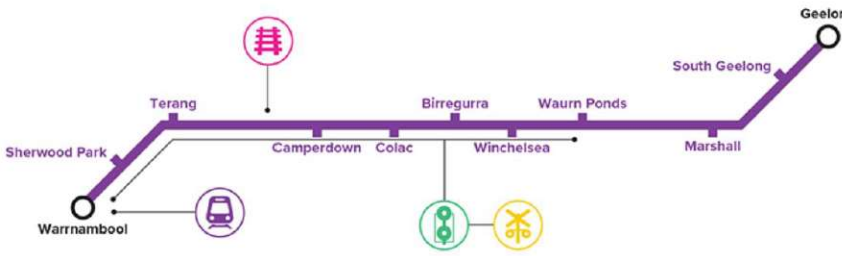
Background	This form is required to propose a suitable Base Case that can be used for relevant credits in the Energy & Carbon, Water and Materials categories, and should be used in conjunction with the Base Case Establishment Procedure. Please fill out this form as completely as possible. Text in the light blue boxes is for explanation only and can be typed over. Use as much space as needed. Refer to and provide attachments as necessary.		
General Project/Asset Information			
Rating Number	303	**Project/Asset Name**	Warrnambool Line Upgrade / Waurn Ponds stabling / Waurn Ponds Station upgrade
Project/Asset Description	The Warrnambool Line Upgrade (WLU), Waurn Ponds stabling (WPS) and the Waurn Ponds Station upgrade (WPSU) all form part of the Australian and Victorian Government's investment in the Regional Rail Revival program, allowing trains to run between Melbourne and Warrnambool at a greater frequency. The Projects include signal upgrades between Waurn Ponds and Warrnambool, upgrades to 12 level crossings, station upgrades at Waurn Ponds, construction of a crossing loop at Boorcan and a stabling yard at Waurn Ponds. Figure 1 presents a schematic of the route and associated work areas.  *Figure 1- Project Overview* WLU is divided into four Project Areas, with the reference design developed by Rail Projects Victoria (RPV) and Aurecon, Jacobs, Mott Macdonald Joint Venture (AJM JV), for each section described below. Preparatory works will occur at the commencement of the projects, including the establishment of laydown areas, land acquisition, delineation fencing along the existing corridor, construction of temporary site access roads, site establishment works, and relocation and/or protection of utilities. Most works will occur within the existing VicTrack owned rail corridor, except for temporary laydown areas required at Waurn Ponds, the excavation of drainage lines at Boorcan and the works associated with improvements to existing level crossings that take place in the roadway. **Waurn Ponds Station** The existing Waurn Ponds Station, located on Sugargum Drive, currently has one platform and carparking. The station will be upgraded to duplicate the platform to the south of the existing rail track and expand the carpark to the east. The RPV / AJM reference design at Waurn Ponds Station includes the following:		

- Duplication of ~1200m of track;
- Construction of a new 180m long platform with the future provision of a 70m extension;
- Station upgrades, including:
    - Pedestrian overpass with associated lifts, stairs and access ramps;
    - Station infrastructure;
    - Retaining walls;
        - 105m long, 0.6m retained height post and panel wall along the south side of the down track (i.e. towards Warrnambool);
        - 220m long, 1.5m retained height post and panel wall along the north side of the up track, upside (i.e. towards Melbourne) of the existing platform.
- New asphalt carpark with lighting and CCTV security cameras;
- Noise mitigation walls; and
- Level crossing upgrade.

Boorcan Crossing Loop

A new 2.5 km crossing loop will be constructed at Boorcan, between Boorcan Road to the west and 250 m past Oswells Road to the east.

The RPV / AJM reference design for the Boorcan Crossing Loop comprises the following:

- Excavation and construction of rail formation to duplicate 2500m of track;
- Six culvert upgrades;
- Two new culverts installation, with associated excavation of the drainage network; and
- Duplication of Oswells Road level crossing

Wider rail corridor

Works along the 190 km rail corridor will occur at discreet locations to upgrade level crossings and signalling infrastructure to enable future diesel multiple unit train operation on the Warrnambool Line.

The RPV / AJM reference design includes the following:

- Upgrades to specific existing level crossings between Marshall and Dennington to enable future diesel multiple unit operations on the Warrnambool line;

	• Construction of a new Combined Services Route (CSR) to accompany the track duplication extents at Waurn Ponds and Boorcan; and
	• Associated ancillary infrastructure and road work.
	
	Waurn Ponds Stabling Yard
	
	A new stabling yard is proposed off Bogans Lane in Waurn Ponds.
	
	The RPV / AJM reference design for the Waurn Ponds Stabling Yard comprises the following:
	
	• A stabling yard;
	• Six new stabling roads;
	  ○ One friction buffer stop at the end of each stabling road
	• Fuelling infrastructure;
	  ○ Fuelling pipes and supporting gantry is to be founded on bored piles.
	• Concrete hardstands;
	• Asphalt access roads and widening of intersections at Bogans Lane/ Reservoir Road;
	• 24 asphalted carpark, walkways and internal roads
	• Driver and cleaners' amenities building;
	• 25,000 litre & 5,000L above ground rainwater tank;
	• Overhead lighting for the stabling yard, including roads and boundary fences; and
	• Associated utility supplies include new stormwater drainage, dewater, sewer and water supply infrastructure; power and telecommunications suppliers

Base Case Information	
Specific Name of the Base Case	The base case for the Warrnambool Line Upgrade project is the RPV / AJM reference design. Therefore, this document will refer to it as 'the Base Case Design' and the Design and As Built submission.
Date of the Base Case	The documentation detailing the scope of the Base Case Design has various issue dates. The key issue dates are listed below: • Waurn Ponds Station Design (Design Report issued 10 January 2019) • Track and Civil Design (Design Report issued 26 March 2019) • Waurn Ponds Stabling Facility Design (Design Report issued 26 March 2019) • Signalling Reference Design (Design Report issued 29 March 2019)
Designer	The Base Case Design was developed by RPV's technical advisor AJM JV in conjunction with RPV and V/Line.

Purpose of the Base Case	The Base Case is intended to justify the business as usual position with the selection of materials, energy and emissions, and water for the construction and operation of the Warrnambool Line Upgrade project. It is also a way to formalise the scope of what has been included in the modelling for construction and operation of the Warrnambool Line Upgrade, demonstrating design enhancements and savings.
Base Case Function (Product or Service provided)	The Base Case Design documents the proposed Warrnambool Line Upgrade project. The key components of the Project are: • Waurn Ponds Station • Boorcan Crossing Loop • Wider rail corridor (signalling upgrades) • Waurn Ponds Stabling Yard The above Base Case infrastructure components are intended to enable much needed extra services between Melbourne and Warrnambool.
Base Case Life	The Design Life of the asset varies across the different elements of the Base Case Design, ranging from track work to paint finishes. For the Base Case, modelling for a Design Life of 100 years has been established. Further details are listed below in Table 1.

Table 1. Project Asset Minimum Design Life Requirements[1]

Project Asset Description	Design Life
Civil	
Civil structures, including all road and rail bridges (underpasses and overpasses), pedestrian overpasses, major culverts (including culverts for shared user paths), earth retaining structures, and drainage elements	100 years
All above ground building structures	50 years
Architectural	
Architectural cladding	40 years
Internal and external paint finishes	10 years
Floor finishes	50 years
Station furniture	40 years
Vertical transportation	
Lifts	20 years
Track	
Track, track fastening systems and sleepers	50 years
Buffer Stops / Friction Arrestors	50 years
Combined Services Route	
Conduits and pits	50 years
Signalling	
Switchgear	20 years
Transformers	15 years
UPS Sets	15 years
Batteries	3 years

[1] *Warrnambool Line Upgrade Project Scope and Technical Requirements (PS&TR), Part B: Technical Requirements (Section 12.1), Issue Date 8 April 2019*

Electrical Cabinets	10 years

Asset refurbishment and/or replacement

The Ene-1, Wat-1 and Mat-1 footprint will ensure that a consistent 100-year operational lifetime is adopted across all asset components, i.e. maintenance/replacement of all installed (operating) assets will be factored in across the 100 years for asset components <100-year lifespans.

Base Case Description

The reference design developed by AJM JV for the request for tender (RFT) has been adopted as the Base Case Design. As specified in the Warrnambool Line Upgrade Base Case Guidance (WLU-AJM-WLU-AWD-REP-XSU-NAP-0000236), the WLU Base Case Design is the design released during RFT with Business As Usual (BAU) assumptions and no inclusion of sustainability initiatives beyond BAU.

The scope of the Base Case Design – referred to as the 'reference design' - is detailed in the following design reports:

- WLU-AJM-WLU-WPD-REP-CGE-WPD-0000128 Waurn Ponds Station Design Report (issued 10 January 2019)
- WLU-AJM-WLU-WPD-REP-CRA-NAP-000127 Track and Civil Design Report (issued 26 March 2019)
- WLU-AJM-WLU-WPD-REP-GGE-NAP-0000111 Signalling Reference Design Report (issued 29 March 2019)
- WLU-AJM-WLU-WPD-CGE-WPD-0000155 Waurn Ponds Stabling Facility Stage 1A (issued 26 March 2019

An exemplar of the reference sources detailed in the above reports is listed in Table 2. In addition, assumptions around the design specifications are provided in Appendix A.

Table 2. Warrnambool Line Upgrade Base Case Design Drawings

Description	Reference
AJM JV Base Case Design scope, as defined on *Victoria Network Area Wide Railway Track and Civil Works Schematic*	WLU-AJM-WLU-AWD-DRG-CGE-VIC-0800020
Waurn Ponds Station	
AJM JV reference design as per *Waurn Ponds Station General Arrangement Plan*	WLU-AJM-WLU-WPD-DRG-CBR-WPD-0801701
Boorcan Crossing Loop	
AJM reference design as per *Camperdown – Boorcan Crossing Loop – Horizontal and Vertical Alignment* (Sheets 1-16)	WLU-AJM-WLU-CPD-DRG-CRA-CPD-0806111, 0806112, 0806113, 0806114, 0806115, 0806116, 0806117, 0806118, 0806119, 0806120, 0806121, 0806122, 0806123, 0806124, 0806125, 0806126
Waurn Ponds Stabling Yard	
AJM JV reference design as per *Waurn Ponds Stabling Yard Civil General Arrangement* (Sheets 1-4)	WLU-AJM-PWD-WPD-DRG-CGE-WPD-0802311, 0802312, 0802313, 0802314

The base case will also require compliance with AS5100:2017 – Bridge Design, which was released after the Base Case drawings were completed.

It is proposed that tenant services are excluded from the operational energy consumption scope, as these are not within the control of the Project scope and would detract from other items design can impact. Tenant services include all non-fixed services such as computers, servers and office equipment, kitchenette consumption and allowance for small power (i.e. other plugged-in devices/chargers).

	Train emissions for Base Case Footprint – it is proposed that train emissions be excluded from the operational energy Base Case Footprint due to an inability for design initiatives to have a significant (if any) influence on train emissions as the train specification and supply are not part of the Project. For further details, refer to the 'Energy and Carbon' section below. Minor maintenance of the built infrastructure during the operational phase will not be included within the models as it represents an immaterial portion. However, major maintenance cycles will be included.
Base Case Qualities – Please explain how the Base Case demonstrates each of the following qualities:	
Applies Business As Usual Technologies	BAU technologies and practices to be applied to the Warrnambool Line Upgrade Base Case are detailed in Appendix A. Predominant sources of BAU assumptions are listed below: **Energy and Carbon** • Green Build Council of Australia's (GBCA) Energy Consumption and Greenhouse Gas (GHG) Emissions Calculation Guide,[2] including Section J of the National Construction Code (NCC2019) for energy efficiency requirements for building elements. • AS1158 – Lighting for Roads and Public Spaces, used for classification of external lighting requirements (comparable lux levels to VLine Train Stabling Facilities Standard 2018) for external areas, which directed the factors used in energy calculations from the above GBCA Energy Consumption and GHG emissions Calculation Guide documentation • National Greenhouse Accounts Factors 2020 • 100% of the electricity used on site is grid imported during operations. • National Construction Code (NCC) 2019 **Water** • GBCA Potable Water Calculator Guide[3], including Water Efficiency Labelling Scheme (WELS) efficiency ratings and standard benchmarks for Irrigations Factors. **Other** • VLine Standards • Victorian Rail Industry Operators Group Standards (VRIOGS)[4].
Transparency	As detailed above in 'Base Case Description,' the reference design developed by AJM JV for the RFT has been adopted as the Base Case Design. Through the approval and issue of the RFT, the Base Case Design was accepted by key stakeholders, including RPV, the Department of Transport and V/Line.
Matching Scope	The IS Rating scope will be very similar to the actual scope with the exceptions as listed above within Base Case Description. Variations (small are highly likely and a much lower likelihood of large) to the original scope could occur for this Project that has not yet been identified. Small variations will be placed through the modelling or data collection of the Actual Case. The Base Case will then be updated to ensure the IS Rating scope reflects the actual scope and a like

[2] *Green Star Energy Consumption and Greenhouse Gas Emissions Calculation Guide, GBCA, September 2019*
[3] *Green Star Potable Water Calculator Guide, GBCA, September 2019*
[4] *Railway Station Design Standard and Guidelines, Victorian Rail Industry Operators Group Standards, March 2011*

	for like comparison can be made. Any improvements to BAU recognised in small variations will follow the rules of this document and will be back-calculated for the actual case. More significant variations (i.e., greater than 30% change in scope) will likely require greater project planning; therefore, modelling the Base Case can occur before commencing. The principles within this document will be followed. Where an additional BAU assumption is identified, the Base Case will be updated.
Accuracy and Detail	The Base Case Design, as represented by the reference sources outlined in the 'Base Case Description' section of this proposal form, allows for sufficient estimation of resource use to calculate a representative energy, water and materials Base Case Footprint.
Alternatives	The RPV / AJM reference design has been selected for the Base Case Design as it is an early design that is representative of the original concept for the Project, while providing a suitable level of detail. The design submitted by Downer during the RFT phase was also considered as a potential base case, however it was deemed not suitable as it includes beyond BAU technologies so therefore could not be used as an appropriate benchmark to assess the Project's sustainability performance. The detailed design is the final option, but this will have a range of sustainability initiatives incorporated and will be used to determine the actual profile.
Credits for which the Base Case is intended to be used	Check all that are targeted: ☒Ene-1 (Level 2 or 3) ☒Wat-1 (Level 2 or 3) ☒Wat-2 (Level 1 or 2) ☒Mat-1 (Level 2 or 3)
Base Case Footprint Calculation – Please explain how the Base Case Footprint(s) will be calculated from the Base Case including any BAU assumptions	
Calculation Approach	The proposed approach for calculating the Warrnambool Line Upgrade Base Case Footprint is: **Design Submission** Through the design development process, initiatives will be captured that reduce the extent of materials, energy and water required during construction and operation, in comparison with the AJM reference design scope and the business as usual definitions included in Appendix A. At detailed design, quantify the energy, water and materials footprints to derive the construction and operation actual footprints. The sustainability benefits of captured initiatives will then be incorporated to determine the base case energy, water and material profiles. The percentage difference will then be determined. **As Built Submission** For the operational profile, the information from the design submission will be used to assess the base case and actual emission. Actual construction emissions will use data from the delivery of WLU and compare it with the base case construction profile generated during the design submission.

Energy and Carbon	BAU technologies and practices applied to the Ene-1 Base Case Footprint for both construction and operation are detailed in Appendix A. **Construction:** The proposed methodology for estimating vegetation clearance (loss of carbon sinks) is listed below: 1. The type of vegetation class being cleared is identified; 2. The area of vegetation to be cleared (for each of the types identified above) is defined; 3. The area being cleared for each vegetation class is multiplied by the appropriate emissions factor (in tCO_2-e). e.g. Appendix E 'Vegetation Emissions Methodology' of the Greenhouse Gas Assessment Workbook for Road Projects[5] – also known as the 'Carbon Gauge' tool. Construction Waste transport (Scope 3 emission) will be included in the energy assessment to enhance the energy model. Given the Project's regional location, Downer seeks to engage the local community with innovative solutions. BAU assumptions are spelled out within C.09. **Operation:** The V/Line Sustainability Action plan indicates that more than 90% of V/Line's energy consumption and more than 80% of GHG emissions are associated with train diesel use. The remaining energy use and emissions are related to mechanical, lighting and electrical operation at stations, stabling yard facilities and signalling. The design will not influence train emissions other than very minor grade and length adjustments, which are considered to provide an insignificant reduction in emissions. As such, it is proposed that the Base Case excludes the diesel train emissions, and instead focuses on all other areas of operation which both make a material contribution to the total emissions profile, and for which energy and GHG reduction initiatives can be explored and implemented to contribute in a meaningful way toward the Ene-1 target level. Internal space services such as lighting and mechanical services, have been calculated by referencing NCC minimum compliance requirements (version 2019 for this Project) in line with GBCA Energy Calculator Guide. Base Case operational energy for external lighting, area classification with comparable lux levels to the specified VLine Train Stabling Facilities Standard 2018 have been adopted from AS 1158 (Lighting for Roads and Public Spaces) and the respective power density factors (W/m2) from the GBCA Energy Calculator Guide used. This is further outlined in Appendix A, Item Reference O.3.
Water	BAU technologies and practices applied to the Wat-1 and Wat-2 Base Case Footprint for both construction and operation are detailed in Appendix A. **Construction:** The Base Case Footprint assumes that all water used for construction is potable water. Construction water includes water for dust suppression, engineered fill compaction, site facilities and amenities. **Operation:** Operational water usage, which includes both irrigation and staff and passenger facilities, has been informed by the Green Star Potable Water Calculator Guide. Operational water will also include train washdown and refill, as informed by the client. It is assumed that all water consumption will be potable water in the Base Case.
Materials	BAU technologies and practices applied to the Mat-1 Base Case Footprint are detailed in Appendix A.

[5] *Greenhouse Gas Assessment Workbook for Road Projects, Transport Authorities Greenhouse Group, February 2013, https://www.rms.nsw.gov.au/documents/about/environment/greenhouse-gas-assessment-workbook-road-projects.pdf*

	Due to the limited detail of the Base case, a materials take-off (Bill of Quantities) could not be produced. Downer first produced the Bill of Quantities during preliminary design. The preliminary design includes sustainability initiatives (both sustainable design elements and materials/processes that are beyond BAU) that will be removed (back-casted) in order to form the Base Case footprint and ensure that these sustainable initiatives are recognised in the resource modelling. The modelling will show: 1. Adoption of BAU technologies and processes will be included in the estimation of Base Case footprint; and 2. Significant differences (whether positive or negative in terms of resource use) during the design development between Preliminary and Final design		
Assessor	Removed for privacy reasons	**Proposal Date**	08/07/2020

IS Project Manager	Removed for privacy reasons	**Date**	09/07/2020
IS Project Manager Comments	Removed for privacy reasons		

IS Verifier(s)	Removed for privacy reasons	**Verifier recommendation**	Removed for privacy reasons
Verifier(s) Comments	Removed for privacy reasons		
Date Verified	Verified (pending acceptance of proposed minor alterations by Project) 15/03/2021		

Document History

Version	Date	Author	Summary of Change
			Removed for privacy reasons

Appendix A – Business as Usual Assumptions

Design life of specific assets provided within the Base Case Proposal Form.

Table 3. BAU Assumptions for Ene-1, Wat-1 and Wat-2 Base Case Development during Construction Phase

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
C.1	Ene-1	Use of plant and equipment (P&E) for construction	• Generators providing electricity for P&E are operated at 60% load using 100% mineral diesel fuel 12 hours per working day. • Unless otherwise known, the fuel consumption rate for P&E will be sourced from the Caterpillar Performance Handbook (June 2018).	• Caterpillar P&E are widely used across the construction industry in Victoria. Data published in their performance handbook is based on their own field testing, computer analysis, laboratory research and experience. • IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	Number and types of P&E for whole Project Total fuel use (kL)
C.2	Ene-1	Use of generators during construction	• Where main site offices are temporary site sheds (instead of occupied permanent buildings), generators providing electricity to main site offices are operated at full load using 100% mineral diesel, 12 hours per working day. • Generators providing electricity to some site offices are operated at full load using 100% mineral diesel, 24 hours per working day. • Generators providing electricity to critical site offices (e.g. server sheds) are operated at full load using 100% mineral diesel 24/7. • Unless otherwise known, the fuel consumption rate will be sourced from the Caterpillar Performance Handbook (June 2018). • Use of generators for both day and night works will be accounted for.	• Caterpillar P&E are widely used across the construction industry in Victoria. Data published in their performance handbook is based on their own field testing, computer analysis, laboratory research and experience. • IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	Number and capacity of generators Total fuel use (kL)
C.3	Ene-1	Construction lighting	• No use of high efficiency LED construction lighting for night-time works. • Intelligent controls/sensors for lighting are not implemented.	• IS Bases cases for numerous ISCA projects both in Victoria and across Australia	Lighting efficiency (Lumens/Watt) Number and capacity of generators Total fuel use (kL) of generators providing lighting
C.4	Ene-1	Purchased electricity (plant, equipment, offices)	• All electricity purchased off the grid. • No purchase of accredited GreenPower. • No onsite renewable energy initiatives (e.g. solar PV).	• The emissions factor for all purchased electricity for construction activities sourced from the Victorian electricity grid using the most recent NGA	kWh of all construction offices

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
			• No sourcing or purchasing of offsite renewable energy initiatives. • No carbon credits from electricity grids will be accounted for throughout the Project. • BAU efficiency plant and equipment.	publication available (August 2019). • Renewable energy sources (e.g. from the installation of solar panels) or the purchase of GreenPower are rarely adopted as BAU in the rail industry due to high cost and the temporary nature of construction site sheds. • IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	kWh of all plant / equipment using purchased electricity
C.5	Ene-1	Transport fuel – Use of Project owned vehicles	• Fuel use for vehicles will be unleaded or diesel. • BAU implementation of Worksite Travel Plan (e.g. no carpooling, no buses for workforce). • No hybrid, electric or biodiesel vehicles.	• Previous projects by rail work packages (e.g. LXRP) indicate that project vehicles typically use unleaded or diesel fuel. • IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	Staff numbers for the Warrnambool Line Upgrade Distance travelled (km) in project vehicles Estimate of fuel use in project vehicles for project purposes
C.6	Ene-1	Off road plant	• Fuel use for off-road plant and equipment will be diesel. • Unless otherwise known, the fuel consumption rate for off-road plant and equipment will be sourced from the Caterpillar Performance Handbook (June 2018).	• Caterpillar P&E are widely used across the construction industry in Victoria. Data published in their performance handbook is based on their own field testing, computer analysis, laboratory research and experience	Number and type of off road plant for whole Project Total fuel use (KL)
C.7	Ene-1	Transport of water to site	• Fuel use for water delivery trucks will be diesel.	• The current norm in industry is for delivery trucks to use diesel. • IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	Number of water delivery trucks for whole Project Distance travelled to site (km) Total fuel use (kL)
C.9	Ene-1	Transport of waste off site	• Waste is transported offsite using a 100% mineral diesel fuel articulated truck. • All waste streams, including contaminated material, will be disposed of to the closest landfill licensed to take relevant material to relevant stockpile locations along the project corridor. • Where spoil is acceptable for reuse, the business as usual preference will be the least cost option. • All excess excavated material will be removed off-site.	• IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	Estimated tonnes of material to be disposed of for each waste category

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
C.10	Wat-1	Water usage	• 100% potable water are used for construction works (e.g. compaction and dust suppression). • Potable water used in site sheds and ablutions (staff kitchens & toilets). • Potable water is defined as "water that is safe for human consumption, food preparation, and food making and acceptable for human consumption'".	• Potable water definition is from the Department of Health & Human Services 2011. • IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	Estimate of water use (kL/day or for entire Project) for construction activities and site office use
C.11	Wat-2	Non-potable water	• 100% potable water is used during construction for compaction and dust suppression in Victoria. • Water not approved by appropriate authorities as being safe for consumption is considered non-potable.	• IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	As above for Wat-1
C.12	Mat-1	Transport of materials to site	• The IS Materials Calculator (V1.2) will be used to estimate transport related fuel and carbon emissions from the delivery of materials. • Materials are imported to site by contractors and are transported by road. • Fuel use by delivery vehicles will be 100% petroleum-based diesel fuel. • No consideration given to use of renewable fuels (such as biodiesel) as alternate fuel sources for transport fuel consumption.	• IS Materials Calculator (v1.2)	Material types Material quantities (tonnes) (see Mat-1 category) Number, type and capacity of delivery trucks Distance travelled to site (km)

Table 4. BAU Assumptions for Ene-1, Wat-1 and Wat-2 Base Case Development during Operational Phase

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
O.1	Ene-1	Purchased electricity	• No purchase of accredited GreenPower. • No onsite renewable energy initiatives e.g. solar PV. • No sourcing or purchasing of offsite renewable energy initiatives. • No sourcing or purchasing of community renewable energy initiatives for offsetting.	• The emissions factor for all purchased electricity for operational activities is sourced from the Victorian grid using the most recent NGA publication available (August 2019). • The use of onsite renewable energy sources, or purchasing equivalents, is considered operational best practice. • IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	kWh of all assets using purchased electricity
O.2	Ene-1	New buildings (occupied spaces)	• Heating and air conditioning design as per Building Code of Australia (BCA) minimum compliance (Deemed to Satisfy). • Internal loads as per Green Star Design & Build Calculator Guide.	• BCA minimum compliance. • NCC Section J Table 6.2a.	kWh of all assets using purchased electricity

<table>
<tr><th>REF #</th><th>IS CREDIT</th><th>ACTIVITY / ASPECT</th><th>BAU STANDARD & ASSUMPTION</th><th>BAU SOURCE/ JUSTIFICATION</th><th>DATA REQUIREMENTS (ESTIMATE OR ACTUAL)</th></tr>
<tr><td></td><td></td><td></td><td>• Reference star rating for appliances, measured by Energy Rating Label, are as follows:
○ Refrigerator - 2.5-star energy-rated appliance
○ Dishwasher - 3-star energy-rated appliance</td><td></td><td></td></tr>
<tr><td>O.3</td><td>Ene-1</td><td>External lighting</td><td>• The process undertaken to calculate the Base Case for external lighting is as follows:
○ The required lux levels are specified in the V/Line Standard for Lighting and Power Installations (NIST-5031);
○ The respective lux levels for various location applications (ie. Fence, car park) nominated by the V/Line Standard are then cross referenced to AS 1158 (Table 2.6-2.9) to obtain a lighting subcategory (‘P’ classification). This is done to enable reference to the Green Star Energy Calculator Guide power density factors (Table 65), as outlined in next point.
○ The lux level category classification from AS1158 can then be cross referenced to the GBCA Energy Calculator Guide, Table 65 (‘Standard practice external lighting power densities’) which provides a power density W/m^2 and applied appropriate area use in design and the Base Case energy calculated.
• The table below provides examples of the cross-referencing method between the 3 reference documents, explained above.
<table><tr><th>Vline Standard 'location'</th><th>Vline Standard Lux required</th><th>AS 1158 equivalent Classification Category</th><th>AS1158 Lux</th><th>Green Star Power Density</th></tr><tr><td>Access pathways</td><td>15h, 9v</td><td>P7</td><td>14h, 7v</td><td>1.4 W/m2</td></tr><tr><td>Staff Car Park</td><td>30 lux average</td><td>P6</td><td>21h, 7v</td><td>2.1 W/m2</td></tr><tr><td>Fence lighting</td><td>10 (min)</td><td>P11b</td><td>7h, 1.5v</td><td>0.6 W/m2</td></tr></table>H= horizontal lux, v = vertical lux as specified.
Note the lux levels used in adopting a category classification from AS1158 are lower than the VLine Standards lux level. This demonstrates a conservative (resulting in lower power densities when GBCA power factors referenced) has been used in calculating the Base Case.
• 24-hour operation profile (which assumes 100% lighting operation for 12 hours out of 24 hours).</td><td>• V/Line Standard – Lighting and Power Installations (NIST-5031) – Table 1
• GBCA Energy Consumption and Greenhouse Gas Calculation Guide – Table 56
• AS1158 Lighting for Roads and Public Spaces</td><td>kWh of all assets using purchased electricity</td></tr>
<tr><td>O.4</td><td>Ene-1</td><td>Internal lighting</td><td>• Internal lighting shall be based on the lighting classification lighting illumination nominated as per AS 1680 with maximum lighting power densities as per NCC Section J Table 6.2.</td><td>• NCC Section J Table 6.2a.
• GBCA Energy Consumption and Greenhouse Gas Calculation Guide – Section 14.3</td><td>kWh of all assets using purchased electricity</td></tr>
</table>

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
			• Lighting operation schedules as per as the Green Star Energy Consumption and Greenhouse Gas Calculation Guide.		
O.5	Ene-1	Vertical Transport	• Assume 219, 000 trips per year (lift duty: medium). • Lift standby power (kW) – 0.15kW. • Hours of lift standby operation (hrs/day) – 24. • Days lift standby (days/year) – 365.	• GBCA Energy Consumption and Greenhouse Gas Calculation Guide – Table 68	kWh of all assets using purchased electricity
O.6	Ene-1	New stations (occupied spaces)	• Hourly load to be converted to kWh based on an operating schedule of 13.3 hours per 24-hour period for the asset lifespan as dictated within the project PS&TRs (Table 1).	n/a	kWh of all assets using purchased electricity and/or gas
O.7	Ene-1	Signalling	• Signalling energy is not included within the IS rating footprint for this Project.	• Energy for motor on points – only one supplier • Energy for location boxes – standards too prescriptive • Energy from equipment huts – standards too perspective • Standards - VRIOGS 0.120 Victorian Signalling Principles - VRIOGS 012.1 Standard for Signaling Design and Documentation	n/a
O.8	Ene-1	Rolling Stock	• Diesel consumed by rolling stock is not included within the IS rating footprint for RRR projects.	n/a	n/a
O.9	Ene-1	Scope 2 Emissions	• The current NGA emissions factor available at the time of detailed design will be used for the estimation of Scope 2 GHG emissions associated with grid purchased electricity during the construction and operation of the asset in Victoria. • Projected reductions in the emission factor for Scope 2 GHG emissions in Victoria (due to 'greening of the grid') will not be included in the operational Ene-1 footprint over the asset life.	• NGA 2020 Factors	n/a
0.10	Ene-1	Removal of carbon sinks (land clearing / vegetation loss)	• The carbon emissions from land and vegetation clearing will be estimated using the Carbon Gauge calculator. • Assumes mandatory revegetation, offsetting, translocation, transplanting requirements under a planning permit only (i.e. does not include voluntary offsetting or voluntary 'net gain'). • Assumes all carbon pools (i.e. woody, non-woody, debris and soil) are removed where vegetation is removed and not replaced. • Extent of green area landscaping as per the design issued at tender phase.	• The Carbon Gauge calculator has been approved by ISCA as a means to calculate GHGs • Adherence to a planning permit / approval is BAU in the rail industry	Estimate of loss of carbon sinks (through loss of vegetation)

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
0.11	Ene-1	Transport of Waste	• Category A waste – if relevant, this waste will need to be taken to a treatment facility, prior to disposal at an EPA licensed landfill facility. • Category B waste – to be taken to the Lyndhurst disposal site. • Category C waste – to be taken to a nearby EPA licensed landfill – Derrimut, Brooklyn, Bulla or Ravenhall. • Non-Destructive Digging waste will be taken offsite as Prescribed waste - Cat C as above. • Non-Destructive Digging waste will be taken offsite as Prescribed waste - Cat C as above. • 100% of fill material as defined by the EPA guidance in Victorian IWRG600.2 will be disposed to landfill and not reused on site, on another project, or sent to a stockpiling facility.	• The largest road transport mode and size from the IS Materials Calculator is selected as it is assumed that industry will deliver materials in a cost effective and efficient manner (i.e. the least number of trips). • Lyndhurst is the only waste disposal site in Victoria that accepts contaminated B waste. • EPA Industrial Waste Resource Guidelines.	Estimated category of soil and tonnes of material for disposal.

O.11a	Wat-1 / Wat-2	New amenities	• The list below details Water Efficiency Labelling and Standard (WELS) ratings for fittings and fixtures (including tapware, toilets, dishwashers) as defined by Green Star 'standard practice'.
			  ○ Toilet – 3 Star (4.5L/flush)
			  ○ Urinals – 3 Star (2L/flush)
			  ○ Taps – 4 Star (7.5L/flush)
			• BAU is assumed to be 100% potable water is used for all station elements, including irrigation purposes.
			• Staff facilities include access to potable water (instant hot and chilled water).
			• Potable water is supplied for drinking and showering purposes.
			• Domestic water used on the rolling stock (e.g. toilets and drinking facilities) is excluded.
			• Recycled water measures:
			  ○ Rainwater Harvesting and Reuse – none
			  ○ Stormwater Harvesting and Reuse – none
			  ○ Greywater Treatment and Reuse – none
			  ○ HVAC Condensate Recovery and Reuse - none
				• WELS Star ratings
				• Green Star Potable Water Guide and Calculator
					Calculator to be used for:
					• General cleaning (platform, hose taps)
					• Building amenities (drinking, amenities, toilets flushing showers etc.)

O.12	Wat-1	New landscaped areas	• BAU is assumed that 100% potable water is used for all station elements, including irrigation purposes.	• Green Star Potable Water Guide and Calculator	Calculator to be used for landscaping
O.13	Wat-1 / Wat-2	Stabling/Wash down facilities and Train refill	• Any water used in association with train washdown facilities being installed/upgraded, would be included in the base case. This information is to be provided by RPV. • Water used in refilling train services will be included in the Base Case and information is to be provided by RPV. • Dewatering and water taps shall be provided along the stabling roads at	• V/Line Standard – Train Stabling Facilities (NIST-004.13)	

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
			regular intervals (every 25m) for both potable water and cleaning water. • Potable water accounts for approximately 80% of water use.		
O.14	Wat-1	Temporary Facilities	• Potable Water • Toilets 12L Flush • Urinal – 6L flush • Handwash 3L per wash (10L/min) • Per person, toilet use 2 times and urinal 3 times per 12 hour day as per page 19 of GBCA potable water guide	• GBCA potable water guide	• Male/female breakdown of site workers. Average amenity use figures per person.

Table 5. BAU Assumptions for Mat-1 Base Case Development during Construction Phase

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
M.1	Mat-1	All materials listed below	• Version 1.2 of the IS Materials Calculator will be used to estimate the materials lifecycle environmental impact (IS EnviroPoints) and embodied carbon emissions from the use of materials on the Project.	• The IS Materials Calculator is an ISCA developed and approved tool for benchmarking	As outlined below
M.2	Mat-1	Transport of key materials	• The business as usual assumption for the transport of key materials will be determined by an average of the distance between the corridor and up to three potential suppliers. • Key materials are: - Concrete - Ballast - Steel - Aggregates	• IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.	Transport distance (km)
M.3	Mat-1	Signalling equipment CSR Routes included	• Signalling equipment is not included within the IS rating footprint for this Project. • CSR routes included as per reference case.	• Location boxes – standards too prescriptive and no are for influence. • Equipment huts – standards too prescriptive and no are for influence. • Signalling bespoke equipment – minimal suppliers • Signal masts – standards too prescriptive and no are for influence. • Distances between signals was suggested and rejected by VLine. • Signal cables – standards too prescriptive and no are for influence. • Standards - VRIOGS 0.120 Victorian Signalling Principles - VRIOGS 012.1 Standard for Signaling Design and Documentation	n/a

<table>
<tr><th>REF #</th><th>IS CREDIT</th><th>ACTIVITY / ASPECT</th><th>BAU STANDARD & ASSUMPTION</th><th>BAU SOURCE/ JUSTIFICATION</th><th>DATA REQUIREMENTS (ESTIMATE OR ACTUAL)</th></tr>
<tr><td>M.4</td><td>Mat-1</td><td>Structural concrete</td><td>• Binder Content defined below as per Green Star Mat-4 Reference Mixes.
• Assume 5% Supplementary Cementitious Materials (SCM) (of total binder content).
<table><tr><th>Concrete Strength grade (MPa following AS1379)</th><th>Portland cement content to be used in establishing the reference case (kg Portland cement/m^3 concrete)</th></tr><tr><td>20</td><td>280</td></tr><tr><td>25</td><td>310</td></tr><tr><td>32</td><td>360</td></tr><tr><td>40</td><td>440</td></tr><tr><td>50</td><td>550</td></tr><tr><td>65</td><td>550</td></tr><tr><td>80</td><td>610</td></tr><tr><td>100</td><td>660</td></tr></table>• Base case does not consider Recycled Concrete Aggregate (RCA).</td><td>• Defined in AS 1379, and are the default reference mixes in the IS Materials Calculator (V1.2)</td><td>Amount of concrete used for entire Project (all types) (tonnes)</td></tr>
<tr><td>M.5</td><td>Mat-1</td><td>Aluminum</td><td>• All aluminum used on the Project will be primary (new) and in accordance with relevant AS/NZS.
• As per the IS Materials Calculator, no secondary (recycled) aluminum is assumed in the base case.</td><td>• IS Materials Calculator Guidelines</td><td>Amount of aluminium used for entire Project (tonnes)</td></tr>
<tr><td>M.6</td><td>Mat-1</td><td>Steel reinforcement and structural steel</td><td>• All reinforced and structural steel used is new (virgin) for all steel works and in accordance with relevant AS/NZS.
• No steel contains recycled content.
• The business as usual preference will be to source steel from the least cost location.</td><td>• AS 5100.1:2017 – Bridge design – Part 1: Scope and general principles</td><td>Amount of steel used for entire Project (all types) (tonnes)</td></tr>
<tr><td>M.7</td><td>Mat-1</td><td>Track structure</td><td>• Track structure will be based on V/Line Standard for Track Design (NIST-2618)</td><td>• V/Line Standard – Track Design (NIST-2618)</td><td>Engineering drawings/ dimensions
Track chainage (km)</td></tr>
<tr><td>M.8</td><td>Mat-1</td><td>Materials wastage</td><td>• Procured material quantities will include a wastage factor.
• The intent of the following BAU material wastage contents is to account for these materials in the Project modelled Mat-1 base case.
• This will then allow a more accurate comparison between base case and actual material quantities procured, and reward where genuine efforts have been made by Construction teams on site to reduce materials wastage.
• The following wastage quantities are assumed:</td><td>• IS base cases for relevant recent projects within Victoria and from other States were referenced to confirm these assumptions.
• Percentages to be applied as uplift to total calculated materials quantities (from bill of quantities).</td><td>Amount of materials used for entire Project (tonnes)</td></tr>
</table>

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
			○ 5% wastage for all steel reinforcement bar used on site. ○ 5% concrete wastage for all ready-mix concrete. ○ 5% wastage for pre-cast concrete, including steel reinforcement. ○ 30% wastage for all shotcrete (including steel fibre). ○ 10% wastage for all grout. ○ Asphalt – 0% RAP ○ 3% wastage for all other structural materials and items e.g. steel rail lines, steel bolts.		
M.9	Mat-1	Gravel and crushed rock	• All gravel and crushed rock materials for pavements (carparks, roads, and footpaths), track foundation, and drains will be virgin/quarried materials and imported to site. • No rock crushing equipment will be used on site. • All uncontaminated excavated spoil from the Project will be disposed of in a landfill and not reused on site, on another project, or sent to a stockpiling facility. • Also refer to waste transportation assumptions.	• PS&TR requires all excess spoil to be removed from boundary in accordance with VicTrack and EPA requirements • All soil re-use must be approved by RPV in consultation with VicTrack and in accordance with VicTrack Soil Reuse Guidelines	Amount of gravel and crushed rock used for entire Project (tonnes)
M.10	Mat-1	Aggregate sand	• All sand used on site is virgin material or manufactured sand.	• VicRoads approves but does not mandate the use of sand as aggregated (refer to VicRoads Technical Note 107 – Use of Recycled Materials for Road Construction). Its use is not considered BAU.	Amount of sand used for entire Project (tonnes)
M.11	Mat-1	Aggregate glass	• No crushed glass will be used as aggregate.	• VicRoads approves but does not mandate the use of crushed glass as aggregate (refer to VicRoads Technical Note 107 – Use of Recycled Materials for Road Construction and VicRoads Standard Section 702 – Subsurface Drainage). Its use is not considered BAU.	Amount of crushed glass used for entire Project (tonnes)
M.12	Mat-1	Asphalt and Recycled Asphalt Pavement (RAP)	• BAU is densely graded asphalt with a bitumen binder. • No RAP is used for asphalt in regional areas. • Hot mix asphalt (i.e. no warm mix or cold mix) is BAU.	• VicRoads have trialed and Type Approved RAP in a number of pavement types, however, they are yet mandate its use in any projects other than trial projects. • There is limited data available relating to the total volume and percentage of projects across Metropolitan Melbourne that have utilised RAP in the past five years. Functional requirements of specific projects and the geographic location are considered to be the two largest constraints in the broader adoption of RAP across Victoria.	Total amount (tonnes) and types of asphalt used for entire Project
M.13	Mat-1	Recycled crushed concrete	• No recycled crushed concrete is used to supplement the requirement for aggregate.	• VicRoads approves but does not mandate the use of recycled crushed concrete (refer to VicRoads Technical Note 107 –	Total amount (tonnes) and types of recycled

REF #	IS CREDIT	ACTIVITY / ASPECT	BAU STANDARD & ASSUMPTION	BAU SOURCE/ JUSTIFICATION	DATA REQUIREMENTS (ESTIMATE OR ACTUAL)
				Use of Recycled Materials for Road Construction for Class 2, 3 and 4). It use is not considered BAU. • Examples of other projects that did not use recycled crushed concrete as an aggregate include the Victorian Desalination Plant and the City-Tulla Widening.	crushed concrete used for entire Project
M.14	Mat-1	Polyvinyl Chloride (PVC)	• Use of PVC for drainage piping is BAU. • PVC will be used for 'drainage off structure' where it is hidden from direct sunlight. • PVC will be used for 'track drainage' and under pavement. • PVC piping will have no recycled content	• Consultation with design engineers. • ISO 1452:2009: Plastics piping systems for water supply and for buried and aboveground drainage and sewerage under pressure – Unplasticised polyvinyl chloride (PVC-U)	Amount of piping (tonnes) used for entire Project (tonnes)
M.15	Mat-1	Polyethylene (PE)	• Use of PE for drainage piping is BAU.	• Consultation with design engineers. • VicRoads approves but does not mandate the use of recycled HDPE products (refer to VicRoads Road Design Note RDN 05-02 December 2018 – Accepted drainage products). Its use is not considered BAU. • Consultation undertaken by LXRA with supplier organisation indicated that they do not produce PE pipes with recycled content as they can't guarantee the quality.	Amount of piping (tonnes) used for entire Project (tonnes)
M.16	Mat-1	Reinforced concrete pipes	• Use of concrete pipes reinforced with cellulose fibre is considered BAU for stormwater drainage within the road pavement, as defined into VicRoads Road Design Note RDN 05-02C December 2018. • Concrete box culverts are considered BAU. • Typically used for 'cross drainage' and piped under roads. Would also be used in stormwater storage.	• VicRoads approves the use of alternate piping materials (refer to VicRoads Road Design Note RDN 05-02C December 2018 – Accepted drainage products), but their use is restricted to outside the road pavement and not considered BAU.	Amount of piping (tonnes) used for entire Project (tonnes)
M.17	Mat-1	Glass	• All glass for the purposes of buildings and structures will be new and in accordance with relevant AS/NZS. • The business as usual preference will be to source glass from the least cost location.	• Consultation with major government projects in Victoria.	Amount of glass (tonnes) used for entire Project (tonnes)
M.18	Mat-1	Timber	• Sawn hardwood will be used for building purposes (e.g. interior finishes such as flooring). • Softwood (structural pine) will be used for structural purposes.	• Consultation with major government projects in Victoria.	Amount of timber (t or m^3) used for entire Project (tonnes)
M.19	Mat-1	Reinforced Concrete Sleepers	• Sleepers used for the Base Case are Standard Sleepers to VLiine standard.	• NIST-2651	Amount of sleepers used (tonnes or m3) for the Project, to compliant spacing as required by the specification