

Our Reference: ACT200114

17 Nov 2021

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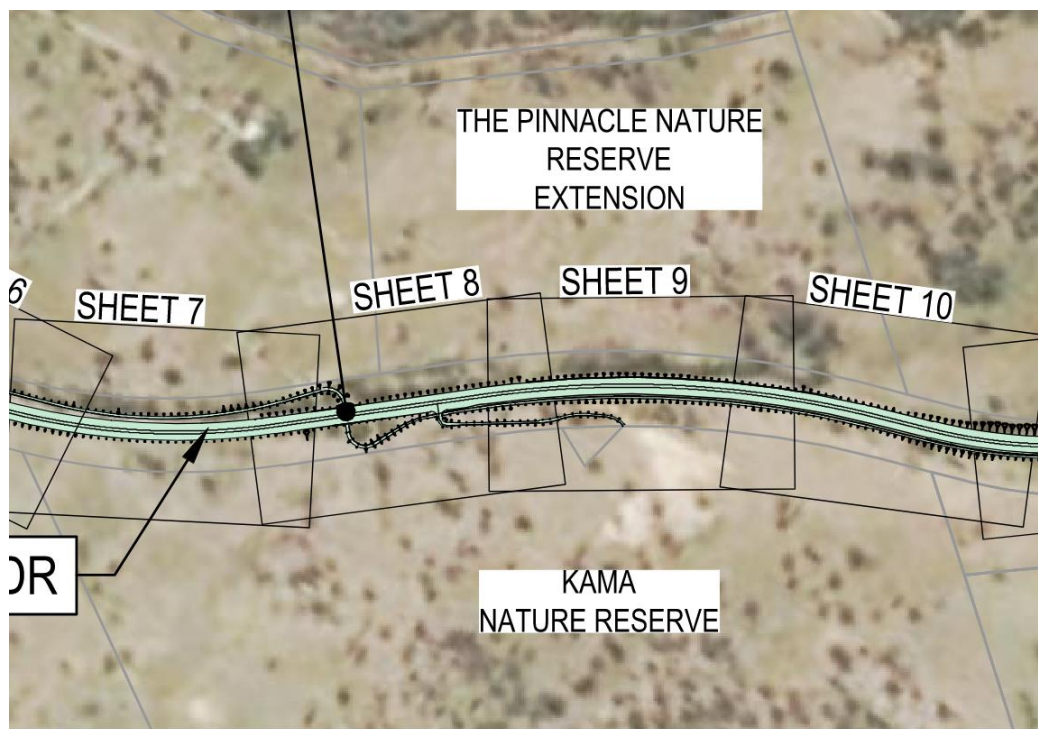
MANAGERS

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## William Hovell Drive Duplication Spill Light Assessment

The following short report outlines the results of the spill lighting assessment undertaken for the William Hovell Drive Duplication along the Pinnacle and Kama Nature Reserve boundaries. The following image indicates the areas of assessment.



The Pinnacle Nature Reserve Extension is located approximately between chainages 2,440 and 3,110.

The Kama Nature Reserve is located approximately between chainages 1,970 and 3,170.

### Lighting Level Requirements

The requirements for spill lighting levels into the natural environment is not provided by the Australian Standards. These standards specifically exclude these requirements and provide some general information how artificial light can be detrimental to flora and fauna and the fact that animals perceive light differently to humans.

AS 4282 provides guidance on the maximum spill lighting allowable for major roadways. However, this criteria is based on the effect on adjacent residential dwellings and is typically calculated at the building line. The standard provides some general commentary on the effects of spill lighting on the environment, but does not include any quantitative assessment criteria.

Various studies have been undertaken on spill lighting and the effect on flora and fauna. However most of these studies have evaluated that night light has a different effect on different species and no clear guidelines have been established in terms of maximum lighting levels (lux). These studies have provided recommendations which typically include the following:

1. Utilising light sources with less light energy in the blue wavelengths,
2. Only providing lighting to areas that are required to be lit, and
3. Providing light sources that are specifically designed for that usage.

A study was undertaken in recent years to measure the light levels produced by moonlight. The final conclusion of this study was that in Sydney on a clear night with a full moon, the illumination on the ground (horizontal plane) is 0.27 lux. The moonlight levels in the ACT are similar to Sydney and this value has been used to provide guidance on the spill light into the nature reserves.

### Current Lighting Design

The current lighting design for William Hovell Drive has been undertaken to address the three recommendations above, as follows:

1. The installation is required to meet the requirements of TCCS. TCCS currently requires that all luminaires have a lighting colour temperature of 4000K, which includes a component of blue light. Providing a luminaire with less blue lighting component will require specific approval and will require further assessment as the total light output per luminaire will also reduce.
2. Lighting has been designed to illuminate the road carriageway with reduced spill light. It has been designed to meet the minimum lighting requirements for a road of this type (ie has not been overlit). The pathways have only been illuminated where the lighting from the adjacent roadway is not sufficient to meet the requirements of the Australian Standards.
3. The luminaires selected are designed specifically to have light distribution to suit major roadways, or pathways, and to minimise waste light. All luminaires have been designed to be mounted with a 0° tilt, to minimise any waste upward light or directing the light beyond the roadway.

The lighting design adjacent to the Pinnacle and Kama Nature Reserve boundaries has been simulated to assess the horizontal lighting at ground level leading to the nature reserve boundaries and extending into them.

The highest levels of light into the reserves are experienced between chainage 2,320 and 2,430. This is the location where the shared user path crosses under the road. At this location the path is closer to the boundary and curves. This results in a need to have the pathway lighting closer to the boundary and positioned to direct light toward the boundaries to ensure the pathway is adequately lit. This location is beyond the Pinnacle Nature Reserve Extension and does not effect it, however it is adjacent to the Kama Reserve and does increase the spill light into that area.

The following table outlines the calculated lighting levels along both reserve boundaries.

Area	Average Illumination (Lux)	Maximum Illumination (Lux)
<b>The Pinnacle Reserve Extension</b>	0.17	0.5
<b>The Kama Reserve (between CH 2,320 and 2,440)</b>	0.71	3.3
<b>The Kama Reserve (excluding CH 2,320 to 2,440)</b>	0.08	0.2

This shows that, with the exception of the area between chainage 2,320 and 2,440, the average horizontal illumination level is below the level of full moonlight (0.27 lux).

The following pages provide images of the calculations undertaken.

All of the visible values indicate the simulated horizontal illumination at ground level.

The light blue line indicates a value of 0.27lux (full moonlight). All values which are less than 0.01lux are highlighted green (ie there is zero spill light in these locations). At the Kama Reserve boundary, between chainages 2,320 and 2,440, the light penetration for values over 0.27 lux extends 15m. In all other locations this penetration is less than 10m beyond the boundary.

The areas align with sheets 7, 8, 9 and 10 of the drawing set.

### Summary

Standards providing quantitative criteria for spill lighting and the effect on nature are not available. This installation has applied the best practice lighting design principles. The spill lighting simulated at the reserve boundaries is typically below the levels experienced during a full moon on a clear night. Where these lighting levels are exceeded these values do not extend beyond 10m from the boundary, with the exception of the Kama Reserve between chainages 2,320 and 2,440. As such the spill light is not expected to have a significant effect on the flora or fauna within the reserves.

