Ashburton Second Urban Bridge and Associated New Road

Lighting Assessment

Ashburton District Council

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1 Introduction

1.1 Ashburton Second Urban Bridge - Project Description

The Ashburton District Council (ADC) proposes to construct, use and maintain a new 2-lane bridge across the Ashburton River and an associated road that directly links Chalmers Avenue through 'green fields' to the east of Tinwald to a connection with Grahams Road, Ashburton. The proposed new bridge and associated new road is collectively referred to herein as the Ashburton Second Urban Bridge project (ASUB) (see Figure 1-1). The ASUB will provide an alternative urban route between east Tinwald and Ashburton township. The distance of the ASUB is approximately 2 kilometres (km).

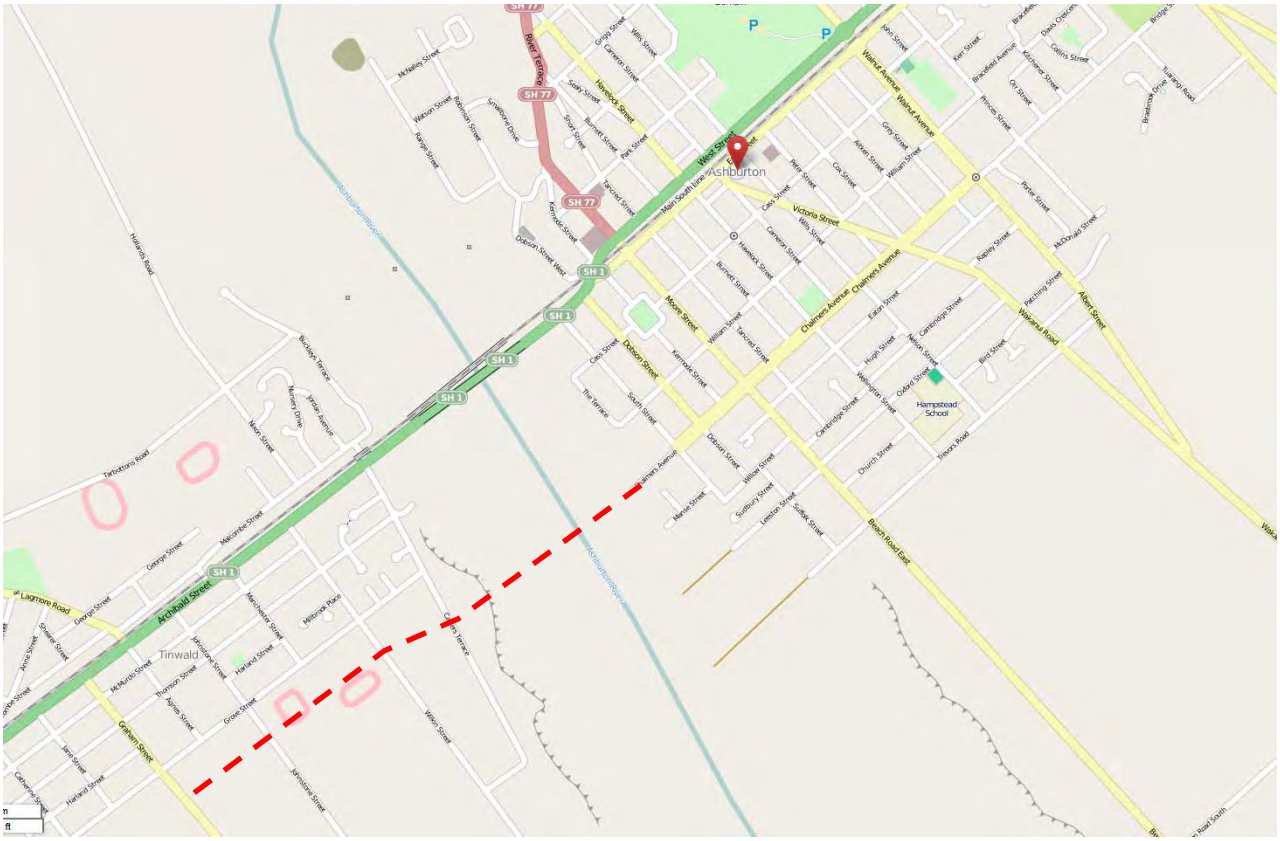


Figure 1: Overview Plan (approximate location shown by red dashed line)

The proposed ASUB project is only one of a number of related transport projects for the Ashburton urban area that was identified in the Ashburton Transportation Study (ATS) completed in 2006. The purpose of the ATS was to identify present and future transportation demands within the Ashburton study area for the 20 year period through to 2026, and to recommend measures to optimise the performance of the land transport system within Ashburton township. The proposed ASUB project is not being undertaken in isolation but rather fits within an overall strategy for transport network improvements within the township.

ADC is seeking a new designation to include the entire infrastructure associated with the ASUB including a 2-lane bridge, traffic lanes (including cycle lanes and parking), footpaths / pedestrian connections, intersections, stormwater infrastructure, landscaping, ancillary road infrastructure (e.g.; services within the road corridor), and road construction.

The area through which the proposed designation runs is currently 'green fields', and comprises rural-residential allotments ranging in size from 4,820m^2 (0.4820ha) to 50,507m^2 (5.5070ha). The 2010 Ashburton District Plan review rezoned approximately 71.6ha of land located to the east of the current Tinwald urban boundary. 15.7ha has been rezoned to Residential C, which allows subdivision down to 360m^2 except where public sewage reticulation is not available, in which case 1,000m^2 is the minimum allotment size. 55.9ha has been rezoned to Residential D, which allows subdivision down to 4,000m^2 except where public sewage reticulation is not available, in which case the minimum allotment size is 10,000m^2 (1ha). The current Tinwald urban area is zoned Residential C.

Traffic modelling indicates that traffic volumes on key routes throughout Ashburton are likely to increase significantly by 2026 regardless of a second bridge. This is expected to result in significant congestion and delays at a number of locations, including the existing bridge and the intersection of SH1 with Moore Street (SH77).

Vehicle number plate surveys undertaken in 2006, and repeated again in 2012, confirm that the bulk of the traffic on the existing bridge during peak times is local traffic between Tinwald and Ashburton. Less than 30% of the traffic is "through traffic" on SH1. The existing state highway bridge is nearing capacity at present, but is still functioning adequately most of the time. ADC and the New Zealand Transport Agency (NZTA) have agreed the traffic issue on the current bridge is primarily a local traffic issue and that the ASUB project will primarily be to serve the local traffic needs of the Tinwald and Ashburton communities. Once constructed, the ASUB will become an extension of the existing urban road network within east Tinwald and Ashburton township and will be maintained and controlled by ADC. It will not become the state highway.

Physical construction of the ASUB is not required until approximately 2026, at which time traffic congestion on the existing bridge is expected to reach a point which justifies the need for a second bridge. Traffic modelling indicates that up to 14,000 vehicles per day (vpd) are likely to use a second bridge by 2026, with between 5-10% expected to be heavy goods vehicles (HGV's). This traffic is likely to distribute amongst side roads to the north and south of the bridge and is expected to result in an overall reduction in total average travel time for all vehicles in the Ashburton urban area.

It is expected that by the time the ASUB project is required to be constructed, the environment within which the proposed designation is located will have undergone a degree of change from the current low density rural-residential land use to a land use that is in accordance with the new residential zonings within the district plan. ADC wishes to protect the route for a future bridge and associated new road before too much further development occurs. The designation for the ASUB is being sought now in order to secure the required land to ensure the project can proceed at the time that it is needed.

The purpose of this report is to assess the effects of lighting on the residential areas that will be located in proximity of the new bridge and roads leading to the new bridge which is part of the proposed ASUB project. This report will consider potential effects such as spill light, glare and sky glow that may result from the proposed lighting installations.

This report also makes recommendations on the type of lighting installations required to mitigate any adverse lighting effects. With the proposed mitigation, it is considered that overall lighting effects will be minimal.

2 Executive Summary

The flowing table outlines the assessed effects of the proposed scheme and recommended mitigation.

Area	Lighting Effect	Lighting Mitigation
Section 1: Section of carriageway between intersections	Minor, Spill light and Glare	Use Type III Cut off luminaire
Section 2: Intersections	Minor, Spill light and Glare	Use Type III Cut off luminaire
Section 3: Bridge	Minor, Spill light and Glare	Use Type III Cut off luminaire
Construction Lighting	Moderate, Intermittent, Temporary, Spill light and Glare.	Use Type III Cut off luminaire, Screening, appropriate measures in Construction Environmental Management Plan

3 Standards and District Plan provisions

3.1 Lighting Standards

Below is a list of relevant lighting standards which this project will be designed to comply with:

- AS/NZS 1158.0:2005 Lighting for Roads and Public Spaces Part 0 – Introduction;
- AS/NZS 1158.1.1:2005 Lighting for Roads and Public Spaces Part 1.1 - Vehicular Traffic (Category V) Lighting - Performance and Installation Design Requirements;
- AS/NZS 1158.3.1:2005 Lighting for Roads and Public Spaces Part 3.1 - Pedestrian Area (Category P) Lighting - Performance and Installation Design Requirements;
- Australian Standard AS 4282:1997 - Control of the Obtrusive Effects of Outdoor Lighting .

3.2 AS/NZS 1158 - Road Lighting Standards (General)

For this Project, all local and residential road lighting design, together with the type of luminaires proposed, will conform to the requirements of the current Australian/New Zealand Standard AS/NZS 1158 Road Lighting (AS/NZS 1158).

AS/NZS 1158 ensures safe vehicle and pedestrian movement and the timely identification of objects and pedestrians by the motorist's eye, while travelling at speed during the darkness hours. AS/NZS 1158 is considered to be an acceptable standard for lighting roads in New Zealand because it provides design requirements and recommendations prepared by committees of experts from industry, government bodies, road users and other sectors. These standards reflect the latest in scientific and industry experience. Under AS/NZS 1158, road lighting is separated into two categories:

- 'Category V' primarily for vehicular traffic; and
- 'Category P' which is for pedestrians mixed with low speed traffic.

There are four subcategories of category V and twelve subcategories of category P, the latter ranging from non-arterial roads to pedestrian footpaths and car parks.

AS/NZS 1158 addresses both spill light and glare restraints, and references the following issues:

- Upward Waste light component
- Sideways spill light component
- Direct viewing of the luminaire (or lamp source)
- Colour of the light.

As road lighting is provided for overall community safety (crash prevention and pedestrian safety), a higher tolerance level has been accepted for the associated glare and spill lighting. AS/NZS 1158 contains limitations on glare, spill light and upward waste light. Within these sections, AS/NZS 1158 cross-references AS 4282 and explains that the spill lighting levels from road lighting is not

considered high enough to be obtrusive, but glare from the road lantern may be of annoyance to adjacent residences. AS/NZS 1158 discusses mitigation measures, such as shielding or the use of cut-off (Type III) luminaires. An explanation of the three different types of luminaires is provided below in Section 4.5 of this report.

In the same cross reference, AS 4282 notes that glare is a possibility if the residents are in direct view of luminaires. If cut-off luminaires are used and the amount of glare as defined by a certain quantity of glare (from the Threshold Increment) is below a certain number (20% as set out in AS/NZS 1158), it is then considered to be adequately controlled. The Threshold Increment (Glare) expected from using full cut-off (Type III) luminaires will be 10.92% for the bridge and 13.03% for the roads leading to/from the bridge. Hence, the type of luminaire is compliant with AS/NZS 1158.

3.3 AS 4282:1997 - Control of the Obtrusive Effects of Outdoor Lighting

The Australian Standard AS 4282:1997 "Control of the Obtrusive Effects of Outdoor Lighting" (AS 4282) addresses both spill light and glare. While AS 4282 has been cross-referenced in AS/NZS 1158, it has not been universally or mandated in New Zealand. There is controversy amongst professional illumination engineers in New Zealand over the technical content of this standard, which is considered to be too onerous and not specific enough for general use for all exterior lighting applications. It should also be noted that AS 4282 specifically excludes public road lighting and was originally intended for evaluating lighting of tennis courts (and similar high illuminance areas) located within residential areas. The use of AS 4282 is not appropriate for road lighting, as the illumination levels for road lighting are relatively low, and the functionality of the lighting for safety of pedestrian and vehicular movement has a higher priority than sources of other potentially obtrusive light.

However, AS 4282 does provide some guidance on what spill light and glare effects are acceptable and assists in evaluating spill light and glare when viewed from a specific location, such as a residential property. To this end, a 10 lux illumination level has been taken as the appropriate cutoff level to determine whether the lighting from the road, cycle way or walkway can be deemed obtrusive and present a nuisance to residents (in accordance with AS 4282). This level (10 lux) of spill light is considered acceptable as a proven criteria from existing installations in lieu of any specific requirement within AS/NZS 1158 and has also been used on other State Highway projects throughout New Zealand as a suggested target level.

3.4 Luminance Control Standard

There is no signage lighting proposed for the project. If signage lighting is added at a later stage, it should be considered separately as outdoor lighting to comply with AS 4282.

3.5 Partially Operative Ashburton District Plan

As notices of requirement for designations are being sought, it is not essential that the Project comply with rules relating to lighting in the Partially Operative Ashburton District Plan (the District Plan). However, when designing the Project lighting and preparing this report, any relevant District Plan provisions and the lighting standards discussed above have been considered, as they provide some guidance as to the appropriate lighting for this Project.

The District Plan contains the following rules relevant to the Residential Zones:

Rule 4.10.4 Lighting

a) All exterior lighting shall be directed away from adjacent properties, roads, and railways and shall not be projected above a horizontal line from the light source.

b) No activity shall result in a greater than 3 lux spill (horizontal and vertical) of light onto any adjoining property, measured at any point more than 2m inside the boundary of the adjoining property.

Appendix A contains a vertical and a horizontal illuminance calculation showing compliance with Rule 4.10.4. Within 2m of the designation boundary and at 1.5m height (the standard height for a window), the calculations show the maximum vertical light spill will be approximately 1.1 lux. The maximum horizontal light spill will be approximately 1.6 lux.

4 Lighting Effects and types of luminaires

4.1 Types of Adverse Lighting Effects

There are three main types of lighting effects that have the potential for varying degrees of intrusiveness to both vehicles and residents living near lighting installations. They are:

- spill light
- glare
- sky glow (upward light)

These effects are illustrated in Figure 2 below and explained in more detail in this section of the report.

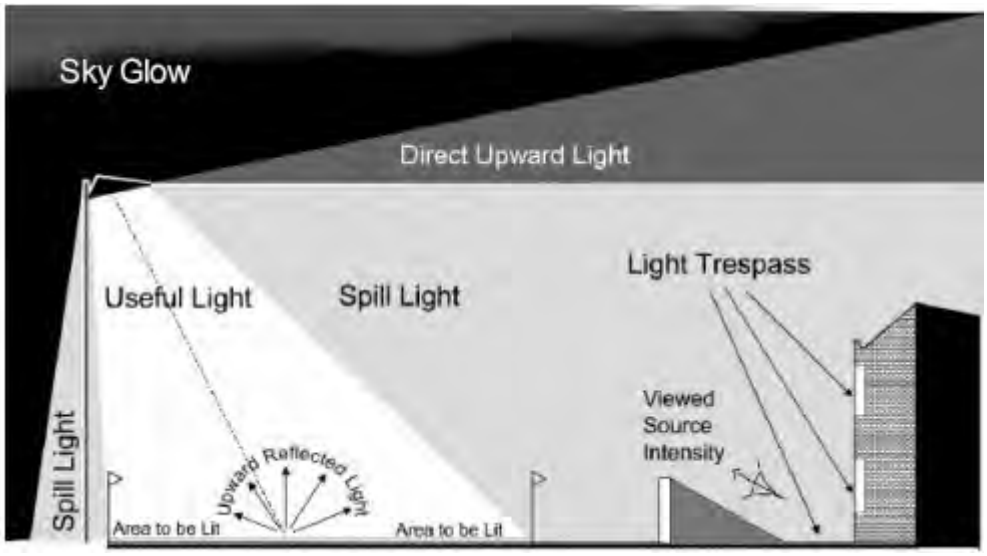


Figure 2: Types of Obtrusive light

4.2 Spill Lighting

Spill lighting or "Light Trespass" can be described as the effects of light or illuminance that strays from its intended purpose. On a roadway lighting system, it is desirable to have all the light directed onto the roadway and not on the adjacent area. Spill light effects cannot be totally avoided but it can be reduced through luminaire selection, mounting height and tilt angle. An example of how spill light will be controlled based on the concept lighting design for the Project is provided in Appendix A to this report. The calculation in Appendix A shows spill light will not be an issue (more than 10 lux) within 2m inside the property boundary as required by the Ashburton District Plan from the lighting columns proposed for the Project. A "worst case example" at the Wilkins Road intersection has been modelled in Appendix B of this report to show that spill light compliance could be achieved (i.e. less than 10 lux at an approximate distance of 20m from the lighting columns).

4.3 Glare

Glare is the brightness of a luminaire when compared with the brightness of the background against which they are seen. For instance, a road luminaire looks much brighter (and has higher glare) when viewed against a black sky, than when viewed in the surroundings of a brightly lit city street. Probably the most annoying and safety related aspect of light pollution is glare. It is defined by the Illumination Engineering Society (IES) as the sensation produced by luminance in the visual field that is sufficiently greater than the luminance to which the eye has adapted to cause annoyance, discomfort, or loss of visual performance and visibility.

The three types are as follows:

- **Blinding glare** - describes effects such as that caused by staring into the sun. It is completely blinding and leaves temporary or permanent vision deficiencies.
- **Disability glare** - describes effects such as being blinded by oncoming car lights, or light scattering in fog or in the eye, reducing contrast, as well as reflections from print and other dark areas that render them bright, with significant reduction in sight capabilities.
- **Discomfort glare** - does not typically cause a dangerous situation in itself, though it is annoying and irritating at best. It can potentially cause fatigue if experienced over extended periods.

Under AS/NZS 1158, if glare can be kept below the 20% maximum of Threshold Increment, AS/NZS 1158 indicates that glare is controlled. In computer calculated renditions for the Project, glare will be assessed at the detailed design stage, and will be compliant with AS/NZS 1158 in all areas. Two example calculations are provided in **Appendix C** to this report, which shows a Threshold Increment (Glare) of 10.92% and 13.03% found at the optimal pole spacing increments, which is well below the requirements of 20% permitted in AS/NZS 1158.

4.4 Sky Glow

Urban sky glow is the result of stray light being scattered in the atmosphere brightening the natural sky background level. This effect is extremely detrimental to astronomers as well as annoying to many people in the general public. The overall impact of sky glow through the area east of Tinwald has been limited due to there being no road lighting for approximately 1.6km through the rural environment. This effect is difficult to mitigate, as it is light that reflects either directly or indirectly off the road surface. Sky glow can be reduced by using darker coloured surfaces (i.e. black asphalt, rather than a light coloured chipping, and dark painted or coloured concrete, rather than white). It will also be reduced by the specification of street luminaires that are able to provide good optical control.

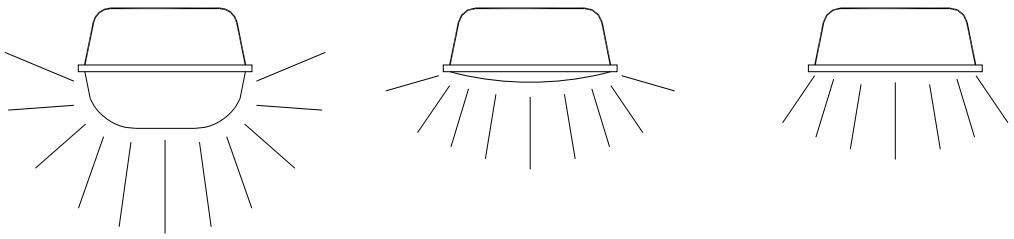
Any road luminaire must limit its Upward Waste Light Ratio (UWLR) below 3% (of the total light output). This is to minimise the direct light content to the night sky environment. The two example calculations provided in Appendix C indicate an UWLR value of 0.0%. This means 100% of the light from the luminaire is being directed where the light is required (downward).

4.5 Types of Luminaires

Road lighting luminaires are designed around three basic design functions:

- Type I: open – these luminaires are nearly obsolete. They allow for the widest spacing but create the greatest glare, exceeding that set by AS/NZS 1158 For this reason, open luminaires will not be used on the Project
- Type II: semi cut-off - these luminaires are widely used for most road lighting projects throughout New Zealand as a compromise between energy consumption and adequate lighting for safe driving
- Type III: full cut-off (or aero screen/flat glass). These luminaires have a completely flat visor, which produce zero upward light above the horizontal plane. The lamp or LED are housed in the upper part of the internal optical housing, which helps to minimise any adverse effects of glare. They are considered to be very 'environmentally friendly' because they reduce spill light. However, when compared to the other two types of luminaires, a greater number of luminaires are typically required to achieve the required lighting parameters.

Diagrams of each type of luminaire are shown below:



Type I Type II Type III

5 Proposed Lighting for the Project

5.1 Introduction

As the Project is located in a rural area soon to be converted into a medium density area, and for road safety reasons, the whole road, the intersections and high conflict areas are to be illuminated. A concept lighting design is shown in Appendix D. All luminaires selected will conform to the photometric and material requirements of AS/NZS 1158. The use of future, new technology control systems is not included in the current lighting design.

5.2 Luminance and Illuminance Levels

For this Project, the road lighting on the main carriageway leading to the bridge will be designed to meet full compliance with AS/NZS 1158 subcategory V4.

- luminance levels of no less than 0.50 candela per square metre
- overall uniformity (minimum-to-average) to be above 0.33
- longitudinal uniformity to be above 0.3
- Threshold Increment (T.I. for glare control) below 20%
- Minimum illuminance to be above 5.0 lux for intersections.

Any Category V road luminaire must have an Upward Waste Light Ratio (UWLR) of below 3% to comply with AS/NZS 1158. This gives an indication of the tight containment of lighting within a specifically designed task area like a road. By using a full cut-off (Type III) luminaire, it is anticipated that the UWLR will be 0.03%, which complies with Category V of AS/NZS 1158. Under AS/NZS 1158, the lighting for the following local roads in Ashburton District must comply with the relevant subcategory: New road (V4), Road on Bridge (V3). The intersection of Grahams Road and the new road leading to the bridge can be considered an isolated intersection where the lighting must comply with partial subcategory V4.

5.3 Lighting Column Arrangements

The lighting column arrangement will be designed as "Staggered" to provide the optimum solution for this installation.

The use of a Staggered installation allows for maximum pole spacing, better uniformity and reduce the number of poles and luminaires which lower the initial cost of the installation and the maintenance and running cost in the future.

5.4 Lighting Column Heights

The recommended pole height for this installation will have a luminaire mounting height of 10.6m. The lighting columns will all be frangible galvanized sectional steel design with a ground planted base section. Any columns requiring attachment to over bridges will have a purpose built bracket attached to the bridge structure and all cabling will be concealed within the bridge.

5.5 Pedestrian and Cycleway Lighting

All cycle way lighting will be incorporated within the road lighting design as the cycle way is part of the road geometry.

5.6 Light Spill Levels

A typical illuminance plot for a straight section of the Project is shown in Appendix A to this report. This analysis shows no significant spill light at a distance of 20m or further from the carriageway.

5.7 Construction Lighting

5.7.1 Construction Activity or Security Lighting

Temporary lighting for construction activities or security lighting for construction sites will need glare and spill light control compliant with AS 4282.

5.7.2 Temporary Road Lighting

For any existing roadway that is to be diverted, modified or re-routed to allow the construction of any new works, existing lighting levels must be maintained or improved on during the works. If existing luminaires must be disconnected or removed before adjacent new lighting has been commissioned, then temporary lighting shall be provided. The nature of this new temporary lighting, including any new luminaires and columns will be compliant with AS/NZS 1158. This lighting has not yet been designed, but will be designed under the CEMP, and be fully compliant with the requirements of AS/NZS 1158.

Mitigation of any lighting effects will be controlled via the use of Type 2 semi cut-off luminaires or Type III full cut-off luminaires (being the same or similar to those proposed in the concept lighting design for this Project).

Lighting for these areas should be designed or reviewed by an accredited Illumination Engineer as part of the CEMP.

5.8 Assessment of Proposed Lighting

Glare will be minimised by the use of cut-off (Type III) LED luminaires and the completed lighting design will be compliant as to be below the maximum Threshold Increment (Glare) of 20% outline within AS/NZS 1158.

A typical illuminance plot of a straight section of the proposed road is shown in Appendix A. This shows no significant spill light within 2m inside the property boundary as required by the District Plan.

The maximum Upward Waste Light Ratio (UWLR) recommended in AS/NZS 1158 should be equal to or less than 3%. The calculations contained in Appendix C show the proposed luminaire comply with this requirement, whereby 100% of the light is directed downward and on the road where it is required.

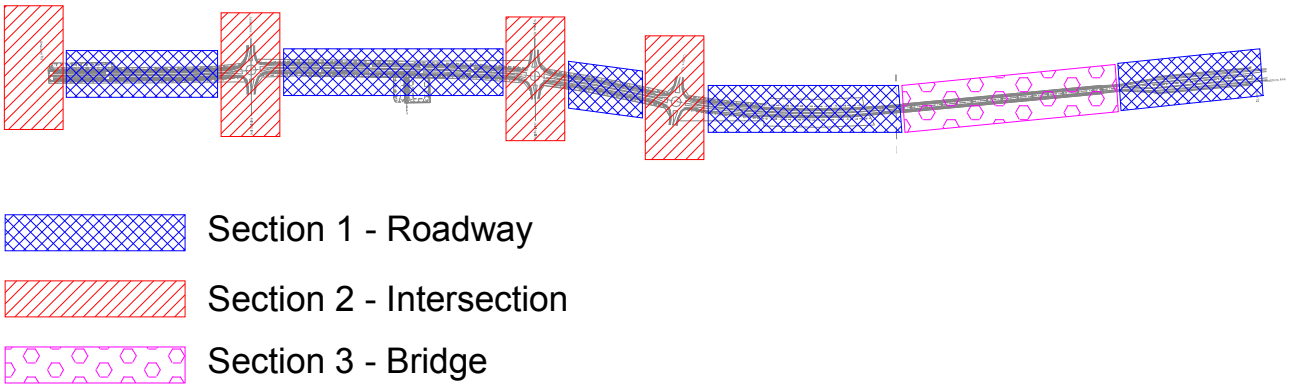
The intersections will be where a higher concentration of light is required due to the minimum lighting requirements for crossroad intersections and roundabouts as prescribed in AS/NZS 1158. Appendix B shows clearly that for the two possible configurations of crossroad intersection or roundabout, there will be minimal effect on the adjoining properties and consequently will have only a minor effect on the existing residents.

Because of the method(s) of controlling glare and spill light describe above, the effects of sky glow are considered to be minimal. Further mitigation will not be required as the lighting effects on the affected area are considered acceptable.

6 Assessment of Lighting Effects

In this section of the report a road lighting assessment is provided for the ASUB project.

- The existing environment
- The proposed lighting solution for road traffic, intersections, cycle ways and construction
- An assessment of potential lighting effects of the permanent lighting against the relevant lighting standards
- Any proposed mitigation measures.



6.1 Section One: Straight section of carriageway between intersections

6.1.1 Existing and Future Environment

The area where this project will be located is currently rural on the South side of the Ashburton River but is expected to gradually develop in accordance with the medium – low densities allowed for within the District Plan for Residential C and D Zones. There is the potential for new residential dwellings to be constructed right up to the proposed designation boundary in places where the designation runs through properties. Internal boundary setbacks will apply in instances where the proposed designation boundary runs along property boundaries, in which case dwellings could be constructed to within 6m of the proposed designation boundary.

On the North side of the new bridge where it will be connecting onto Chalmers Avenue the area contains a mix of residential property on the East side and a concentration of industrial property on the West side of Chalmers Avenue. Very minimal to no lighting is currently installed in the proposed project area.

6.1.2 Proposed Environment during Operation

The main carriageway will consist of two traffic lanes which include a cycle and parking lane, with one lane in either direction separated by a 2m flush median throughout until it connects the new

bridge. The bridge itself will consist of two traffic lanes which include a cycle lane, with one lane in either direction.

On the straight sections of roads between the intersections and the road leading to the bridge the lighting would incorporate luminaires with a full cut-off (Type III3) optic installed on 10.6m column throughout in a Dual Staggered arrangement.

The use of Type III optic luminaires will minimise the effect of spill light and upward waste light into the night sky environment.

6.1.3 Description of Lighting Effects

The new road lighting layout will require areas such as conflict points and intersections to have an increased level of illumination from the main carriageway, to meet compliance with AS/NZS 1158.1.1 subcategory which will have to be met at the time of design.

6.1.4 Assessment of Lighting Effects

The Concept Lighting Design has been designed in accordance with AS/NZS 1158 compliance for spill lighting and glare. In addition, Rule 4.10.4 of the District Plan requires no greater than 3 lux spill (horizontal and vertical) at any point more than 2m inside the boundary of the adjoining property. Vertical and horizontal illuminance calculations show compliance with Rule 4.10.4 whereby the maximum vertical light spill will be approximately 1.1 lux and the maximum horizontal light spill will be approximately 1.6 lux.

The effect of lighting coming from the new main carriageway on both existing and future residents will be less than minor.

The only effect will be a perceived increase of lighting as there has been no previously installed road lighting installed in the area.

6.1.5 Recommended Mitigation Measures

As the road lighting will be designed to the requirements of AS/NZS 1158 for glare, spill light and upward waste light, the lighting effects will not be obtrusive. Therefore, no further mitigation will be required.

It is recommended that a condition is placed on the designation requiring that road lighting shall be designed in general accordance with the Concept Lighting Design (attached at Appendix D) and shall be designed to meet the requirements of AS/NZS 1158 - Road Lighting Standards and AS 4282:1997 - Control of the Obtrusive Effects of Outdoor Lighting (or the equivalent standards at the time of detail design).

6.2 Section Two: Grahams Road, Johnstone Street, Wilkins Road and Carters Terrace Intersections

6.2.1 Existing and Future Environment

Refer to Section 6.6.1 above for a description of the existing and future environment.

No lighting is currently installed in the proposed project area.

6.2.2 Proposed Environment during Operation

The proposed road layout plans for the project show the new link road intersections with Grahams Road, Johnstone Street, Wilkins Road and Carters Terrace will consist of a standard crossroad type intersection with right-turn bays. The proposed lighting at these new intersections would incorporate luminaires with a full cut-off (Type III) optic installed on 10.6m column.

The number of luminaires will be minimal as these intersections will be kept to a minimal size.

The use of Type III optic luminaires will minimise the effect of spill light and upward waste light into the night sky environment.

Should roundabouts be constructed at these intersections, the number of luminaires would increase.

6.2.3 Description of Lighting Effects

The new road lighting layout will require areas such as conflict points and intersections to have an increased level of illumination from the main carriageway, to meet compliance with AS/NZS 1158.1.1 subcategory which will have to be met at the time of design.

6.2.4 Assessment of Lighting Effects

The effect of lighting on this project will be on both existing and future residents who have properties located near or adjacent to the future intersections.

The use of standard crossroad intersection configurations will allow for a minimal number of poles and luminaires to be installed. However should roundabouts be constructed at these intersections, these will require a subsequent increase in the number of lighting poles and luminaires to achieve compliance with AS/NZS 1158.

Appendix B shows clearly that for the two possible configurations of either crossroad intersection or roundabout, there will be minimal effect on the adjoining properties and consequently will have only a minor effect on the existing residents. Because of the method(s) available to control glare and spill light, the effects of sky glow are considered to be minimal. Further mitigation will not be required as the lighting effects on the affected area are considered acceptable.

The impact for those residents will likely be perceived as being more than minor as they are currently not affected by any road lighting. Although the proposed lighting solution will ensure that it complies with AS/NZS 1158 Road Lighting Standards, the existing residents might perceive the new road lighting as intrusive regardless of the lighting complying with all road lighting standards.

The Concept Lighting Design has been designed in accordance with AS/NZS 1158 compliance for spill lighting and glare. In addition, Rule 4.10.4 of the District Plan requires no greater than 3 lux spill (horizontal and vertical) at any point more than 2m inside the boundary of the adjoining property. Vertical and horizontal illuminance calculations show compliance with Rule 4.10.4 whereby the maximum vertical light spill will be approximately 1.1 lux and the maximum horizontal light spill will be approximately 1.6 lux. It is considered any lighting effects on both existing and future dwellings in the vicinity of the intersections will be minor.

6.2.5 Recommended Mitigation Measures

As the road lighting will be designed to the requirements of AS/NZS 1158 for glare, spill light and upward waste light, the lighting effects will not be intrusive at the designation boundary. Therefore, no further mitigation will be required.

It is recommended that a condition is placed on the designation requiring that road lighting shall be designed in general accordance with the Concept Lighting Design (attached at Appendix D) and shall be designed to meet the requirements of AS/NZS 1158 - Road Lighting Standards and AS 4282:1997 - Control of the Obtrusive Effects of Outdoor Lighting (or the equivalent standards at the time of detail design).

Consideration could be given to include planting of trees at the boundary separating the new intersections and existing residential sections in order to lessen any perceived lighting effects. However, this is not considered necessary in order to mitigate any adverse effects arising from the proposed ASUB project.

6.3 Section Three: New Ashburton Bridge

6.3.1 Existing Environment

No existing Bridge / No existing lighting.

6.3.2 Proposed Environment during Operation

On the Bridge the lighting would incorporate luminaires with a full cut-off (Type III) optic installed on 10.6m column throughout in a Dual Staggered arrangement.

The use of Type III optic luminaires will minimise the effect of spill light and upward waste light into the night sky environment.

6.3.3 Description of Lighting Effects

The new road lighting layout will require areas such as conflict points and intersections to have an increased level of illumination from the main carriageway, to meet compliance with AS/NZS 1158.1.1 subcategory which will have to be met at the time of design.

6.3.4 Assessment of Lighting Effects

The effect of lighting on adjacent area will be minimal as no adjacent residents are located near the bridge, nor are any anticipated by the District Plan zoning in future.

6.3.5 Recommended Mitigation Measures

As the road lighting will be designed to the requirements of the Standard AS/NZS 1158 for glare, spill light and upward waste light, the lighting effects will not be obtrusive. Therefore, no further mitigation will be required.

It is recommended that a condition is placed on the designation requiring that road lighting shall be designed in general accordance with the Concept Lighting Design (attached at Appendix D) and shall be designed to meet the requirements of AS/NZS 1158 - Road Lighting Standards and AS

4282:1997 - Control of the Obtrusive Effects of Outdoor Lighting (or the equivalent standards at the time of detail design).

6.4 Construction Lighting

6.4.1 Existing Environment

No lighting is currently installed within the proposed construction area.

6.4.2 Proposed Environment during Operation

The site construction office and yard will require temporary security lighting.

6.4.3 Description of Lighting Effects

During the winter months in the early period of the morning and late afternoon the use of Temporary lighting might be necessary to start the work of finish the work at the end of the day. Some light spill and Glare could occur at that time but only be moderately.

6.4.4 Assessment of Lighting Effects

In temporary construction sites, spill lighting and glare can cause a detrimental effect. However, construction and security lighting is usually of a temporary nature and can be reduced with careful location of site offices and equipment in relation to surrounding properties, and with such measures as full cut-off luminaires, sunshade screening and buffer zones.

6.4.5 Recommended Mitigation Measures

Temporary lighting for construction activities or security lighting for construction sites will need glare and spill light control compliant with AS 4282.

Construction and security lighting is usually of a temporary nature and will be reduced with careful location of site offices and equipment in relation to surrounding properties. This should be managed through the Construction Environmental Management Plan (CEMP).

It is recommended that:

1. The CEMP ensures that in all areas adjacent to residences, all security and construction lighting will be installed so that it can be shielded, or directed to the required work area to minimise light spill beyond the site so far as is reasonably practicable

2. The CEMP shall confirm that construction and temporary lighting will meet District Plan Rule 4.10.4 regarding light spill.

7 Recommended Conditions

1. Road lighting shall be designed in general accordance with the Concept Lighting Design (attached at Appendix D). It shall be designed to meet the requirements of AS/NZS 1158 - Road Lighting Standards and AS 4282:1997 - Control of the Obtrusive Effects of Outdoor Lighting (or the equivalent standards at the time of detail design).

2. The Construction Environmental Management Plan shall identify the measures to be taken to manage and control glare and light spill arising from construction and temporary lighting. Measures shall include, but not be limited to, the following:

    a. Temporary lighting for construction activities or security lighting for construction sites will need glare and spill light control compliant with AS 4282

    b. Location of site offices and equipment in relation to surrounding properties

    c. All security and construction lighting will be installed so that it can be shielded, or directed to the required work area to minimise light spill beyond the site so far as is reasonably practicable

    d. Compliance with Rule 4.10.4 of the Partially Operative District Plan.

8 Conclusion

Road lighting is essential for road and pedestrian safety issues. The lighting proposed for the ASUB project on the environment will have no more than minor adverse effects, provided that the final lighting design is prepared in general accordance with the concept lighting design attached as in Appendix “D” and complies with AS/NZS 1158 and AS4282.

Road lighting is the compromise between adequate road safety for the user and for the non-user in the residential area surrounding the proposed new road and intersections.

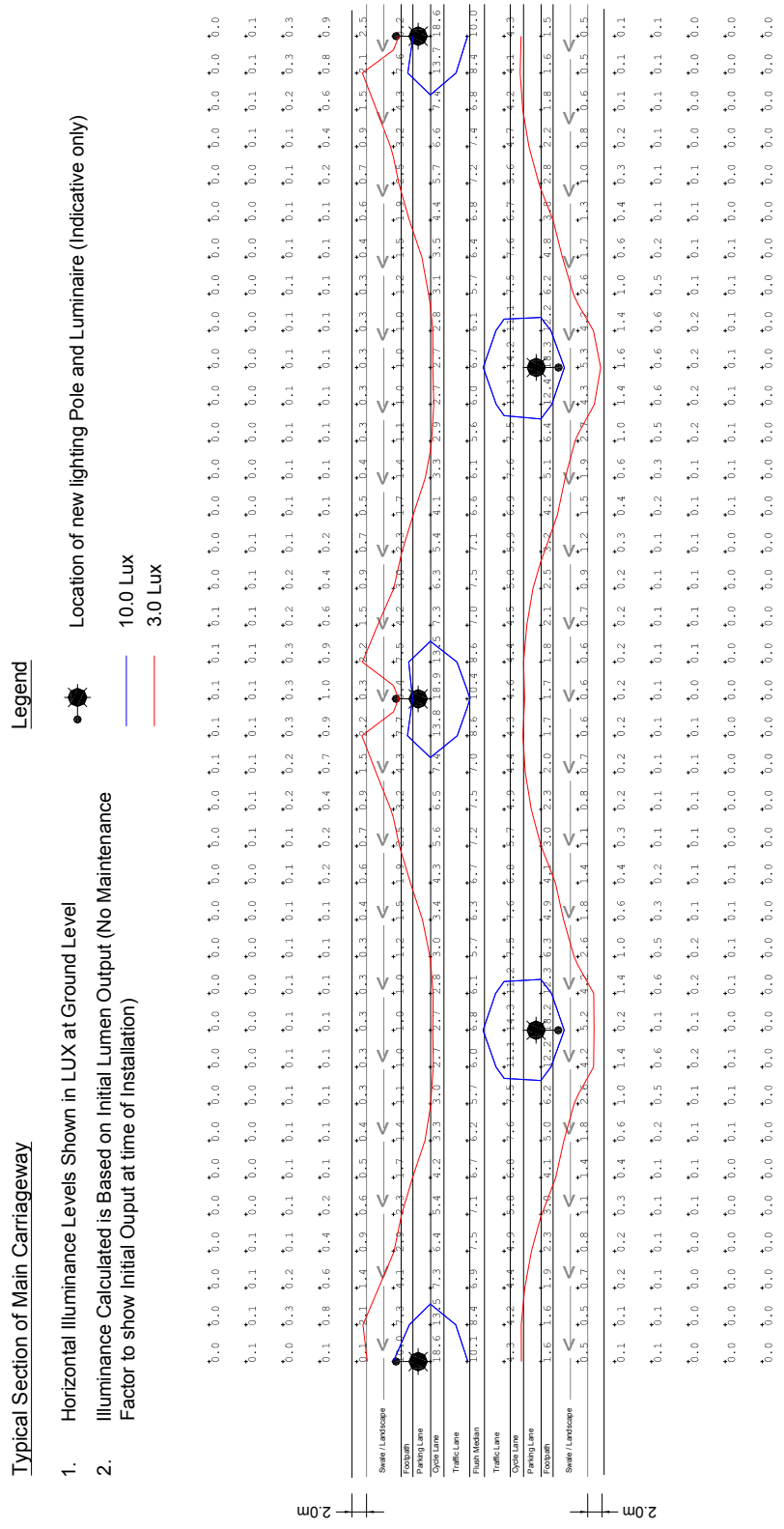
The requirements of the relevant lighting standards are met by the concept lighting design, and therefore, the final lighting design for the Project will be able to comply with the Road Lighting Standard AS/NZS 1158.

At the time of construction of the ASUB project, both existing and future residents will notice a difference in their environment due to the inclusion of road lighting, however it is considered that any adverse effects will be less than minor due to the lighting design meeting the requirements of AS/NZS 1158 and AS4282, and the District Plan when measured at the proposed designation boundary.

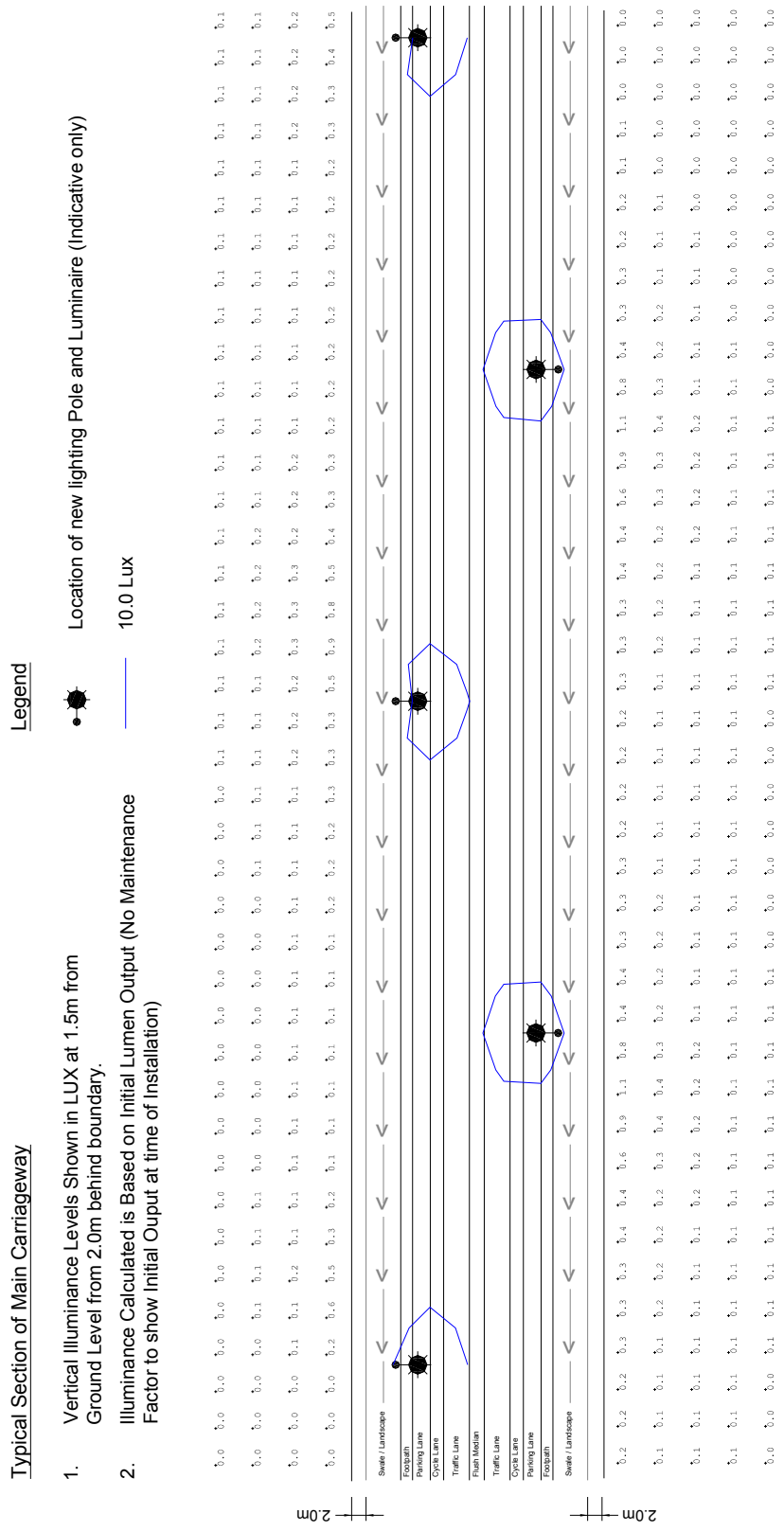
All exterior lighting needed for any construction activity or for security reason will be designed to comply with the District Plan along with the recommendations and requirements of AS4282.

Appendix – A

Expected Horizontal illuminance with Type III optical distribution

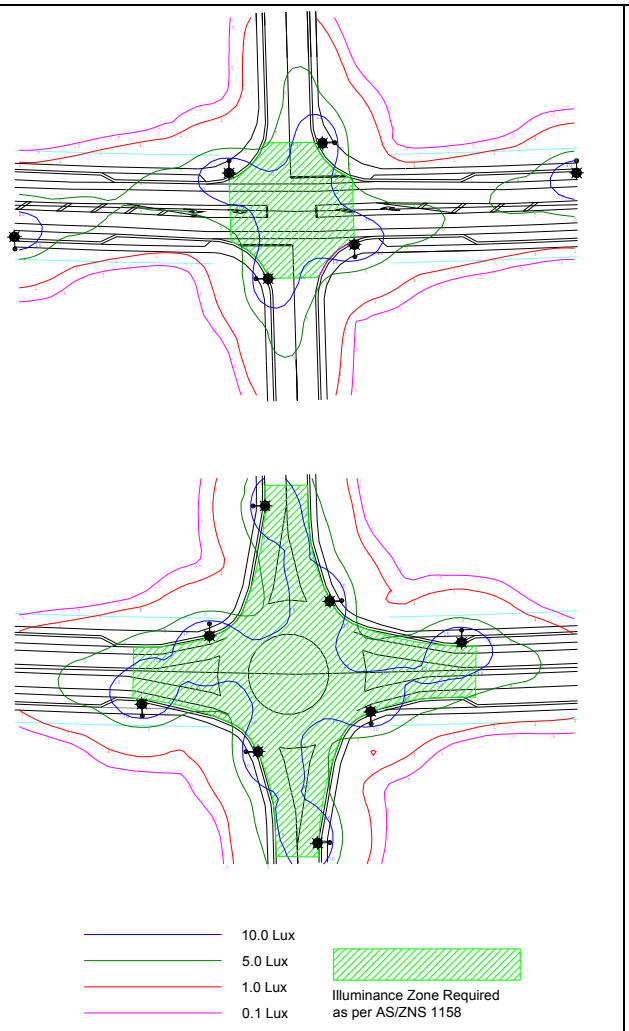


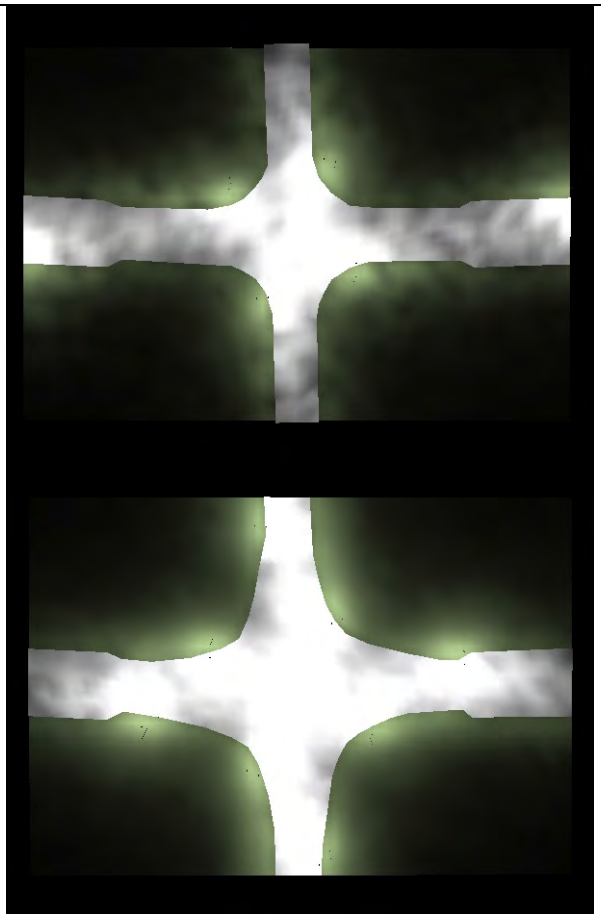
Expected Vertical illuminance with Type III optical distribution



Appendix - B

Expected Horizontal illuminance with Type III optical distribution at Wilkins Road Intersection.





Appendix - C

Sample Straight Road Calculation for the new road leading to the new bridge and on the bridge itself

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RESULTS FOR RUNNING SAASTAN WITH NOMINATED SPACINGS
[NEW ZEALAND MODE]

Job name: Ashburton 2nd Urban Bridge - Leading Roads

Luminaire I-table: F:\Complile 29032013 Files\LEH2\CIE Files\GPLS-90W 49LED4K-ES-LEH2 (S1204301).cie
Luminaire Description: LM79 Output 7536 Lms
Lamp Wattage & Type: 102w LED
Light Source: LED
Stores Code: Luminous Flux: 7.747 Klms
Upcast Angle: 0 Degrees Arrangement: 3 Single-Stagger
Lane Width: 6.3 m Lanes per Carriageway: 2
Mounting Height: 10.6 m Total Carriageway Width: 12.6 m
Maintenance factor: 0.7
Overhang 1st Row:-1.7 m Overhang 2nd Row:-1.7 m
Outreach Size: 3 Outreach Size: 3
Traffic Flow: Two Way ----->
<-----
Lighting Category: V4

Spacing (m)	Traffic Direct- ion	Lane No.	R Table or	LBar (>=0.50) (>=0.55)	Uo (>=0.33) (>=0.31)	Ul (>=0.3) "	UWLR (=<3) "	TI (=<20) "	Esl (>=50) "	Esr (>=50) "	Comply with V4
43.00	Normal	1	NZN4	.53	0.45	0.33	.00	12.67	84.57	84.57	YES
43.00	Normal	1	NZR2	.53	0.56	0.38	.00	12.69	84.57	84.57	YES
44.00	Normal	1	NZN4	.51	0.45	0.32	.00	12.85	84.29	84.29	YES
44.00	Normal	1	NZR2	.51	0.54	0.37	.00	12.86	84.29	84.29	YES
45.00	Normal	1	NZN4	.50	0.44	0.30	.00	13.02	84.23	84.23	YES
45.00	Normal	1	NZR2	.50	0.53	0.36	.00	13.03	84.23	84.23	YES
46.00	Normal	1	NZN4	.49	0.44	0.30	.00	13.13	86.10	84.23	NO
46.00	Normal	1	NZR2	.49	0.52	0.36	.00	13.12	86.10	84.23	NO
47.00	Normal	1	NZN4	.48	0.44	0.29	.00	13.30	85.99	84.21	NO
47.00	Normal	1	NZR2	.48	0.51	0.35	.00	13.29	85.99	84.21	NO

NOTE: Where 'Normal' &/or 'Oncoming' lines are shown, compliance with the nominated Category, at a particular spacing, is only applicable when there is a 'Yes' for each lane and R-table i.e. ANY 'No' indicates failure at that spacing.

PleVcat - Vers 5.06 (Built: 3/5/12) *Run: 1/ 9/2013 at 10:09:56*

Appendix - C

Opus International Consultants Ltd.
****

RESULTS FOR RUNNING SAASTAN WITH NOMINATED SPACINGS
[NEW ZEALAND MODE]

Job name: Ashburton 2nd Urban Bridge - Bridge

Luminaire I-table: F:\Complile 29032013 Files\LEH2\CIE Files\GPLS-90W 49LED4K-ES-LEH2 (S1204301).cie
Luminaire Description: LM79 Output 7536 Lms
Lamp Wattage & Type: 102w LED
Light Source: LED
Stores Code: — Luminous Flux: 7.747 Klms
Upcast Angle: 0 Degrees — Arrangement: 3 Single-Stagger
Lane Width: 3.5 m — Lanes per Carriageway: 2
Mounting Height: 10.6 m — Total Carriageway Width: 7 m
Maintenance factor: 0.7
Overhang 1st Row: 0 m — Overhang 2nd Row: 0 m
Outreach Size: 3 — Outreach Size: 3
Traffic Flow: Two Way ----> <----
Lighting Category: V4

Spacing (m)	Traffic Direct- ion	Lane No.	R Table or	LBar (>=0.50) (>=0.55)	Uo (>=0.33) (>=0.31)	Ul (>=0.3) "	UWLR (=<3) "	TI (=<20) "	Esl (>=50) "	Esr (>=50) "	Comply with V4
50.00	Normal	1	NZN4	.70	0.44	0.33	.00	9.94	77.69	77.69	YES
50.00	Normal	1	NZR2	.64	0.54	0.46	.00	10.73	77.69	77.69	YES
51.00	Normal	1	NZN4	.69	0.43	0.32	.00	10.04	77.44	77.86	YES
51.00	Normal	1	NZR2	.63	0.53	0.50	.00	10.81	77.44	77.86	YES
52.00	Normal	1	NZN4	.67	0.41	0.30	.00	10.14	77.42	77.85	YES
52.00	Normal	1	NZR2	.62	0.52	0.48	.00	10.92	77.42	77.85	YES
53.00	Normal	1	NZN4	.66	0.39	0.28	.00	10.27	77.64	77.64	NO
53.00	Normal	1	NZR2	.60	0.53	0.43	.00	11.07	77.64	77.64	YES
54.00	Normal	1	NZN4	.65	0.38	0.26	.00	10.38	77.65	77.65	NO
54.00	Normal	1	NZR2	.59	0.52	0.42	.00	11.19	77.65	77.65	YES

NOTE: Where 'Normal' &/or 'Oncoming' lines are shown, compliance with the nominated Category, at a particular spacing, is only applicable when there is a 'Yes' for each lane and R-table i.e. ANY 'No' indicates failure at that spacing.

PleVcat - Vers 5.06 (Built: 3/5/12) *Run: 1/ 9/2013 at 10:11:09*

Appendix - D

Road lighting Concept Design Drawings

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PO Box 5848, Auckland 1141
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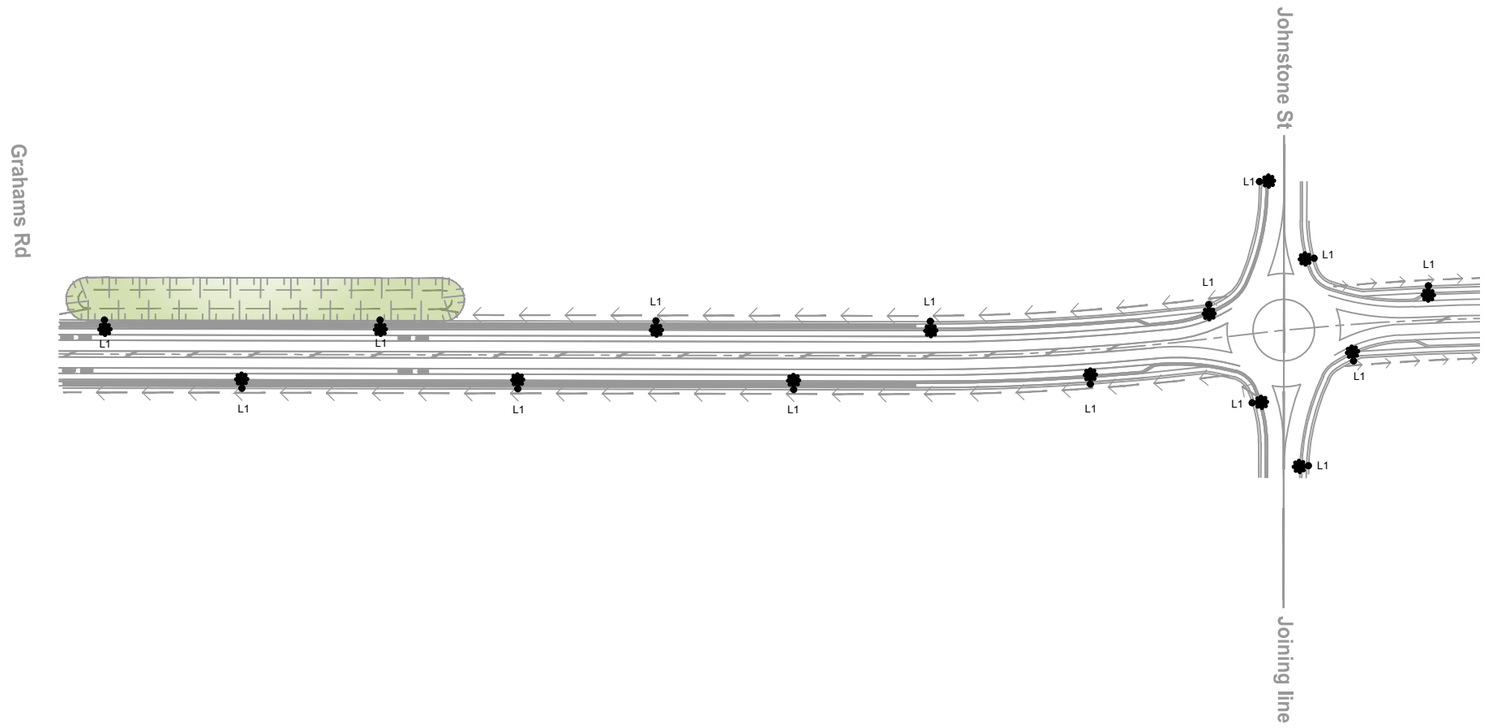

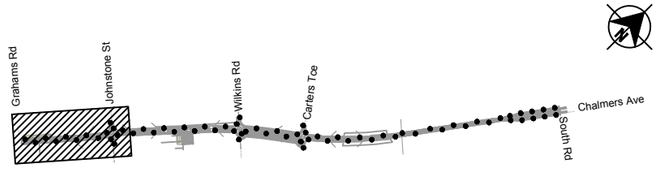

KEY PLAN

LIGHTING SCHEDULE

L1 Philips Roadstar 102w LED luminaire (GPLS-90W49LED4K-ES-LEH2 - 571mA) mounted on a Standard ground planted frangible sectional steel 10.6m octagonal column with a 3.0m 15° tilt mitred outreach arm & 5° 42mm spigot. Tilt luminaire to 0°.

L2 Philips Roadstar 102w LED luminaire (GPLS-90W49LED4K-ES-LEH2 - 571mA) mounted on a Standard flanged based sectional steel 10.6m octagonal column with a 3.0m 15° tilt mitred outreach arm & 5° 42mm spigot. Tilt luminaire to 0°.

DESIGN CRITERIA

Concept design in accordance with AS/NZS 1158, Category V4.

SYMBOLS:

New pole, outreach arm and luminaire.
(Position of the poles are indicative only, final position to be confirm at detail design stage)

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1:2000 @ A3
0 10 20 30 40 50 60 70 80 90 100 m

Revision	Amendment	Approved	Revision Date

OPUS
Christchurch Office
+64 3 363 5400
PO Box 1482
Christchurch 8140
New Zealand

Drawn	Designed	Approved	Revision Date
R.S.D.	R.S.D.	S.T.	01.09.2013

Project No.	Scale
6-DHLNB.06	1:1000@A1, 1:2000@A3

Project
ASHBURTON DISTRICT COUNCIL
ASHBURTON 2nd URBAN BRIDGE
NOTICE OF REQUIREMENT

Sheet
CONCEPT LIGHTING LAYOUT
GRAHAMS ROAD TO JOHNSTONE STREET

Drawing No.	Sheet. No.	Revision
6/619/115/3603	500	0

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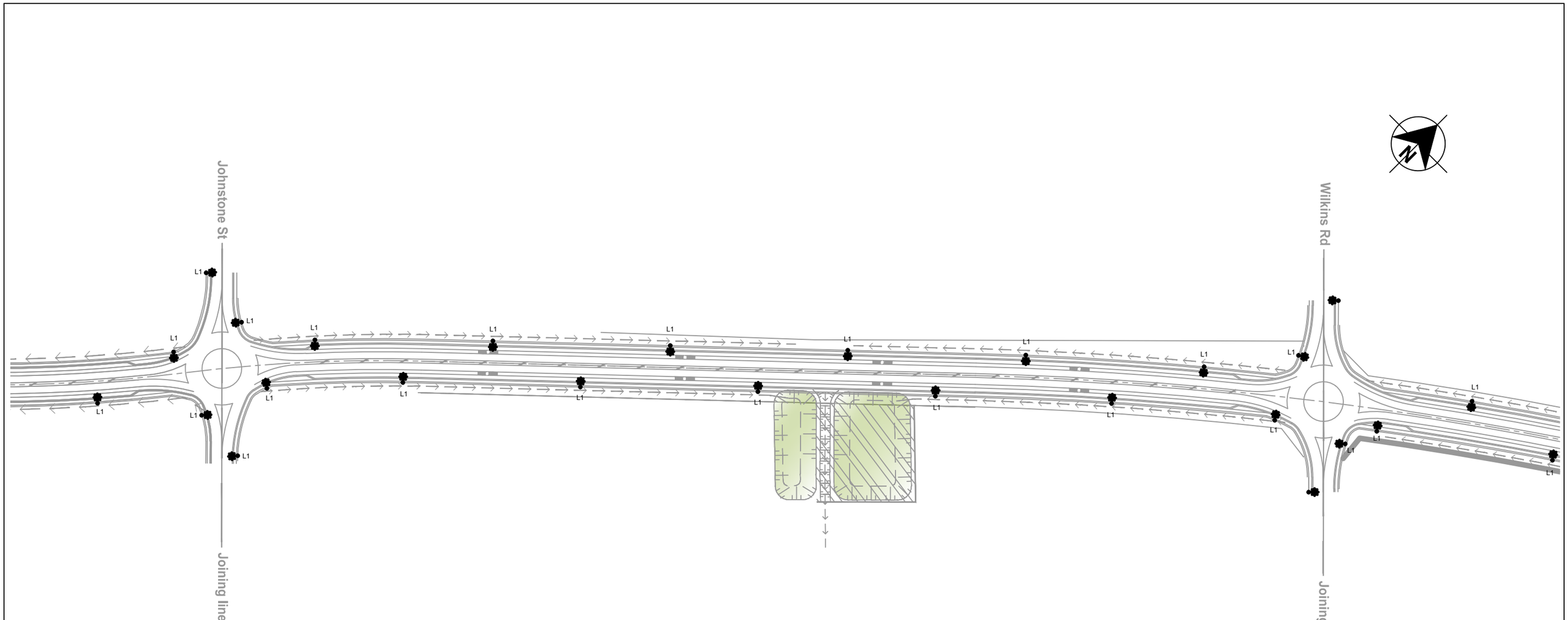

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LIGHTING SCHEDULE

L1 Philips Roadstar 102w LED luminaire (GPLS-90W49LED4K-ES-LEH2 - 571mA) mounted on a Standard ground planted frangible sectional steel 10.6m octagonal column with a 3.0m 15° tilt mitred outreach arm & 5° 42mm spigot. Tilt luminaire to 0°.

L2 Philips Roadstar 102w LED luminaire (GPLS-90W49LED4K-ES-LEH2 - 571mA) mounted on a Standard flanged based sectional steel 10.6m octagonal column with a 3.0m 15° tilt mitred outreach arm & 5° 42mm spigot. Tilt luminaire to 0°.

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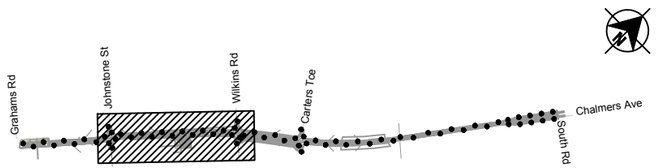

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6-DHLNB.06	1:1000@A1, 1:2000@A3

Project
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Sheet
CONCEPT LIGHTING LAYOUT
JOHNSTONE STREET TO WILKINS ROAD

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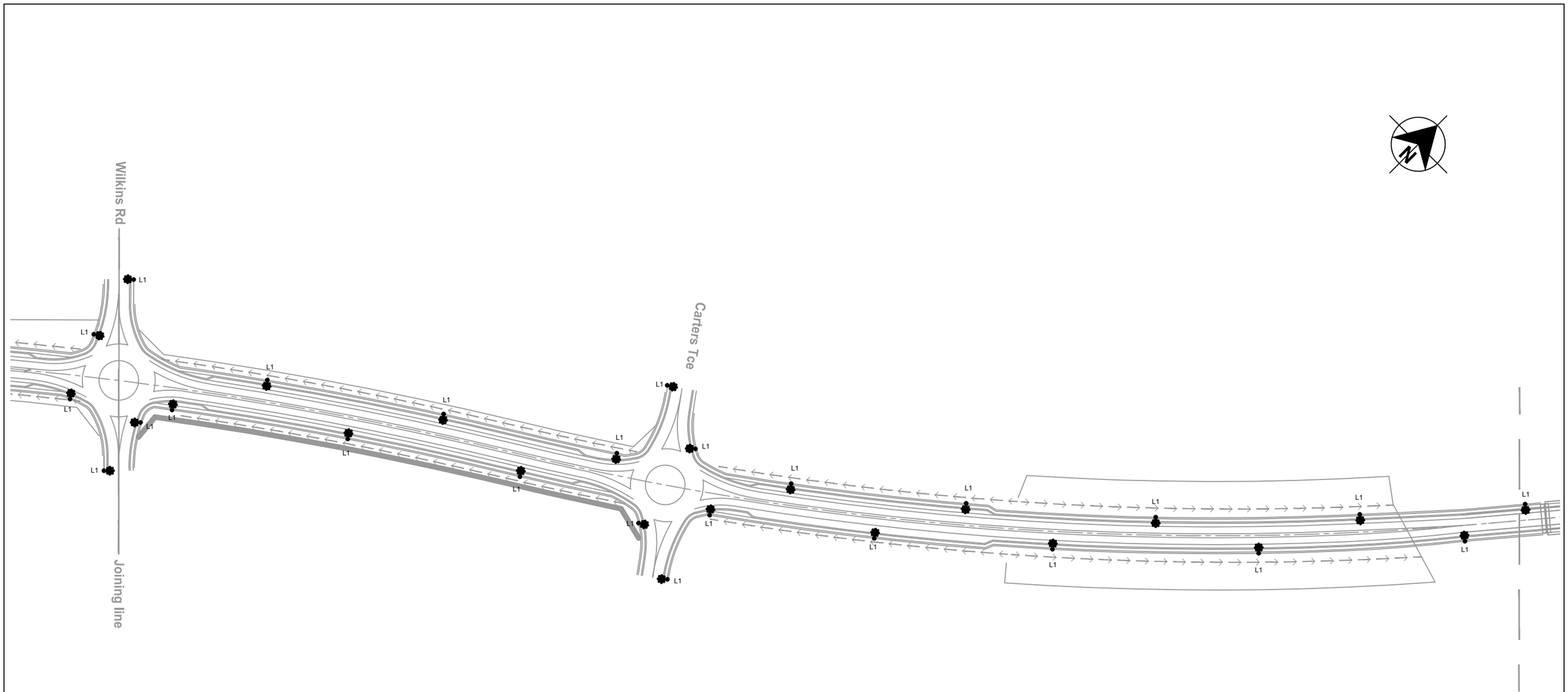

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LIGHTING SCHEDULE

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L2 Philips Roadstar 102w LED luminaire (GPLS-90W49LED4K-ES-LEH2 - 571mA) mounted on a Standard flanged based sectional steel 10.6m octagonal column with a 3.0m 15° tilt mitred outreach arm & 5° 42mm spigot. Tilt luminaire to 0°.

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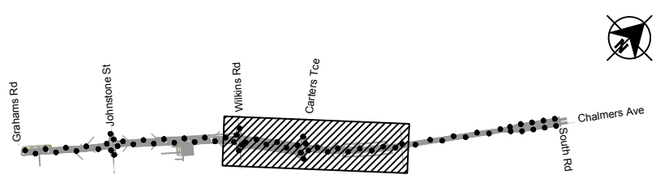

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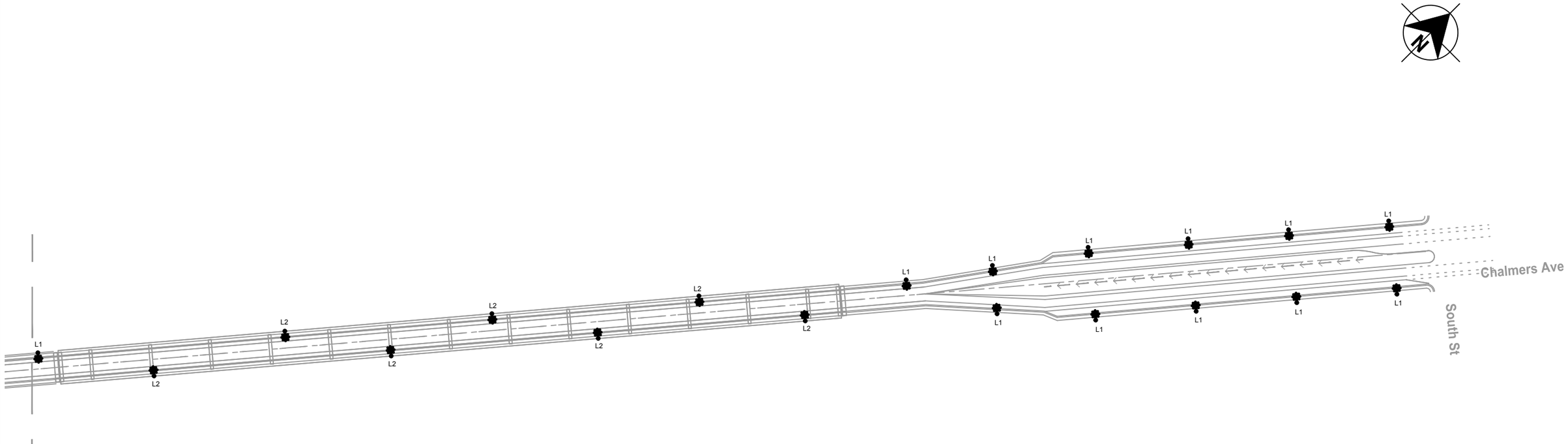

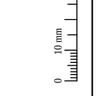

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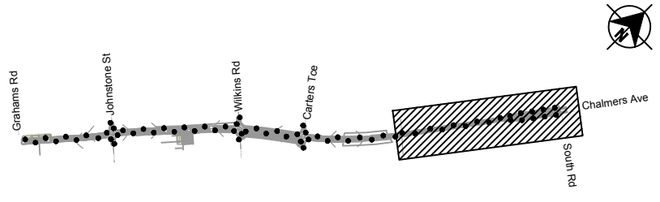

KEY PLAN

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Project
ASHBURTON DISTRICT COUNCIL
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Sheet
CONCEPT LIGHTING LAYOUT
ASHBURTON RIVER TO SOUTH STREET

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