



SMEC INTERNAL REF: 3002750

Water Quality /
Hydrology Report

William Hovell Drive Duplication

Reference No. 3002750

Prepared for Infrastructure Development Partners Group on behalf of Transport Canberra and City Services

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A	26/05/2021	Rosie Robinson	Anton Kandiah	Dan Keep

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SMEC Company Details

Approved by	Dan Keep		
Address	Suite 2, Level 1, 243 Northbourne Avenue, Lyneham, ACT, 2602, Australia		
Telephone	6234 1931	Facsimile	6234 1966
Email	dan.keep@smec.com	Website	www.smec.com
Signature			

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1 Introduction

SMEC has been engaged by Infrastructure Delivery Partners Group (IDPG) on behalf of Transport Canberra and City Services (TCCS) to undertake the detailed design of the duplication of a 4.9 km portion of William Hovell Drive (WHD) between John Gorton Drive (JGD) and Drake-Brockman Drive (DBD).

An initial Scoping Report was provided to the Australian Capital Territory Planning and Land Authority (ACTPLA) on 4 September 2020. ACTPLA's Scoping Document for the Project was thereafter provided on 19 October 2020 in accordance with Section 212 of the P&D Act.

The Scoping Document requires various matters to be addressed in an EIS, including matters regarding water quality which are detailed in the following table:

Scoping Document Reference	Description
8.2 Detailed Requirements / 8.2.7	<ul style="list-style-type: none"> Describe the impacts of construction and operation on water quality in downstream waterways, including the Molonglo River and Deep Creek, including the proposed future Deep Creek Water Quality Control Pond Describe the impact of sediment and road surface run-off entering nearby waterways Describe the impacts of changes to water flow regimes, including consequences of increased water flow during large rainfall events

Table 1: Scoping document - water quality requirements

This report provides an assessment of potential water quality and hydrology impacts as identified above.

1.1 Project Location

The proposed road duplication is to be completely contained to the road reserve extending from JGD to DBD. This Site is unleased Territory land, with TCCS – Roads ACT as the custodian. The land is zoned TSZ1 – Transport under the Territory Plan, and runs adjacent to parcels of leased rural land, nature reserves and existing and future urban areas.

Proposed locations for site compounds and stockpile areas include:

- Site Compound 1 located adjacent JGD intersection, approximate size 19,000m²
- Site Compound 2 located at DBD intersection, approximate size 10,000m²
- Stockpile Site 1 located at CH3500, approximate size 10,000m²
- Stockpile Site 2 located at CH2100, approximate size 6,000m².

Figure 1 provides a map of the Project Site and surrounding study area more broadly.

The Project Site crosses a hillside that sweeps to the south of The Pinnacle Extension Nature Reserve and to the north of the Kama Nature Reserve. From the intersection with JGD, WHD declines slightly and then steadily increases in gradient toward the Kama and Pinnacle Extension Nature Reserves. The road turns slightly to the north and continues to increase in gradient with the highest point located near the Old Weetangera Cemetery.

Centrally through the alignment, the embankment on the south-western side of WHD becomes relatively steep, with views from the road reserve over rural rolling hills toward development in the Molonglo Valley. Mounds of fill from the previous construction of WHD are located along the north-eastern side of the alignment and generally obscure views from the road.

The Project is located entirely within the Murrumbateman Interim Biogeographic Regionalisation of Australia (IBRA) Subregion of the South Eastern Highlands IBRA Bioregion (IBRA v.7). The Murrumbateman IBRA Subregion covers an area of approximately 630,454ha.

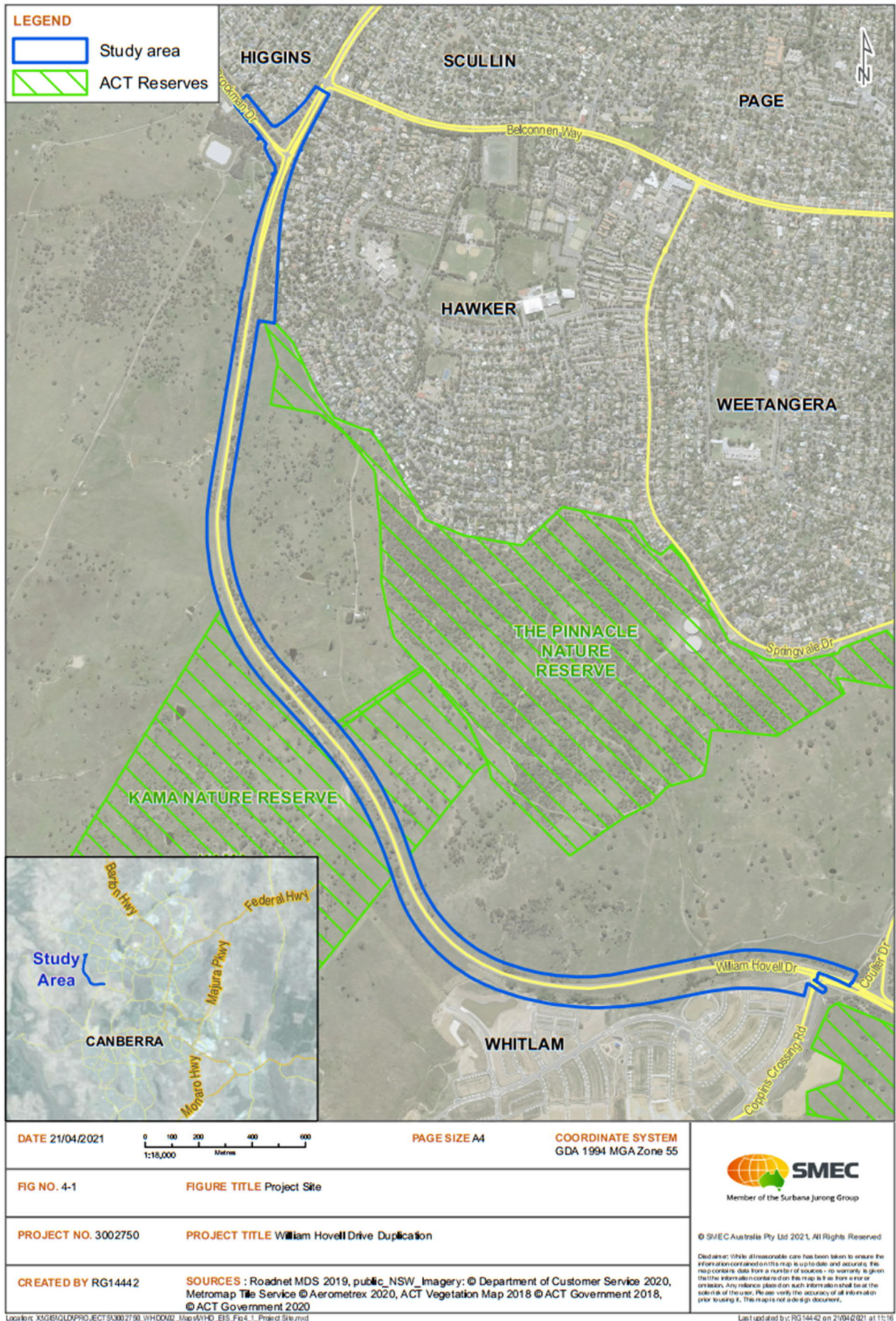


Figure 1: Project Site

1.2 Project Area

The current natural flow of surface water occurs from the Pinnacle Nature Reserve and passes beneath WHD through existing transverse culverts, and discharges into the future Deep Creek Dam on the western side of Whitlam and tributaries of Molonglo River to the northern section of the project. Deep Creek runs south west, towards the Molonglo River, which also flows to the south-south-west of the project. The Molonglo River runs eastwards into Lake Burley Griffin. Refer to Figure 2 below.



Figure 2: Deep Creek Tributary

There are twenty-three culvert crossings within the proposed upgrade section of the road. The culvert catchments generally comprise non-residential areas which includes the nature reserve and native open areas. The proposed road upgrade is only impacted by the local catchments which drain to the cross-drainage systems.

2 Water quality and hydrology assessment

An assessment of water quality and hydrology was carried out by reviewing aerial photographs and the following previous studies:

- Molonglo Catchment and Scrivener Dam Flood Hydrology Review - Phase 2 (SKM, 10 June 2011)
- Molonglo 3 - Stormwater Masterplan- Deep Creek - (GHD, July 2015)
- Molonglo 3 - Stormwater Management WSUD Strategy - (GHD, December 2015)
- Whitlam Concept Masterplan - (Roberts Day, June 2016)
- Deep Creek Corridor Water Quality Pond, Concept Design Report - (GHD, March 2019)
- Memo - Whitlam / Molonglo 3 Regional Pond - (Calibre, September 2018).

The existing transverse drainage systems under the proposed upgrade have been retained where practically possible to ensure consistency in the flow regime between existing and post-developed conditions. As such, there will only be minor change in flow attenuation between the present day and post construction. The drainage plans provide the details and locations of the proposed culverts to protect the road from flooding for events up to 1% AEP.

Previous flood studies carried out for Lake Burley Griffin and Scrivener Dam shows the proposed road upgrade is further upstream of Molonglo River and is not impacted by the river for rainfall events up to 1% AEP. A relevant flood impact map (SKM for ACTPLA, 2011, 'Molonglo Catchment and Scrivener Dam Flood Hydrology Review - Phase 2') is included below:

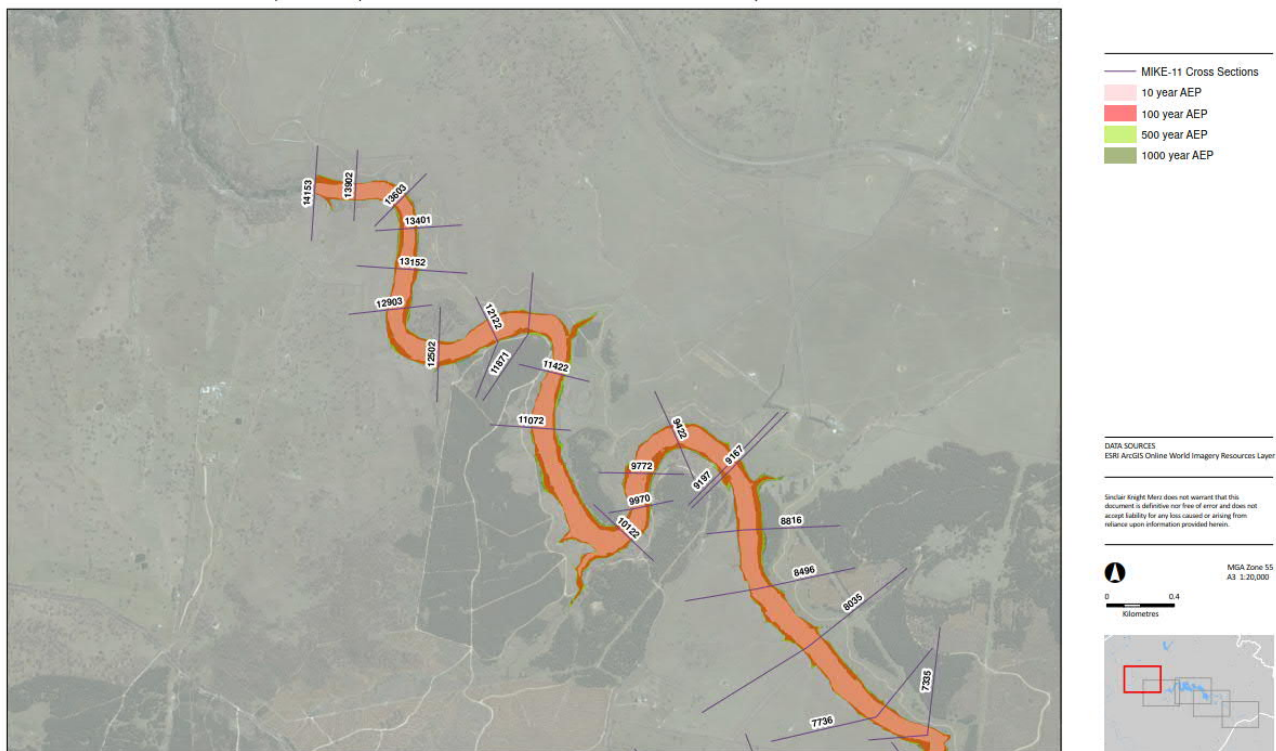


Figure 3: Flood Inundation Map (Sheet 5 of 5) 10, 100, 500 and 1000 Year Annual Exceedance Probability Flood (SKM for ACTPLA, 2011, 'Molonglo Catchment and Scrivener Dam Flood Hydrology Review - Phase 2')

2.1 Climate change

The drainage infrastructure is to be designed to account for the impact of climate change in accordance with the ACT Climate Change Strategy 2019-2025 (ACT Government, 2019). During the Document Readiness design stage, a sensitivity analysis will be conducted to assess the capacity of transverse drainage culverts for 1% AEP in accordance with this strategy.

2.2 Water quality

The proposed drainage catchments reflect the existing drainage catchment scenario where practically possible. The main catchment characteristics is dense grass with sparse tress. WHD also contains three existing underpasses which help provide some additional relief for the transverse culverts during larger storm events.

Vegetated swales are an effective way of reducing sediment transportation. Generally vegetated swales would be provided within the road verge on both sides of the road to collect runoff from the road surface to remove pollutant particles including sediments. This will continue the current characteristics of WHD and provide ease of maintenance. As the runoff passes through the swales, the contaminants will be removed by via filtration and infiltration.

Where kerbs and gutters are provided, the stormwater runoff from the road surface would be collected in sumps which would then discharge into vegetated swales within the road verge. The proposed section of the road falls within Deep Creek catchments and the runoff from the road catchment will directed through vegetated swales for water quality treatment and eventually flow into Deep Creek.

A stormwater masterplan has been prepared (separately) for Deep Creek to determine the pollutant reduction targets by developers and ACT Government, so the overall reduction target is reached. The report, prepared by GHD, *Molonglo 3 – Stormwater Management WSUD Design Strategy* (July 2015), states that WSUD interventions installed by the ACT Government are required to reduce the pollutants by approximately:

- 16% TSS
- 11% TP, and
- 11% TN.

As part of the WHD Duplication Project, a MUSIC model was prepared for the road upgrade to confirm that the proposed water quality measures meet the reduction targets. The modelling results (refer to the following table) indicate reduction targets of:

- 18.7% TSS
- 10.8% TP, and
- 10.6% TN.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	122	116	4.6
Total Suspended Solids (kg/yr)	31100	25300	18.7
Total Phosphorus (kg/yr)	27.3	24.3	10.8
Total Nitrogen (kg/yr)	370	330	10.6
Gross Pollutants (kg/yr)	4030	3260	19.3

Table 2: Treatment Train Effectiveness - MUSIC model

As shown above, the water quality reduction target for the concept design is very close to the requirements stated in Molonglo 3 – Stormwater Management WSUD Design Strategy (July 2015). During the Document Readiness phase of the WHD Duplication Project, the drainage design will be revised and adjusted to ensure water quality requirements are met.

3 Impacts

As a result of the duplicated road, the area of hardstand would increase and there would be an associated minor increase in peak stormwater runoff. The Project would maintain or increase the stormwater drainage provisions to manage the surface water for events up to the one percent AEP, while also providing additional protection during and following major storm events. As such, there should be no change with regard to the risk for erosion and scour at the stormwater discharge points or potential for sediment discharge and pollution.

Other potential water and hydrological impacts include:

- Erosion and sedimentation during construction works
- Impact on flooding as some of the proposed civil works for the shared path and road widening may impact the existing head available for the transverse drainage culverts, which may affect capacity for events larger than the one percent AEP
- Spill management as a result of refuelling, maintenance of machinery and storage of potential pollutants
- Potential flood threats and appropriate protection or removal of dispersible materials, hazardous materials and equipment containing such materials
- Disturbed areas which have not undergone suitable stabilisation.

4 Mitigation

The following table sets out the proposed mitigation measures to manage the potential hydrological impacts of the WHD Duplication Project.

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Water quality impacts to Deep Creek	As Detailed Design progresses, consultation with the EPA would take place to confirm whether a WWL is required due to the proximity of Deep Creek.	High	Pre-construction and Construction	EPA
Local and regional drainage conditions altered Impact on flooding as some of the proposed civil works for the shared path and road widening may impact the existing head available for the transverse drainage culverts, which may affect capacity for events larger than the one percent AEP.	Design mitigation measures so they adhere to ecological limits (e.g. water flow rates or quality) of adjacent MNES and other environmental values. Undertake stormwater assessments to ensure the design of the development does not place unnecessary pressure on existing stormwater infrastructure.	High	Construction	TCCS
Changes to existing flow paths and overland flow due to proposed Project				
Potential changes to groundwater availability due to vegetation	To mitigate these impacts, it is proposed to plant new evergreen trees alongside	High	Construction	EPA

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment.	the locations where existing trees would be removed. Indeed, where possible, established trees would be retained to provide landscape screening. A schedule of additional plantings would therefore be provided to soften the impact on the predominantly rural landscape. All construction works are covered by an ESCP approved the EPA.			
Additional run off from new impervious surfaces increases flow downstream and impacts areas beyond the project boundaries.	All construction works are covered by an ESCP approved the EPA.	High	Construction	EPA
Reduction in water quality in waterways due to runoff and sedimentation during Construction and operation				
Change to water flow regimes in waterways due to construction and operation	Design mitigation measures so they adhere to ecological limits (e.g. water flow rates or quality) of adjacent MNES and other environmental values.			Change to water flow regimes in waterways due to construction and operation

Table 3: Water quality and hydrology mitigation measures

5 Residual risk

Based on the mitigation measures identified in Section 4, an assessment of the residual risks associated with the proposal have been considered. The following table sets out the residual risk assessment of the Project's hydrology impacts.

Risk (as per Section 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Local and regional drainage conditions altered	High	Possible	Minimal	Very Low

Risk (as per Section 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Changes to existing flow paths and overland flow due to proposed Project	High	Possible	Minimal	Very Low
Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment	Medium	Possible	Minimal	Very Low
Additional run off from new impervious surfaces increases flow downstream and impacts areas beyond the project boundaries.	High	Possible	Minimal	Very Low
Scoping Document risks identified				
Reduction in water quality in waterways due to runoff and sedimentation during construction and operation	High	Possible	Minimal	Very Low
Change to water flow regimes in waterways due to construction and operation	High	Possible	Minimal	Very Low
Rain event causing flooding, erosion or damage to road infrastructure.	High	Possible	Minimal	Very Low

Table 4: Water quality and hydrology residual risk assessment

Appendix A MUSIC Model and Catchment Plans

The MUSIC model that was developed and that catchments it was based on are included in the following pages.

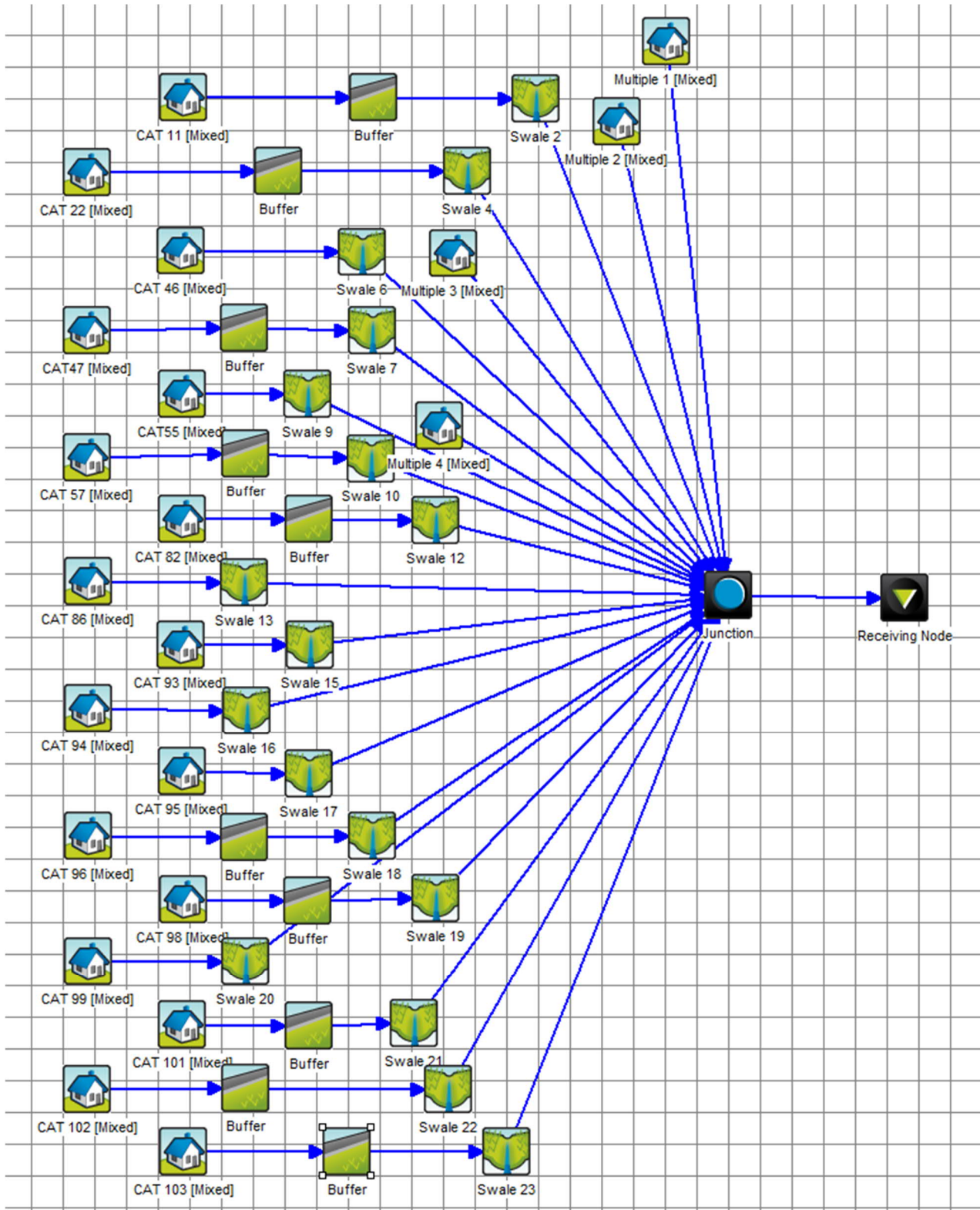
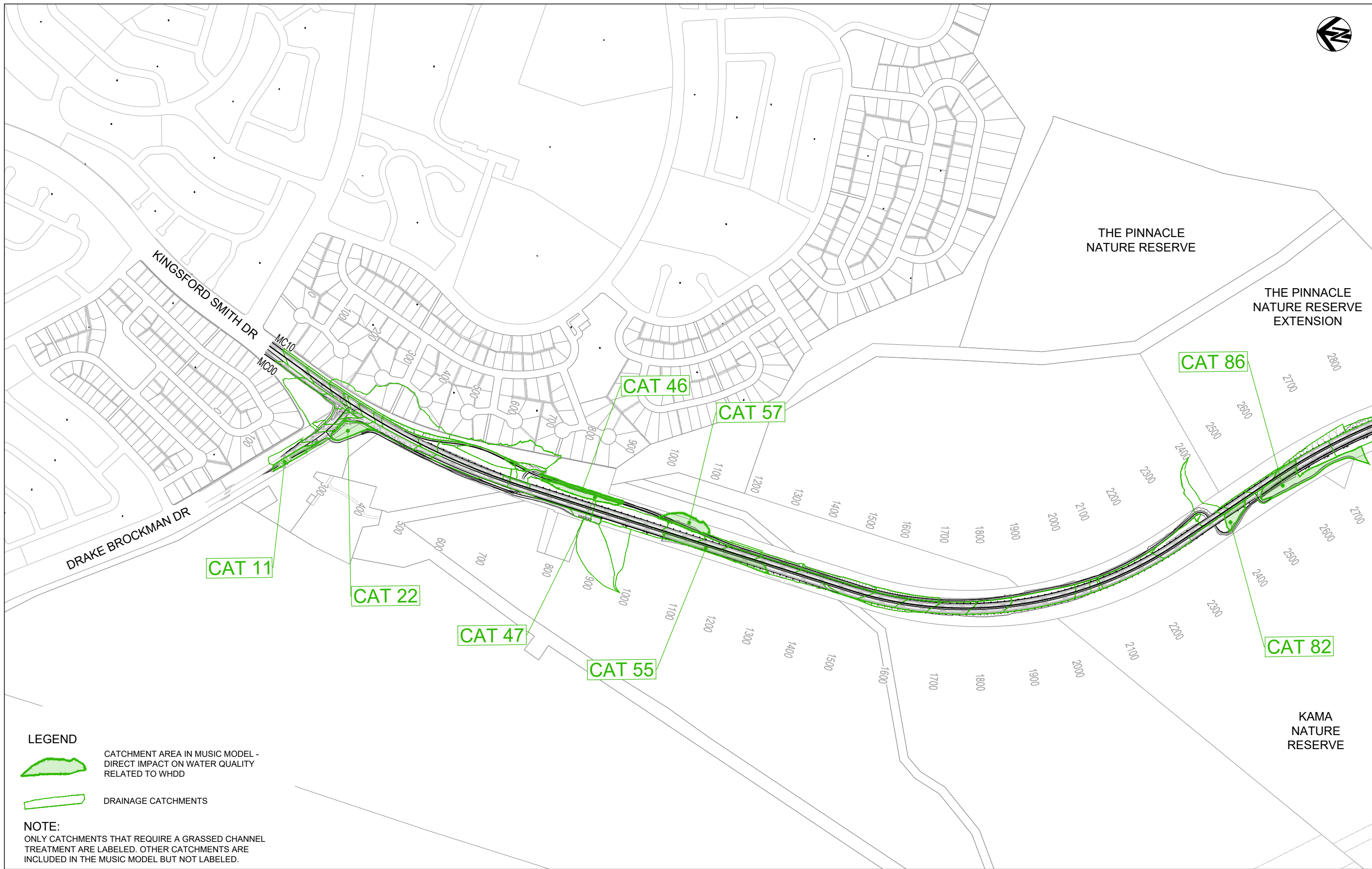


Figure 4: WHD Duplication MUSIC Model


The catchment areas and treatments are detailed in the following table:


Catchment	Area (Ha)	Treatment
Multiple 1(1 TO 7)	0.653	No Treatment
Multiple 2 (10,12,14-21,23-32)	1.828	No Treatment
11	0.136	Grassed Channel
22	0.234	Grassed Channel
Multiple 3 (36-45, 48-52,57-71)	4.464	No Treatment
46	0.112	Grassed Channel
47	0.204	Grassed Channel
55	0.446	Grassed Channel
57	0.275	Grassed Channel
Multiple 4 (72 TO 100) excl catchment below	8.615	No Treatment
82	0.165	Grassed Channel
86	0.714	Grassed Channel
93	0.24	Grassed Channel
94	0.063	Grassed Channel
95	0.147	Grassed Channel
96	0.095	Grassed Channel
98	0.457	Grassed Channel
99	0.294	Grassed Channel
101	0.797	Grassed Channel
102	0.274	Grassed Channel
103	0.716	Grassed Channel

Table 5: WHD Duplication catchment areas and treatments



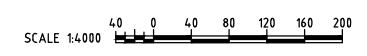
LEGEND

 CATCHMENT AREA IN MUSIC MODEL - DIRECT IMPACT ON WATER QUALITY RELATED TO WHDD

 DRAINAGE CATCHMENTS

NOTE:
 ONLY CATCHMENTS THAT REQUIRE A GRASSED CHANNEL TREATMENT ARE LABELED. OTHER CATCHMENTS ARE INCLUDED IN THE MUSIC MODEL BUT NOT LABELED.

NOT FOR CONSTRUCTION



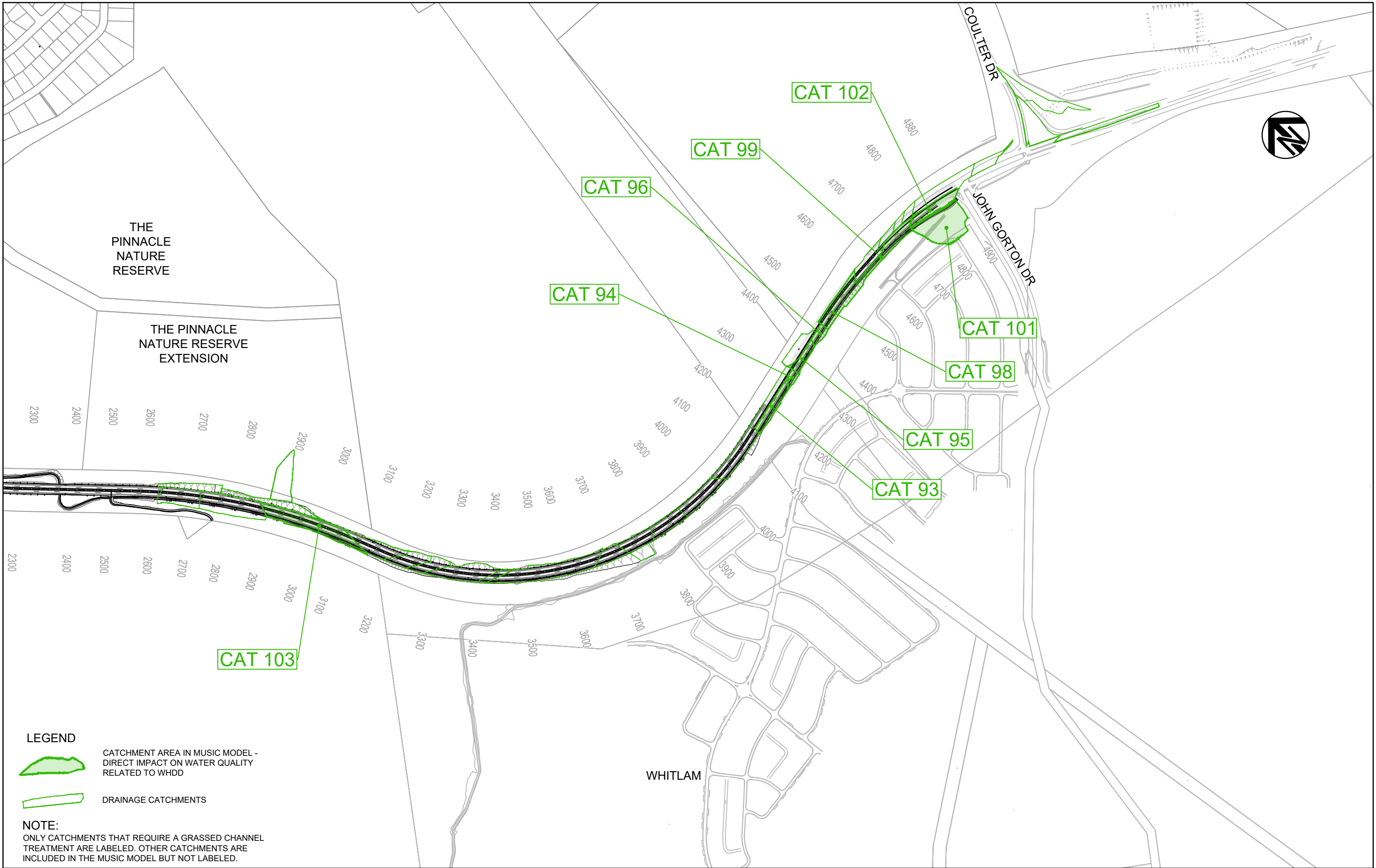
**WILLIAM HOVELL DRIVE DUPLICATION MUSIC MODEL
 CATCHMENTS RELATED TO WHDD WATER QUALITY - SHEET 1**

INFORMATION DOCUMENT

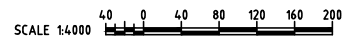
3002750-210527-INF-0021



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 LEVEL 5 20 BERRY STREET
 NORTH SYDNEY NSW 2060



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**WILLIAM HOVELL DRIVE DUPLICATION MUSIC MODEL
CATCHMENTS RELATED TO WHDD WATER QUALITY - SHEET 2**

INFORMATION DOCUMENT

3002750-200527-INF-0022



Member of the Surbana Jurong Group

© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA

Appendix B Waterways: Water Sensitive Urban Design General Code

Rules	Criteria	Compliance
Element 1: Mains water use reduction		
1.1 Mains Water Use Reduction Target		
<p>R1</p> <p>This rule applies to all development currently connected or intended to be connected to mains water supply except any of the following:</p> <ul style="list-style-type: none"> a) development subject to the estate development code b) development for minor alterations or extensions involving 50% or less of the existing floor area. <p>Development achieves a minimum 40% reduction in mains water consumption compared to an equivalent development constructed in 2003.</p> <p>Note: Compliance with this rule is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p>	<p>This is a mandatory requirement. There is no applicable criterion.</p>	<p>Not Applicable</p> <p>The development is for a major road duplication and no water consumption is proposed.</p>
Element 2: Stormwater Quantity		
2.1 On-site stormwater retention		
<p>R2</p> <p>This rule applies to development for at least one of the following:</p> <ul style="list-style-type: none"> a) development on sites greater than 2,000m² involving works that have the potential to alter the stormwater regime of the site, including sites subject to the estate development code b) development within existing urban areas 	<p>C2</p> <p>Development complies with all of the following:</p> <ul style="list-style-type: none"> a) It is demonstrated that stormwater retention measures can be more successfully met offsite b) development complies with at least one of the following stormwater retention management measures: 	<p>Not Applicable</p> <p>The development is for a major road duplication and no water consumption is proposed.</p>

Rules	Criteria	Compliance
<p>which increases impervious area by 100m².</p> <p>This rule does not apply to any of the following:</p> <ul style="list-style-type: none"> a) development of major roads b) sites identified in a precinct code that stormwater retention requirements for the site have been fully dealt with through an estate development plan. <p>Development complies with at least one of the following:</p> <ul style="list-style-type: none"> a) stormwater retention management measures are provided and achieve all of the following: <ul style="list-style-type: none"> i). Stormwater storage capacity of 1.4kL per 100m² of the total impervious area of the site is provided specifically to retain and reuse stormwater generated on site as a whole ii). Retained stormwater is used on site b) development captures, stores and uses the first 15mm of rainfall falling on the site. <p>For this rule, on-site stormwater retention is defined as the storage and use of stormwater on site.</p> <p>Note: Compliance with this rule is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p> <p>Note: ACT Practice Guidelines for Water Sensitive Urban Design defines acceptable uses of stormwater on site.</p>	<ul style="list-style-type: none"> i). An equivalent volume of stormwater is stored and used at an offsite location within the same catchment or a catchment in proximity to the site as part of a stormwater offset agreement ii). If it is demonstrated that the above stormwater retention measures are unable to be provided, then a contribution to the construction of offsite measures within the same catchment or a catchment in proximity to the site as a means of offset may be approved by the Planning and Land Authority. <p>For this criterion, the meaning of a stormwater offset agreement as defined and detailed in the ACT Practice Guidelines for Water Sensitive Urban Design.</p> <p>Note: Compliance with this criterion is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p>	

Rules	Criteria	Compliance
<p>Note: Any site specific stormwater retention requirements for new estates must be nominated on planning control plans submitted with the estate development plan.</p>		
<p>2.2 On-site stormwater detention</p>		
<p>R3</p> <p>This rule applies to development for at least one of the following:</p> <ul style="list-style-type: none"> a) development on sites greater than 2,000m² involving works that have the potential to alter the stormwater regime of the site, including sites subject to the estate development code b) development within existing urban areas which increases impervious area by 100m² <p>This rule does not apply to any of the following:</p> <ul style="list-style-type: none"> a) development of major road b) sites identified in a precinct code indicating that stormwater detention requirements have been fully met. <p>Stormwater detention measures are provided and achieve all of the following:</p> <ul style="list-style-type: none"> a) capture and direct runoff from the entire site b) Stormwater storage capacity of 1kL per 100m² of impervious area is provided to specifically detain stormwater generated on site c) The detained stormwater is designed to be released over a period of 6 hours after the storm event. 	<p>C3</p> <p>Stormwater detention measures are provided and achieve all of the following:</p> <ul style="list-style-type: none"> a) ensure that the peak rate of stormwater runoff from the site does not exceed the peak rate of runoff from an unmitigated (rural) site of the same area for the 1 Exceedance per Year (1EY) b) A maximum of 30% of the runoff from the site may bypass the onsite stormwater detention system where it can be demonstrated that at least one of the following circumstances applies: <ul style="list-style-type: none"> i). Difficult ground levels ii). The nature of the receiving drainage system cannot receive runoff from the entire site iii). The need to retain significant trees or vegetation iv). other demonstrated circumstances. <p>Note: Compliance with this criterion is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p> <p>Note: where an estate development plan has partially achieved the stormwater detention measures, this can be taken into account for the detention measures on individual sites.</p>	<p>Not Applicable</p> <p>The development is for a major road duplication and no water consumption is proposed.</p>

Rules	Criteria	Compliance
<p>For this rule on-site stormwater detention is defined as the short term storage and release downstream of stormwater runoff.</p> <p>Note: Compliance with this rule is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p> <p>Note: Calculating on-site detention can include 50% of the volume of rainwater tanks where stormwater is used on-site.</p> <p>Note: For new estates any stormwater detention must be nominated on planning control plans submitted with the estate development plan. In particular, where an estate development plan has partially achieved the stormwater detention measures, this can be taken into account for the detention measures on individual sites.</p>		

2.3 Stormwater quantity for major road on sites over 2000m²

<p>R4</p> <p>This rule applies to development of major roads involving sites greater than 2000m².</p> <p>Development complies will all of the following:</p> <ul style="list-style-type: none"> a) The capacity of existing pipe (minor) stormwater connection to the site is not exceeded in the 1 in 10 year storm event <p>The capacity of the existing overland (major) stormwater system to the site is not exceeded in the 1 in 100 year storm event</p>	<p>C4</p> <p>Development for major roads on sites greater than 2000m² complies with at least one of the following:</p> <ul style="list-style-type: none"> a) A reduction of the 1 in 5 year and 1 in 100 year stormwater peak run off flow to predevelopment levels b) The capacity of the downstream piped stormwater system to its outlet with an open channel is not exceeded in the 1 in 10 year storm event. <p>Note: Compliance with this criterion is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p>	<p>Complies with R4</p> <p>R4 applies as the development is for a major road duplication involving sites greater than 2,000m². The drainage is configured to ensure the duplication of William Hovell Drive does not place unnecessary pressure on existing stormwater infrastructure.</p> <p>There are 23 culvert crossings within the proposed upgraded section of the road, however these are generally within non-residential areas and capture flows into the nature reserves and open rural areas.</p> <p>The existing transverse drainage lines have been retained to provide consistency with the current drainage arrangement and minimise impact to flora, fauna and nature reserves.</p>
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Rules	Criteria	Compliance
		The drainage designs and culverts have sufficient capacity to ensure the road is protected from flooding up to the 1 in 100 year storm event.
2.4 On-site stormwater detention for estate development plans		
There is no applicable rule.	<p>C5</p> <p>This criterion applies to estate development plans.</p> <p>Stormwater detention measures are provided and the peak rate of stormwater runoff from the estate does not exceed the peak rate of runoff from an unmitigated (rural) site of the same area for minor and major storms.</p> <p>Note: Compliance with this criterion is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p> <p>Note: The Major (1% Annual Exceedance Probability (AEP)) and Minor storms are as defined by Transport Canberra and City Services Directorate (TCCS) or the agency responsible for stormwater management.</p> <p>Note: Stormwater detention measures required for each individual block may contribute toward meeting the overall detention requirements for the estate as demonstrated in an estate development plan. Note: Any site specific stormwater detention must be nominated on planning control plans submitted with the estate development plan.</p>	<p>Not Applicable</p> <p>The development is not for an EDP.</p>
Element 3: Stormwater Quality		
3.1 Stormwater Quality Target – sites greater than 2000m ²		
R6 This rule applies to development for all of the following:	C6 It is demonstrated that at least one of the following applies:	<p>Not Applicable</p> <p>The development is for a major road duplication and no water consumption is proposed.</p>

Rules	Criteria	Compliance
<p>a) where the development site is greater than 2,000m²</p> <p>b) where development involves works that have potential to alter the stormwater regime for the site.</p> <p>This rule does not apply to development of major roads.</p> <p>The average annual stormwater pollutant export is reduced when compared with an urban catchment of the same area with no water quality management controls for all of the following:</p> <p>a) gross pollutants by at least 90%</p> <p>b) suspended solids by at least 60%</p> <p>c) total phosphorous by at least 45%</p> <p>d) total nitrogen by at least 40%.</p> <p>Note: Compliance with this rule is consistent with the ACT Practice Guidelines for Water Sensitive Urban Design and is demonstrated by a report by a suitably qualified person, using the MUSIC model. If a tool other than the MUSIC model is used then a report by an independent suitably qualified person must be submitted demonstrating and confirming compliance with the rule. If parameters that are non-compliant are used then a report must also be submitted by an independent suitably qualified person stating how and why the parameters are appropriate.</p>	<p>a) stormwater quality measures can be more successfully met offsite</p> <p>b) a sensitive downstream environment will be negatively impacted.</p> <p>Development complies with at least one of the following:</p> <p>a) an equivalent load of pollutants is captured at an offsite location as part of a stormwater offset agreement</p> <p>b) if the above stormwater quality measures are unable to be provided, then a contribution to the construction of offsite measures as a means of offset may be approved by the Planning and Land Authority.</p> <p>For this criterion a stormwater offset agreement is defined as detailed in the ACT Practice Guidelines for Water Sensitive Urban Design.</p> <p>Note: Compliance with this criterion is consistent with the ACT Practice Guidelines for Water Sensitive Urban Design and is demonstrated by a report by a suitably qualified person, using the MUSIC model. If a tool other than the MUSIC model is used then a report by an independent suitably qualified person must be submitted demonstrating and confirming compliance with the criterion. If parameters that are non-compliant are used then a report must also be submitted by an independent suitably qualified person stating how and why the parameters are appropriate.</p>	
<p>3.2 Stormwater quality Target – major roads</p>		
<p>R7</p> <p>This rule applies to development of major roads, including the</p>	<p>C7</p> <p>If it can be demonstrated that the stormwater quality measures specified in the rule are unable to</p>	<p>Complies with R7</p> <p>Vegetated swales are to be provided within the road reserve on both sides of the road to collect</p>

Rules	Criteria	Compliance
<p>duplication of an existing major road in full or in part.</p> <p>The average annual stormwater pollutant export is reduced when compared with a road catchment of the same area with no water quality management controls for all of the following:</p> <ul style="list-style-type: none"> a) gross pollutants by at least 90% b) suspended solids by at least 60% c) total phosphorous by at least 45% d) total nitrogen by at least 40%. <p>Note: Compliance with this rule is consistent with the ACT Practice Guidelines for Water Sensitive Urban Design and is demonstrated by a report by a suitably qualified person, using the MUSIC model. If a tool other than the MUSIC model is used then a report by an independent suitably qualified person must be submitted demonstrating and confirming compliance with the rule. If parameters that are non-compliant are used then a report must also be submitted by an independent suitably qualified person stating how and why the parameters are appropriate.</p>	<p>be provided, then a contribution to the construction of offsite measures as a means of offset may be approved by the Planning and Land Authority.</p> <p>Note: Compliance with this criterion is consistent with the ACT Practice Guidelines for Water Sensitive Urban Design and is demonstrated by a report by a suitably qualified person, using the MUSIC model. If a tool other than the MUSIC model is used then a report by an independent suitably qualified person must be submitted demonstrating and confirming compliance with the criterion. If parameters that are non-compliant are used then a report must also be submitted by an independent suitably qualified person stating how and why the parameters are appropriate.</p>	<p>runoff and remove pollutant particles and sediment. Where kerb and gutter is provided, surface water is collected and discharged to vegetated swales.</p> <p>For the portion of the duplication within the Deep Creek catchment, runoff is directed to vegetated swales before being discharged to Deep Creek.</p> <p>A MUSIC model was prepared for the road upgrade to determine if the proposed water quality measures meet the reduction targets.</p> <p>Modelling of the project indicates that the following reductions are achievable:</p> <ul style="list-style-type: none"> • 18.7% TSS (target is 16%) • 10.8% TP (target is 11%) and • 10.6% TN (target is 11%). <p>As shown above, the proposal achieves reasonable compliance with the water quality targets for Deep Creek from the Molonglo 3 – Stormwater Management WSUD Design Strategy (July 2015). The drainage design will be investigated further during detailed design to ensure water quality requirements are met.</p>

Element 4: Climate change adaptation

4.1 Nuisance flooding – sites greater than 2000m²

<p>There is no applicable rule.</p>	<p>C8</p> <p>This criterion applies to development on sites greater than 2,000m² involving works that have potential to alter the existing drainage and overland flow regime for the site.</p> <p>Overland flow paths are provided and achieve all of the following:</p> <ul style="list-style-type: none"> a) accommodate overland stormwater flows up to the 1%AEP 	<p>Consistent with C8</p> <p>As a result of the duplicated road, the area of hardstand would increase and there would be an associated minor increase in peak stormwater runoff. The Project would increase the stormwater drainage to manage the increased surface water for events up to the 1% AEP, while also providing additional protection during and following major storm events. As such, there should be no change with regard to the risk for erosion</p>
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Rules	Criteria	Compliance
	<p>b) reduce nuisance flooding.</p> <p>Note: Compliance with this criterion is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p>	<p>and scour at the stormwater discharge points or potential for sediment discharge and pollution.</p> <p>The existing transverse drainage systems under the proposed upgrade would be retained where practically possible. There would only be a minor change in flow attenuation between the present day and post construction. The drainage plans provide the details and locations of the proposed culverts to protect the road from flooding for events up to 1% AEP.</p>
4.2 Green/living infrastructure		
<p>R9</p> <p>This rule applies to at least one of the following developments:</p> <ul style="list-style-type: none"> a) Development on sites greater than 2000m² involving works that have potential to alter the stormwater regime for the site b) Development within existing urban areas that increase the impervious area of the site by 100m² or more. <p>Development achieves a minimum of 20% of the site area to be permeable.</p> <p>Note: Compliance with this rule is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p>	<p>C9</p> <p>It is demonstrated that the development achieves all of the following:</p> <ul style="list-style-type: none"> a) Increases permeable surfaces and living infrastructure through green spaces b) Plants that require irrigation are supported by sustainable water systems such as onsite stormwater harvesting to achieve microclimate benefits c) Promotes evapotranspiration to mitigate extreme temperatures, improve air humidity and overall human comfort. <p>Note: Compliance with this criterion is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p>	<p>Not Applicable</p> <p>The development is for a major road duplication and it will not alter the stormwater regime for the site. The EIS chapter on Water Quality and Hydrology (Section 6.7.5) details the approach to stormwater management in the project. The use of vegetated swales provides an acceptable level of permeable surfaces in the road reserve to help manage stormwater flows and the water quality of runoff.</p>
Element 5: Entity (Government agency) Endorsement		
5.1 Water infrastructure		
<p>There is no applicable rule.</p>	<p>C10</p> <p>This criterion applies to development that will result in</p>	<p>Noted</p> <p>An Operation and Maintenance Plan will be prepared and</p>

Rules	Criteria	Compliance
	<p>municipal water sensitive urban design infrastructure being handed to the ACT Government.</p> <p>An operation and maintenance plan is to be endorsed by the ACT Government for the water sensitive urban design assets that are to be handed to the ACT Government.</p> <p>Note: Compliance with this criterion is demonstrated through a report from a suitably qualified person consistent with the methods specified in the ACT Practice Guidelines for Water Sensitive Urban Design.</p>	<p>endorsed by the EPA during the construction period. This would detail the vegetated swales proposed throughout the project.</p>

Table 6: Assessment against the Waterways: Water Sensitive Urban Design General Code (21 Feb 2020)

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