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To	**Melinda Holloway**	From	**Nina Barich**
Copy	**Laurence Newcome – Melbourne Water**	Reference	**2008**
Date	**12 January 2021**	Pages (including this page)	**8**
Subject	**615 Hume Freeway, Beveridge Catchment Analysis**		

The site at 615 Hume Freeway, Beveridge is located within the Beveridge North West Precinct Structure Plan (PSP) and Melbourne Water's Kalkallo Creek Development Services Scheme (DSS).

The Beveridge North West Precinct Structure Plan (PSP) is a blueprint for development that aims to balance meeting complex policy requirements and providing affordable development. The Kalkallo Creek Development Services Schemes (DSS) outlines the plan for stormwater infrastructure required to ensure that the new development within this precinct meets appropriate standards for flood protection, water quality, waterway health and amenity. It has been prepared by Melbourne Water based on the PSP and topography of the land. The DSS estimates the costs of infrastructure which is used to establish contributions under the Water Act (1989) that apply to developers to fund the provision of infrastructure.

The site is proposed to have 2 main catchments, a northern catchment and a southern catchment. The northern catchment will drain to a constructed waterway which traverses the north-west corner of the site and drains into a future wetland / retarding basin to the west of the site located on the north side of Camerons Lane. The southern catchment drains south through an existing low density residential area. The existing low density residential area is included in the Beveridge Central PSP and is subject to future development.

Several parties involved with development in the catchment have queried the feasibility of the southern catchment to be conveyed through the existing low density residential area without flow mitigation. The following outlines the potential options for drainage of the catchment.

1 Existing Proposed Drainage Solution

Figure 1 illustrates the existing proposed Kalkallo Creek DSS drainage solution for the catchment encompassing the site. The site is referenced as property 119 on the extract from the Kalkallo Creek DSS map.

The Kalkallo Creek DSS scheme map indicates a constructed waterway traversing the site from CH9 - CH7. Based on existing topography and the proposed urban structure as nominated in the PSP, it is estimated that the contributing catchment at CH9 is approximately 53.4 ha. The catchment contributing to the waterway within the site is approximately 57.4 ha and the additional catchment contributing to the waterway from the property located at Lot 1 Camerons Lane, Beveridge is approximately 9.6 ha.

Based on existing topography and the proposed urban structure as nominated in the PSP, it is estimated the contributing catchment to the constructed waterway from CH5 – CH7 is approximately 78.7 ha. The additional contributing catchment from CH7 - CH10, the point to which the waterway discharges into the proposed wetland / retarding basin asset RB2 is 68.6 ha.

The catchment draining to the south from within the site is estimated to be approximately 47 ha, with an additional 9.6 ha contributing at Camerons Lane from the site at Lot 1 Camerons Lane, Beveridge. The catchment delineation based on existing topography and the proposed urban structure is

illustrated in **Figure 2**.

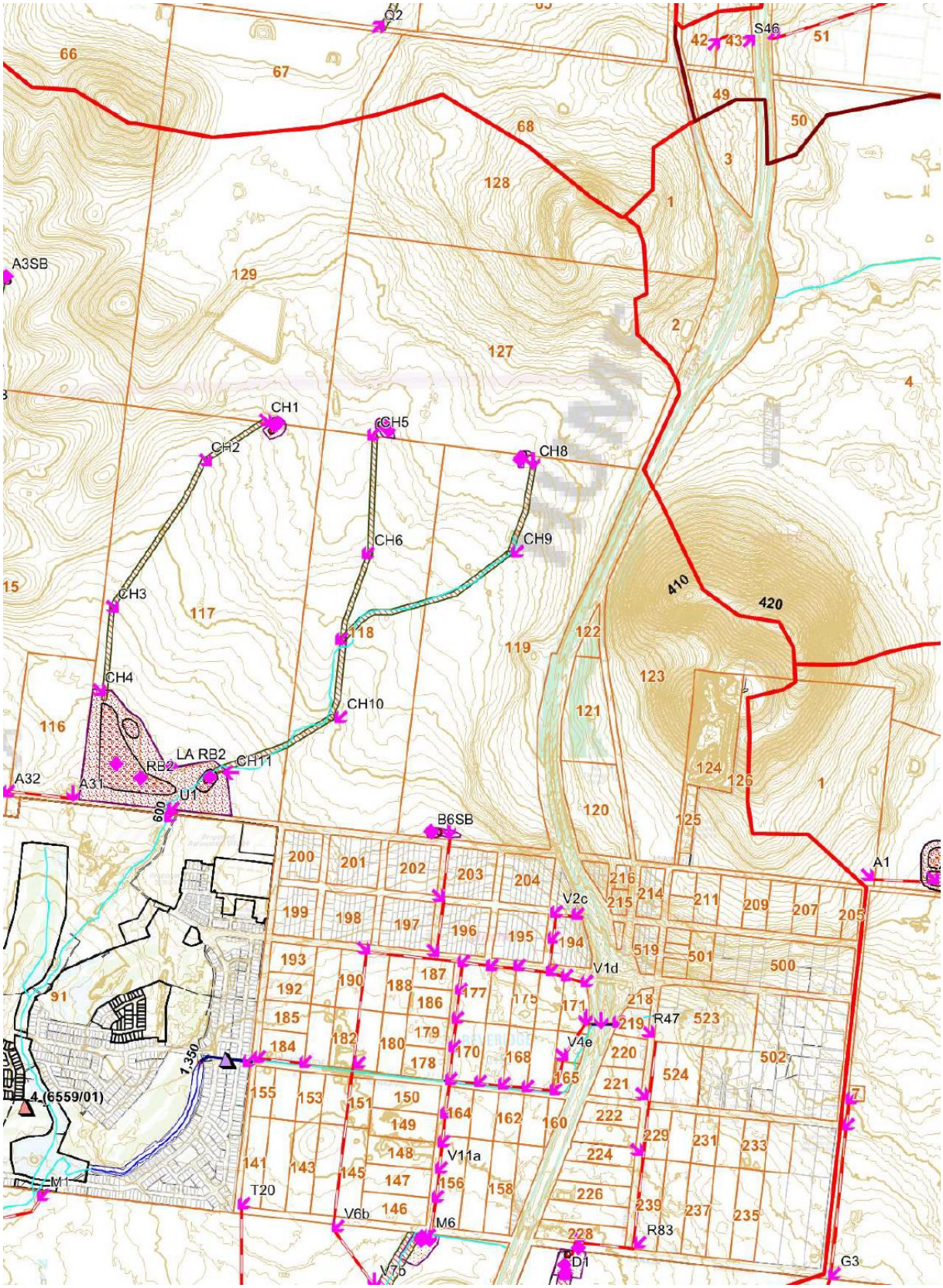

Figure 1 – Kalkallo Creek DSS

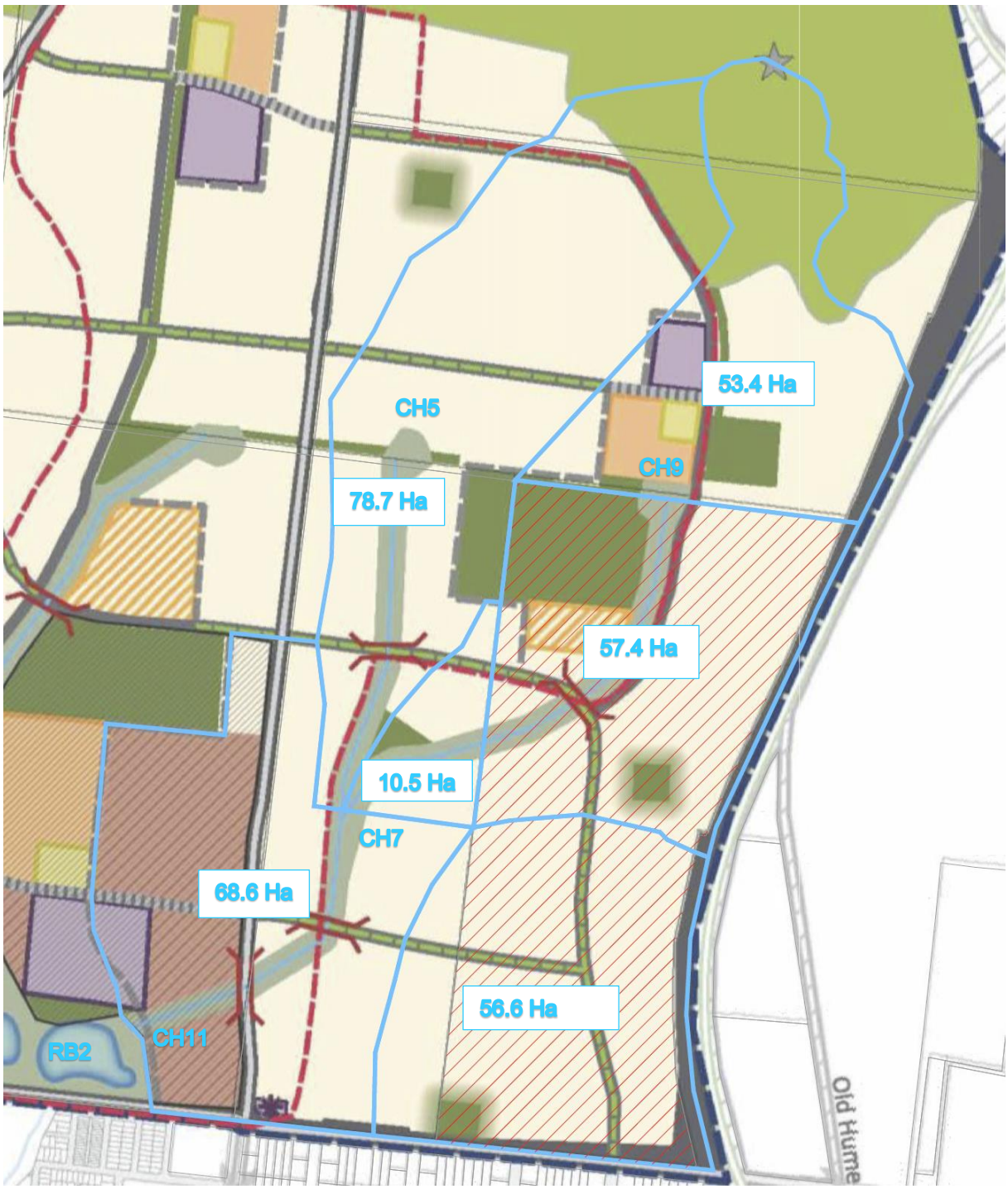

Figure 2 – Major Catchments

Southern Catchment

The catchment draining to the south from within the site is estimated to be approximately 47 ha, with an additional 9.6 ha contributing at Camerons Lane from the site at Lot 1 Camerons Lane, Beveridge.

The Kalkallo Creek DSS nominates the regular flows generated from the urbanisation of the catchment to discharge into a proposed sediment basin located in a drainage reserve within the site at 615 Hume Freeway, Beveridge. The flows will then cross Camerons Lane and continue south via a pipe located in Malcolm Street.

Peak flows for the catchment have been calculated based on the probabilistic rational method using 2016 Intensity Frequency Duration (IFD) data. The peak 1% AEP design flow for the catchment is estimated to be approximately 12.1 m^3/s. The peak 20% AEP for the catchment is estimated to be approximately 5.8 m^3/s.

Table 1 – Peak Design Flows at B6SB for 56.65 ha Catchment

Storm Event	Peak Flow (m^3/s)
20% AEP	5.8
1% AEP	12.1

Whilst the current Kalkallo Creek DSS does not nominate any retardation with the sediment pond B6SB; the air space above the normal water level has the ability to provide some mitigation to the peak design flows. This is because the normal water level of the sediment pond will need to be set approximately 2 m below existing surface level to allow for pipe connection/s to the pond whilst maintaining a dry pipeline from the first pit upstream of the pond.

The sediment pond should be sized to capture 95% of the coarse particles that are ≥ 125 µm for a 4 Exceedances per Year (EY) design flow; provide adequate storage volume to hold 5 years of sediment accumulation prior to clean-out; and ensure the velocity through the sediment pond during the peak 1% AEP storm event is ≤ 0.5 m/s. Based on complying with these design requirements, it is estimated that the sediment pond would require to be approximately 1,200 m^2 at Normal Water Level (NWL). This would require a drainage reserve of approximately 0.8 ha.

It is estimated that the storage volume above the sediment pond available for retardation is approximately 5,700 m^3. This has the capacity to mitigate the peak 1% AEP design flow discharging from the drainage reserve to approximately 8 m^3/s.

The existing Kalkallo DSS nominates a 1% AEP pipeline from the sediment basin, conveyed south along Malcolm Street. Based on the mitigated flows and the existing topography, it is estimated that this pipeline would need to be a 1500 mm diameter. However; with careful design of the drainage reserve at B6SB; the flow may be able to be reduced marginally to facilitate a 1350 mm diameter pipeline along Malcolm Street.

There is also the ability surcharge some flows from the pipeline and have the flows conveyed overland (this is based on the assumption that the full 1% AEP design flow will need to be conveyed in a culvert under the proposed Freeway on-ramp and Camerons Lane). Malcolm Street can safely convey approximately 4 m^3/s overland, which would reduce the flow in the pipe to approximately half and facilitate the implementation of a 1050 mm diameter pipe. Additional catchment will contribute to this drainage system at Lithgow Street, but an opportunity exists to split the flows at this location across several pipes and north-south road reserves.

Northern Catchment

A RORB model for the catchment has been constructed. RORB was adopted as the design runoff routing model for generation of flows and, if required, simulation of storages catchment. RORB generates catchment runoff based on the selection of local rainfall intensity frequency duration data and appropriate loss models.

A RORB model has been adopted to assess the catchment and the flows in the waterways to the point of discharge into the wetland / retarding basin RB2. The total area draining from the proposed eastern tributaries into RB2 is 267.3 ha.

An existing conditions model was developed to establish appropriate parameters for use in the model through reconciliation to other known methods for estimating flow. Once appropriate parameters were selected, the model was then updated to reflect the proposed development scenario.

The model was set up utilising ARR '87. This is to enable comparison with the overall model, also adopting ARR '87. A check has been undertaken for the model with the application of ARR2019. **Table 2** outlines the catchment areas and peak 1% AEP design flows at various locations throughout the catchment.

Table 2: Peak flows for Northern Catchment Discharging to RB2

Location	Total Catchment Area (Ha)	Peak 1% AEP Flow (m^3/s)	
		ARR'87	ARR2019
CH8 – CH7	120.03	15.02	13.74
CH5 – CH7	78.66	10.44	9.41
CH10	216.13	26.33	23.04
RB2	276.31	29.31	27.02

Note: Flows taken at downstream location, flows at RB 2 are for the eastern catchment discharging to RB2 only and do not include the western catchment.

2 Alternative Scheme Option

Urbanisation provides the opportunity to drain catchments to different locations through pipe design and the design and grading of roads. As there are questions raised over the ability of the future development located south of the site to convey the flows from the existing catchment contribution of 56.65 ha; it is proposed to divert some of this catchment west though the site located at Lot 1 Camerons Lane to the proposed waterways and to RB2.

Figure 3 illustrates the proposed split of the southern catchment to drain some additional area to the west.

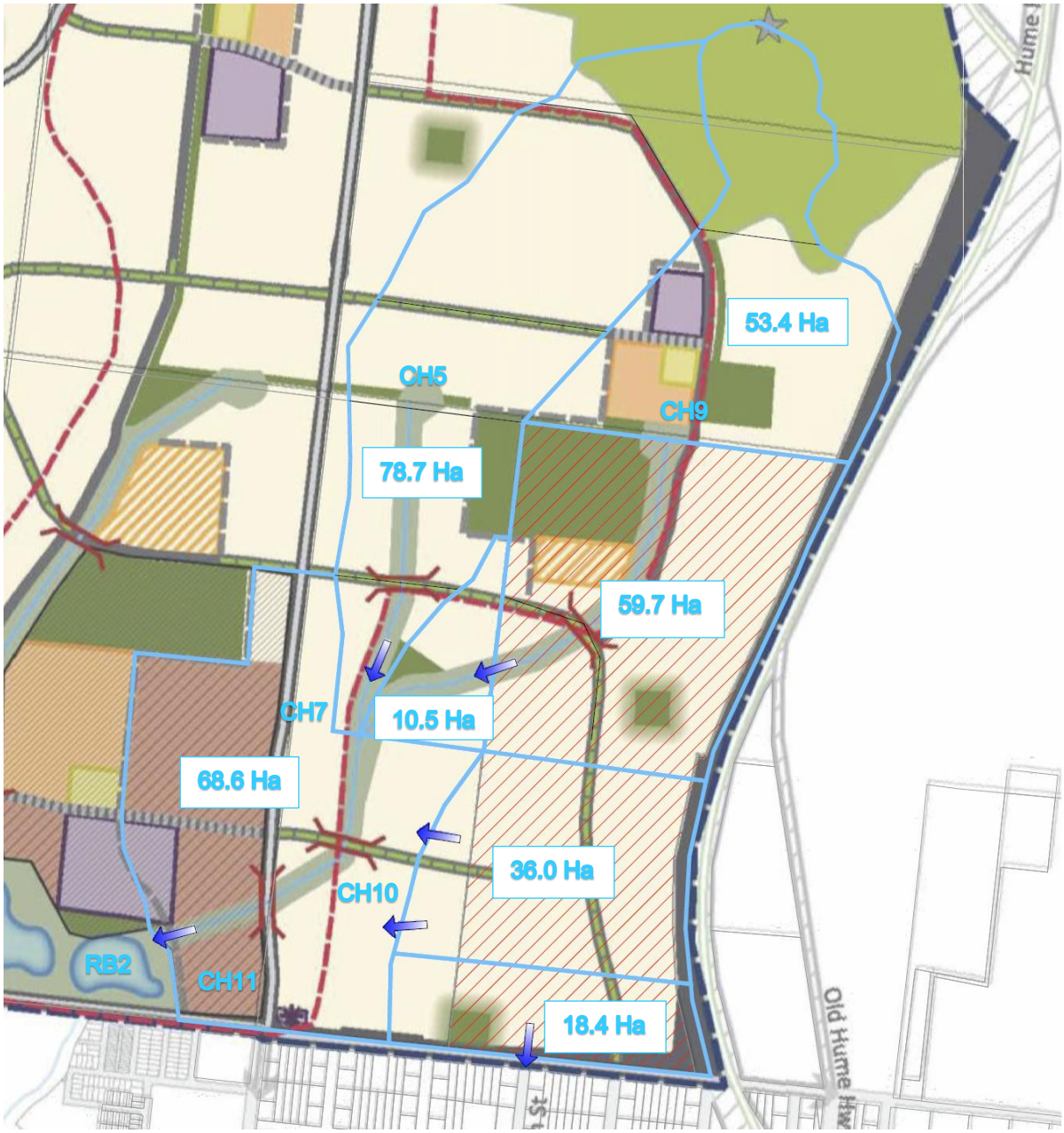

Figure 2 – Proposed Major Catchments

It must be noted that the ability to divert the full additional catchment (~38.2 ha) is dependent upon the urban structure, design and the inclusion of east – west road reserves between the two properties. As a minimum, it is believed that the catchment to the north of the east – west connector road discharging at CH10 could be diverted, which is approximately 22.2 ha.

In diverting the flows, a check has been undertaken to ensure the additional catchment discharging to the west does not result in any adverse effects on the assets.

Table 3 outlines the peak flows discharging to the south-west based on a revised RORB model incorporating the changes to the catchment.

Table 2: Peak flows for Northern Catchment Discharging to RB2

Location	Total Catchment Area (Ha)	Peak 1% AEP Flow (m^3/s)	
		ARR'87	ARR2019
CH8 – CH7	120.03	15.34	13.97
CH5 – CH7	80.97	10.41	9.31
CH10	238.32	29.27	25.32
RB2	305.59	34.28	31.47

The results indicate an increase in peak flows in the waterways, which is to be expected from the diversion of a catchment with a magnitude of 38 ha. A quick hydraulic check has been undertaken on the waterways from CH7 – CH10, and from CH10 – CH11, to ascertain if the increase in flow will result in an increase in waterway corridor width. The results indicate that whilst the increased flow results in an increase in hydraulic width of approximately 0.5 m, the width remains less than 25 m and therefore a 45 m wide waterway corridor with active edges is still acceptable for these tributaries.

A rational method flow computation has been undertaken to assess the ability to convey the peak flows generated from the additional catchment to the west through the proposed development. The results indicate that the peak 1% AEP design flow from the catchment north of the connector is approximately 6.2 m^3/s. It is estimated that approximately 3.4 m^3/s will need to be conveyed overland via road reserves to the waterway at CH10. This gap flow can be safely conveyed along a 22 m or wider connector road reserve at minimum grades. It is estimated a 1050 mm diameter pipe would be required to convey the regular flows to the waterway through the development. Alternatively, the flow should be split across several road reserves or the pipe diameter increased.

The results of the rational method computations indicate that the peak 1% AEP design flow from the additional catchment south of the connector is approximately 5 m^3/s. It is estimated that 2.75 m^3/s would be conveyed overland via road reserves to the retarding basin. This flow magnitude would need to be conveyed along 2 separate road reserves for safety. It is estimated a 900 mm diameter pipe would be required to convey the regular flows to the retarding basin through the development, or a larger pipe if the overland flow cannot be split.

The reduction in the southern catchment will reduce the size of the sediment pond required and the drainage reserve. It will also reduce the size of the pipeline required to convey the flows south along Malcolm Street.

Peak flows for the catchment have been calculated based on the probabilistic rational method using 2016 Intensity Frequency Duration (IFD) data. The peak 1% AEP design flow for the catchment is estimated to be approximately 5.7 m^3/s. This is less than the previously estimated peak 20% AEP design flow.

Without any mitigation of the peak flows in the drainage reserve, it is estimated the 1% AEP design flow pipeline from Camerons Lane along Malcolm Street would need to be a 1200 mm diameter. If some flows are surcharged from the pipeline, it is estimated that the pipeline could reduce to a 900 mm diameter.

Based on complying with the sediment pond design requirements, it is estimated that the sediment pond would require to be approximately 460 m^2 at NWL for an 18.4 ha catchment. This would require a drainage reserve of approximately 0.5 ha.

3 Summary

The existing Kalkallo Creek DSS can be implemented in accordance with the scheme intent without the inclusion of additional drainage reserve for retardation of the catchment draining south across Camerons Lane in the site at 615 Hume Freeway, Beveridge.

Alternatively, the urban layout provides the ability to drain some additional catchment from the site at 615 Hume Freeway, Beveridge west into the proposed retarding basin instead of south and across Camerons Lane. This will reduce the size of the drainage infrastructure required for the south, including the size of the pipeline along Malcolm Street and further to the south, and the sediment pond located on the immediate north of Camerons Lane. The diversion of the catchment does not impact on the size of the waterway corridors to the west, and flows from the diverted catchment can be safely conveyed through the neighbouring development. This alternative is more likely to restrict the ability of the site at 615 Hume Freeway to develop prior to the construction of the permanent outfalls.