach to standardising the supporting documentation for FY20. For example, in the absence of a typical Project Management Plan, Aurizon Network has provided documentation to detail how scope is developed and demonstrate planned versus actual scope for FY20. Supporting documentation will be standardised in line with other renewal projects from FY21.

IV.00477 Track Renewal Package 2

Track Renewal is a coordinated program renewing the track structure (including sleepers, rail, fastenings and in some locations, ballast) and in turn maximising the efficiency of construction. The renewal of track assets at the scoped locations ensures the ongoing integrity and reliability of the network, facilitating current and future rail traffic in a reliable manner.

The project involves upgrading the track structure to 60kg premium HH rail, 28tal concrete sleepers with galvanized Pandrol E clips and new ballast in select locations. Sites that have been identified for Track Renewal in FY20 were spread across the Goonyella, Newlands, Moura and Blackwater systems. A track upgrade site is determined by combining a site that has worn rail in need of replacement, and an area of fist or timber sleepers that require replacement. In some cases (depending on the condition of the ballast), the scope may also request that the ballast be replaced at the same time. Upgrading the track structure at the same time minimises the amount of time that the track is disrupted in that location and the need to incur multiple site mobilisation costs.

The minimum scope to be completed at a location is driven by the amount of worn rail needing to be replaced, however consideration is also given to maximising the productivity of mobilising resources to that location. As labour and machinery are charged daily, the preference is to maximise the productivity from the costs being incurred by undertaking additional fist or timber sleeper replacements in that location. As a result, in those locations where the Track Laying Machine (**TLM**) was utilised, the amount of sleeper replacement being undertaken may be increased to fully utilise the already paid for plant and labour, with the only additional cost being the sleepers and associated clips and pads.

In the early 1980's mainline track was constructed with 22.5tal concrete sleepers with 'fist clips'. These fist clips fasten the rail to the sleeper by leveraging (via a pin and clip arrangement) through the body of the sleeper. With constant exposure to the coal and coastal environments, the pins and clips of these sleepers are becoming severely corroded. The clips and pins are losing tension which can result in wide gauge and eventual failure of sleeper. Furthermore, these sleepers are rated at 22.5tal while the current track standard calls for 28tal sleepers.

The pins corrode within the sleeper, so the extent of corrosion is not fully evident on visual inspection. Given the increasing wide gauge issues, maintenance inspection of the affected areas has been increased to reduce the risk of gauge issues and likelihood of derailment. To manage this sleeper failure, a rolling sleeper replacement program has been implemented over the last couple of years. The replacement of the fist sleepers are on a priority basis determined by the condition of the sleeper. This is in addition to manual replacement during routine maintenance. Where rail is approaching the end of its life and is supported by timber sleepers which have a poor condition or fist sleepers, it is replaced with a concrete pandrol sleeper to meet current axle loads.

Aurizon Network manages its Track Renewal program using the project management function within the Engineering and Project Development area, with all asset renewal activity managed by the Asset Renewal Program Manager. One of the key benefits of this approach is that the Program Manager, along with the relevant Asset Manager, has a complete view of proposed works and can program numerous projects to occur concurrently by deferring or bringing forward works in a like location. For example, if a section of sleepers in a location are programmed for replacement and on review the sleepers are expected to require replacement in 2 years and the ballast renewed in 3 years, it is more efficient both in resource use and track possession to complete all three activities at the one time. This completion of multiple works at a single location is classed as Track Renewal works.

IV.00426 Rail Renewal Program Package 2

Aurizon Network has 5,562 kilometres of track across the CQCN, the majority of which was installed in the 1980s and 1990s. The main reason for the Rail Renewal program is due to rail wear as a result of friction between wagon wheels and the rail. Lubrication of curved rail and appropriate rail grinding is necessary to ensure rail reaches its maximum rail life. The greater the train weight the higher the friction and the greater the wear, meaning tracks carrying loaded trains will wear at a faster rate than tracks carrying empty trains.

The Rail Renewal Program for the CQCN aims to renew damaged or worn rail assets to ensure compliance with the mandatory Civil Engineering Track Standard (**CETS**) - Network Safety Management System requirements. CETS prescribes the standards for the design, construction, monitoring, maintenance and modification of rail used in the CQCN and outlines specific thresholds for rail wear.

Rail wear limits are determined by several factors including; curve radius, axle load, rail type, rail size and curve leg. Rail wear is captured by manual measurements from track inspections and data from the Rail Inspection Vehicle (**RIV**) which measures the head loss of the rail at set intervals along the track. Wear measurements over the history of the curve can be used to determine the wear rate and the date in which replacement is required. Wear rates are directly associated with the level of traffic which passes over any respective track segment.

At high annual gross tonnages, the rate of growth of rail defects may become the limiting rail life factor. Rail wear reduces the rail cross section and does not transfer loads over the required number of sleepers and consequently internal rail stress becomes excessive, increasing the likelihood of rail bending.

Aurizon Network's rail renewal strategy supports the proactive replacement of life expired rail or defective rail before it can adversely impact safety and operational performance. The Rail Renewal program is a long-term asset renewal program with a prioritised program of works developed and funded yearly.

IV.00455 Package 1 & IV.00456 Package 2 – Control Systems Renewal

Control Systems assets include Aurizon Network's train control system, asset protection and signalling control assets as well as managing Australia's largest non-commercial telecommunications data network. Control Systems assets are required to maintain service reliability and asset condition within CQCN through:

- Renewing assets or components which are life expired to hold continuity of safe train operations and where possible, extending the life of asset through component renewal or part asset renewal;
- Focusing on remote monitoring and diagnostic capabilities for field assets to reduce travel time to site to fix issues; and
- Managing assets with obsolete parts/systems which are hard to source.

The program consists of a total 10 project groups. Each project group has a prioritised scope identified within the Scope Priority Model.

1. Train Detection:

This project is the renewal of train detection assets in order to replace end of life track circuit related equipment and reduce fault impacts experienced by the network operators and reduce maintenance effort on the track circuit equipment.

2. Interlocking Assets:

Interlocking assets are the signalling components which control local signalling equipment e.g. signals and track circuits according to predetermined functional and safety rules. Interlocking assets allow Network Control to operate Remote Control signalling equipment which displays to the train controller via UTC status of signals and points and shows the passage of train through the CQCN Rail Network.

3. Power Resilience:

Trains have been delayed due to instability of the older signalling power systems, particularly during storm activity. The solution to this problem has been achieved by the rollout of uninterruptable power supplies, generator sets and battery renewals, that significantly reduce power instability caused by storms. The implementation of new Power Equipment Rooms **(PER**) that house the equipment is a rapid deployment package. In areas where the sites have been completed, this project has delivered a reduction in signals being restored to stop during power changeover which has had a flow on effect of reducing train delays.

4. UTC/DTC Upgrade

The UTC/DTC upgrade project provided software and hardware updates to the key train control systems Universal Train Control (**UTC**) & Direct Train Control (**DTC**) which operate throughout the CQCN. The upgrades included software changes to the UTC system to improve safety & reliability and hardware changes to improve telemetry systems and Networking equipment that enables communications with field signalling equipment and the UTC and DTC system elements. These updates maintain and extend the life of the existing train control systems.

5. Transmission Renewal:

This project renewed elements of both the DMR and Optic Fibre (**OF**) based Synchronous Digital Hierarchy (**SDH**) transmission systems to provide a reliable telecommunications system that enables communications from central control systems to field sites for Train Control, Traction Power Control and Radio Systems throughout the CQCN.

6. Diagnostic Computer Renewals:

This project replaced life expired Signalling Diagnostic Computers at numerous sites across the CQCN. The project objective was to improve fault detection and reduce signalling outage time in the network.

7. Asset Protection:

The asset protection replacement was a technology refresh program driven by equipment obsolescence. This project replaced end of life and obsolete asset protection equipment in order to preserve the level of protection they provide, including replacement of weighbridges and hot wheel bearing detectors, as well as the installation of a new mainline weigher to provide required resilience.

8. Vital Disabling Release

This project delivered non-vital disabling panels to key level crossings, providing simpler, quicker and reduced risk of human error means of disabling level crossing signalling in support of local track maintenance activities. The non-vital approach delivers many of the benefits of VDR, but at significantly less comparative cost, and has improved the operational efficiency of the signalling network. This project can be measured by the operational impact that is caused by installing temporary safe working alterations at level crossings.

9. Control Systems Infrastructure Renewal

The project renewed elements of the telecommunications and signalling operational network that provide optical fibre cabling and equipment rooms and generators that provide the base infrastructure that the signalling, telecommunications and control systems require to enable and support train operations throughout the CQCN. Key benefits of this project are extending life of the control systems infrastructure assets, improved reliability, and reduced maintenance cost. Newer generation assets have richer monitoring and remote diagnostic features.

10. Location Cases (Project IV.00455 only)

This project renewed location cases and relocated them outside of the Danger Zone in line with the Asset Policy. Location cases are generally replaced in the shadow of larger interlocking replacements. The housing itself has a life in excess of 50 years.

IV.00447 Structures Renewal Package 2

The Structures Renewal program facilitates current and future rail traffic and provides an asset suitable to the corrosive environments within the CQCN. Culverts and structures across the CQCN were predominantly installed during the initial track construction in the 1960's. These structures were designed for lower axle load and traffic tonnages than current operational requirements. The impact of running larger and heavier trains across these culverts since being installed have led to their accelerated degradation.

Due to overstress or condition deterioration culverts may collapse, leading to loss of top and line of the overlying track. Failure mechanisms will depend on the shape and dimension of the cross-section, maintenance undertaken to date as well as the culvert material. Culvert outlets and inlets which exhibit signs of scour are also a concern as the scour may advance towards the track and if unchecked may undermine the culvert and track itself. At best, speed restrictions would then be required to be imposed until repair/renewal of culverts is carried out while the worst case could see train derailment and track closures enforced until such time as the culverts are replaced and track reinstated.

The renewal or upgrade of the culverts increases the strength of the culverts to align with Civil Engineering Structures Standards (**CESS**), providing increased confidence in the asset and progressively improving the track infrastructure to enable future growth.

The Structural Renewal Program involves significant upfront site inspection, survey, design and approval activities. Routine inspections, in accordance with CESS, identify structures approaching the end of their life which are then prioritised for completion under the project, using a priority rating model.

Benefits of the project include less maintenance works, reduced inspection requirements, removal of speed restrictions and reduction of risk of derailments.

The Structures Renewals Package aims to replace life-expired or near life-expired structures throughout the CQCN with new structures compliant to a 300LA design loading configuration (Australian Standard) and design flood immunity of Q100 (to top of rail) and Q50 (to top of formation).

IV.00462 Turnout Renewal Package 2

The Turnout Renewal program includes major component replacements and points machine improvements to extend the life and improve performance of turnouts.

Treatments are matched to the traffic task e.g. refurbishment of turnouts to improve their operation, removal of turnouts no longer required and component replacement to extend life.

The turnouts identified in the FY20 scope are life-expired and require constant maintenance to allow the safe passage of traffic. Failure to replace these aged turnouts will increase ongoing maintenance requirements and increase the risk of turnout failure causing system delays and derailment.

The program has looked to maximise efficiency of works by completing clusters of turnouts together. This improves the productivity of work crews and provides an easier to maintain track by renewing formation as a single block ensuring effective drainage and resilience of the turnout renewed.

IV.00474 Sleeper Renewal Package 2

This Sleeper Renewal program seeks to replace priority life expired and/or ineffective timber sleepers and corroded fist fastened sleepers designed for 22.5tal and selected timber sleepers ‘on a face’ (i.e. replace everything between the start and finish points) with 28tal Pandrol e-clip concrete sleepers at numerous identified sites within the Goonyella, Moura, Newlands and Blackwater systems.

The sleeper is a fundamental component of the track structure and performs four critical functions to ensure the reliable passage of trains:

- Holds the track in alignment both vertically and horizontally;
- Holds the rails on which trains are conveyed and guided to “gauge”;
- Spreads the load of the trains from the wheels to the underlying soil and formation in a controlled and designed manner; and
- Provides mass and resistance to lateral forces from trains and thermal effects.

As detailed in the *IV.00477 Track Renewal Package 2* summary, an ongoing sleeper program has been implemented to carry out sleeper replacement on a priority basis determined by the inspection regime of the track assets.

In addition to the renewal of fist concrete sleepers due to fastenings at end of life, sleeper upgrade and renewal requirements also include:

- Replacement of derailment damaged sleepers previously left in track, but at end of service life under current increased traffic operations; and
- Upgrade of timber sleeper track with high sleeper replacement and maintenance requirements.

Derailment damaged sleepers suffer various damages which affect the sleeper performance and hence reliability and transit times of train services traversing them.

Timber sleepers have similar and more dramatic degradation effects. Timber sleepers still constitute a significant portion of the network. Timber, because of its organic nature, degrades and loses life not only by train traffic but also through climate and exposure to the weather environment independently of train traffic.

IV.00453 Formation Renewal Package 2

The Formation Renewal program is a rolling asset renewal program with a prioritised program of works developed and funded yearly which seeks to renew failed and end of life formation segments at priority sites to ensure the safe passage of trains. The rail formation serves the purpose of providing a stable foundation on which the rail infrastructure is constructed on. It also provides drainage across the rail corridor under general rainfall and particularly flood conditions.

Formation across the CQCN was predominantly constructed as early as the 1960's and periodically upgraded with tonnage increase and failure. The CQCN formation and alignment were originally designed for lower axle load tonnages than current operational requirements. Formation, due to overstress or condition deterioration, may result in the collapse or shear failure leading to loss of top and line of the track or even derailment.

The newly developed Formation Decision Support Tool has improved scope identification through continuous data improvement of track geometry and field formation (e.g. failure) data calibration.

The Formation Decision Support Tool and maturity of data use enable the program to move toward a higher proportion of planned, preventative formation renewal.

IV.00450 Bridge Ballast Renewal Package 2

The Bridge Ballast Renewal program seeks to renew and replace ballast depth and profile in line with the CETS limit at priority sites across CQCN. Bridge Ballast Renewals are a separate program to *IV.00605 FY20 Ballast Renewal Program* which is summarised earlier in this *Appendix B*. Aurizon Network has approximately 20km of ballast on 353 ballast-deck bridges across the CQCN.

The replacement of fouled ballast on bridges ensures that the track can drain freely, and the ballast is able to absorb and transfer the weight of trains evenly. This prevents the development of 'mud holes' and prevents the track from 'pumping', issues that can lead to a rail break which could lead to a derailment.

Ballast is typically made from crushed stone and forms the bed upon which sleepers are laid. Its primary functions are to:

- "Lock" track in place
- Enable even load distribution to the underlying formation/bridge structure;
- Facilitate the drainage of water; and
- Enable mechanised reinstatement of top & line.

In comparison to ballast undercutting practises, ballast renewal on bridge decks pose a unique problem due to their narrow design and the fact that there are often significant safety concerns (working at height) as well as environmental concerns of fouled ballast spilling into creeks and rivers below. The narrow design ensures that ballast undercutting techniques through mechanised, efficient, bespoke machinery cannot be utilised. As a result, manual techniques of track de-construction and re-construction are required.

The scope for this rolling program is based on the following analysis:

- Civil Asset Management System (**CAMS**): based on ballast depth, extent and depth of fouling, RIMS defects, track geometry;
- Defects: feedback from Network Asset Maintenance based primarily on track geometry and defects data;
- Speed Restrictions: bridges with speed restrictions impacting revenue traffic throughput;
- New technologies: utilisation of ballast matting and membranes in order to reduce the changes in track stiffness between splay set to splay set; and
- Track Criticality Rating: location of the bridge has been assessed in accordance with the Criticality Asset Strategy and Policy.