ENGENY
WATER MANAGEMENT

Melbourne Water

Lancefield Road PSP

Report on Drainage Design Process for DSS

14 August 2017

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CONTENTS

Appendices

1. INTRODUCTION

This report has been commissioned by Melbourne Water on behalf of Melbourne Water and the Victorian Planning Authority (VPA).

This report describes the work undertaken by Engeny Water Management (Engeny) to prepare the proposed drainage Development Services Schemes (DSSs) for the Lancefield Road Precinct Structure Plan (PSP) area.

This report represents my expert opinion.

1.1 Author Details

1.1.1 Name and Business Address

Paul Clemson
Suite 15, 333 Canterbury Road
Canterbury, Victoria, 3126

1.1.2 Qualifications

I have the following qualifications:

Education: Bachelor of Engineering (Civil), Monash University, 2006

1.1.3 Experience and Expertise of the Author / Reviewer

I am a senior engineer in the Melbourne branch of Engeny, with eleven years of experience in the water industry. I have extensive experience on a diverse range of engineering projects including stormwater drainage and quality studies, drainage master planning, flood mapping, potable water supply network planning, recycled water design and sewer network planning and design.

Since 2011, I have led Engeny's work with Melbourne Water's Development Services team. This work has involved taking a technical lead and project management role on numerous projects to design new DSSs and technically review existing DSSs on behalf of Melbourne Water. In 2014, Engeny was one of three consultants appointed to Melbourne Water's Development Services Technical Panel. In 2015, Melbourne Water engaged Engeny to prepare four DSSs to plan for key drainage assets to cater for proposed development as part of the Lancefield Road PSP. I was Engeny's project manager and technical lead for the project.

A CV with more details regarding my experience is included in **Appendix A** (Paul Clemson CV).

This report has been reviewed in accordance with Engeny's quality assurance system.

This report was reviewed by Scott Dunn who is a principal engineer with Engeny. Scott has extensive experience in surface water management, including drainage master planning, flood studies, drainage design and construction site experience.

2. INSTRUCTIONS

Instructions were received from Harwood Andrews on behalf of the VPA. **Appendix B** provides a copy of the instructions.

3. REFERENCE DOCUMENTS

Documents were provided to me by Harwood Andrews. An index listing these documents was attached to my instructions and is included in **Appendix B**.

I also referred to the following information in the preparation of this report:

1. Oldbury Development Services Scheme Report (Engeny, August 2015)
2. Devon Park Development Services Scheme Report (Engeny, September 2015)
3. Sunningdale Development Services Scheme Report (Engeny, September 2015)
4. Williamsons Road Development Services Scheme Report (Engeny, September 2015)
5. Sunbury / Diggers Rest Growth Corridor Plan (Growth Areas Authority, June 2012)
6. Final Assessment Riparian Vegetation and Geomorphology in the Sunbury Growth Area (Alluvium / Biosis, 2014)
7. Erosion Analysis Classification for Waterways Around Sunbury (Alluvium, 2015)
8. Sunbury Erosion Potential Investigation (Alluvium, 2015)
9. Best Practice Environmental Management Guidelines (CSIRO, 1999)
10. Waterway Corridors Guidelines for greenfield development areas within the Port Phillip and Westernport Region (Melbourne Water, 2013)
11. Draft 'Design, construction and establishment of constructed wetlands: design manual' (Melbourne Water, 2015)
12. MUSIC Guidelines: Input parameters and modelling approaches for MUSIC users in Melbourne Water's service area (Melbourne Water, 2016)
13. MUSIC Guidelines (Melbourne Water, 2010)
14. Floodway Safety Criteria (Melbourne Water, 1996, available online)
15. Principles for Provision of Waterway and Drainage Services for Urban Growth (Melbourne Water, 2007)
16. Guidelines for the Design and Construction of Road and Drainage Infrastructure (Hume City Council, 2008).

4. RESPONSE TO INSTRUCTIONS

4.1 Instructions

In undertaking this assessment, I have:

- Reviewed relevant information, including the information listed in Section 3 of this report
- Responded to instructions as detailed below.

The instructions that are the subject of this report are to:

(1) Outline the process undertaken by Engeny to determine the total asset footprint of the conceptual assets in the DSSs, including wetlands and retarding basins; and

(2) Assess this process against current relevant Melbourne Water guidelines, including the:

(a) Draft 'Design, construction and establishment of constructed wetlands: design manual' (2016); and

(b) 'MUSIC Guidelines: Input parameters and modelling approaches for MUSIC users in Melbourne Water's service area' (2016).

This report relates to the preparation of DSSs in the Lancefield Road PSP only. Engeny was not engaged by Melbourne Water to develop the DSSs in the Sunbury South PSP.

4.2 Processes to Prepare the DSSs

4.2.1 Overview

In 2015, Engeny prepared four DSSs on behalf of Melbourne Water to plan for proposed key drainage assets in the Lancefield Road PSP. The concept designs for the DSS within the Lancefield Road PSP are described in the following Engeny reports:

- Oldbury Development Services Scheme Report (Engeny, August 2015)
- Devon Park Development Services Scheme Report (Engeny, September 2015)
- Sunningdale Avenue Development Services Scheme Report (Engeny, September 2015)
- Williamsons Road Development Services Scheme Report (Engeny, September 2015).

The concept design process utilised:

- Melbourne Water DSS costing spreadsheet
- RORB hydrological modelling
- Model for Urban Stormwater Improvement Conceptualisation (MUSIC) water quality modelling
- Hydrologic Engineering Centre River Analysis System (HECRAS) one-dimensional hydraulic modelling.

4.2.2 Site Visit

As part of the preparation of the DSSs, I undertook a site visit to publicly accessible areas of the subject site on 15 April 2015. The site visit was undertaken to obtain an understanding of site specific opportunities and constraints.

Figure 4-1, Figure 4-2 and Figure 4-3 provide a selection of photographs from the site visit.

Figure 4-1 Emu Creek at Konagaderra Road

Figure 4-2 Tributary of Emu Creek

Figure 4-3 Tributary of Jacksons Creek, north of Emu Road

4.2.3 Flow Estimation and Pipe Sizing

In accordance with Principles for Provision of Waterway and Drainage Services for Urban Growth (Melbourne Water, 2007), DSS pipes have been provided at the low point or low points of all developable properties with an area greater than 0.4 hectares.

Scheme pipes were sized using Rational Formula calculations. Melbourne Water's standard runoff coefficients, as identified in Melbourne Water's DSS costing spreadsheet, have been adopted based on the land use identified in the Lancefield Road PSP. For areas of the DSSs beyond the Lancefield Road PSP, but which drain through the Lancefield Road PSP, runoff coefficients were adopted based on land use identified by the Sunbury / Diggers Rest Growth Corridor Plan (Growth Areas Authority, June 2012).

The low point or low points of properties were identified using a digital terrain model produced using LiDAR. LiDAR (Light Detection and Ranging) is an airborne remote sensing technique for rapid collection of terrain data. The preparation of the DSSs used LiDAR from a combination of the following data sets:

- 2008/09 Greater Melbourne LiDAR dataset
- 2009/10 North West LiDAR dataset.

For catchments less than 60 hectares, pipe capacities were sized based on Hume City Council design standards as per Guidelines for the Design and Construction of Road and Drainage Infrastructure (Hume City Council, 2008), which are:

- Residential areas: 20 per cent annual exceedance probability (AEP) capacity
- Industrial / commercial areas: 10 per cent AEP capacity.

For catchments greater than 60 hectares, pipe capacities were sized based on Melbourne Water's design standard, which is:

- Residential and industrial / commercial areas: 20 per cent AEP capacity.

For residential areas, the Lancefield Road PSP did not distinguish between different densities of development. The density of development impacts the volume and rate of runoff. Following discussions with the VPA and Melbourne Water, a typical residential lot size within the PSP of 440 square metres was adopted. Engeny assumed the same typical residential lot size will occur in growth areas identified by the Sunbury / Diggers Rest Growth Corridor Plan (beyond the Lancefield Road PSP).

4.2.4 Constructed Waterways and Waterway Reserves

The DSSs include constructed waterways where overland flows exceed safe road capacities and where existing natural waterways are not being retained (based on advice from Melbourne Water considering the environmental values of the waterway).

Overland flows have been estimated based on the gap flow in a one per cent AEP storm event. The gap flow is the estimated rate of stormwater flow in a one per cent AEP storm in excess of the capacity of the DSS pipe along the same alignment.

Melbourne Water's Floodway Safety Criteria (1996, available online) provides the following recommended safety limits for flows along continuously grading streets in urban areas that are designed to function as a component of the major drainage system when pipe capacities are exceeded:

- Average velocity (v_{av}) x Average depth (d_{av}) <= 0.35 m^2/s
- Average depth (d_{av}) <= 0.30 m.

Engeny developed a HECRAS model with cross-sections defining an access street road reserve in Hume City Council's Guidelines for the Design and Construction of Road and Drainage Infrastructure (August 2008). The HECRAS model was modified to reflect a range of longitudinal grades of the road and a range of peak flows were applied to the model to determine the threshold flow when at least one of the safety criteria is exceeded for each longitudinal grade.

The calculated overland flow was checked to determine whether the safety criteria are exceeded, based on the assumption that the overland flow path will have the same grade as the pipe. The DSSs include constructed waterways (instead of pipes) where the estimated overland flows do not satisfy Melbourne Water's safety criteria.

Where the DSSs include constructed waterways, the width of the waterway reserve has been defined based on criteria in Waterway Corridors Guidelines for greenfield development areas within the Port Phillip and Westernport Region (Melbourne Water, 2013).

4.2.5 Water Quality Assets

The DSSs include a series of water quality treatment assets (wetlands and stand-alone sediment basins) so that future urban runoff is to be treated to Best Practice Environmental Management Guidelines (BPEMG) in terms of water quality. The urban runoff treatment objectives are:

- 80 % removal of total suspended solids
- 45 % removal of total phosphorous

- 45 % removal of total nitrogen.

Water quality assets in the DSSs have been designed with consideration of the concept level design deemed to comply criteria outlined in Melbourne Water's Design, Construction and Establishment of Constructed Wetlands: Design Manual (Draft). Key steps undertaken based on these guidelines that impact the total footprint of water quality assets are:

- Inlet ponds for each wetland and the stand-alone sediment basins have been sized using the Fair and Geyer Equation.
- Wetland treatment areas have been sized based on results of MUSIC modelling.
- Estimation of areas for sediment drying, maintenance access tracks and high flow bypasses.

In line with Melbourne Water's Design, Construction and Establishment of Constructed Wetlands: Design Manual (Draft), MUSIC models were developed to analyse the water quality performance of the treatment assets in the DSSs and verify that BPEMG water quality objectives were achieved. The MUSIC models were developed in accordance with Melbourne Water's MUSIC Guidelines (December 2010), which were the applicable guidelines at the time of the DSS preparation. The MUSIC model simulates 10 years of rainfall data from a dataset between 2000-2010, which was consistent with rainfall data used in the Sunbury Erosion Potential Investigation (Alluvium, 2015).

The purpose of the wetlands in the DSSs is to either:

- Protect a downstream tributary and provide water quality treatment to achieve BPEMG.
- Provide water quality treatment only to achieve BPEMG (with no downstream tributary).

4.2.6 Protection of Tributaries

A key aspect of the DSSs within the Lancefield Road PSP is the requirement to protect tributaries that are prone to erosion. The requirements for each tributary were informed by the following investigations:

- Final Assessment Riparian Vegetation and Geomorphology in the Sunbury Growth Area (Alluvium/Biosis, 2014)
- Erosion Analysis Classification for Waterways Around Sunbury (Alluvium, 2015)
- Sunbury Erosion Potential Investigation (Alluvium, 2015).

The strategy of the DSSs is to locate a wetland or stand-alone sediment basin at the upstream end of tributaries that require protection. The wetland provides treatment in order to achieve BPEMG objectives (as discussed in Section 4.2.5) and also assists in the protection of the downstream tributary from erosion. Each wetland was designed with a low flow outlet pipe that will bypass the tributary and discharge low flows directly into either Emu Creek or Jacksons Creek, thereby protecting the tributary from erosion from the increased frequency of flows due to development. Each wetland has also been designed with a high flow outlet that discharges directly into the tributary in order to maintain a similar hydrologic regime in the tributary compared to pre-development conditions.

4.2.7 Flood Storage

For the DSSs within the Lancefield Road PSP, Melbourne Water set no specific objective for peak flow control. As discussed in Section 4.2.6, the DSSs include assets in order to preserve the physical integrity and manage the risk of large-scale erosion of the tributaries.

The setup of each wetland and stand-alone sediment basin includes an extended detention depth of 0.35 metres (in accordance with Melbourne Water's Design, Construction and Establishment of Constructed Wetlands: Design Manual (Draft)). Above this, the DSS design allows for a further 0.65 metres depth for flood storage. The flood storage in this 0.65 metre zone has been estimated using the footprint of the water quality asset and assuming 1 in 5 batters above the extended detention depth.

The output from each EPI analysis in the Sunbury Erosion Potential Investigation (Alluvium, 2015) is a solution curve of storage provided by the wetland versus maximum flow through the low flow bypass pipe. As the storage provided by the wetland increases the maximum flow required through the bypass pipe reduces. The additional storage above the extended detention depth provided by the wetlands achieves the minimum storage requirement in the EPI solution curve.

Some wetlands will discharge all flow directly to Emu Creek or Jacksons Creek (i.e. their purpose is for water quality treatment and they do not protect a downstream tributary). Hydrological modelling has been undertaken to identify the capacities of scheme assets that will discharge flow from these wetlands into Emu Creek or Jacksons Creek. Hydrological modelling has been undertaken using RORB. RORB is an industry standard hydrological modelling and it is Melbourne Water's preferred hydrological modelling package.

The RORB models were developed to reflect developed conditions, with fraction impervious values based on typical fraction impervious values identified in Melbourne Water's MUSIC Guidelines (December 2010) for the various future land use types identified in the Lancefield Road PSP. Retarding basins were added to the models at the location of each wetland in the DSS, with the RORB models accounting for storage above the extended detention depth of the wetland. The peak outflows from the retarding basin

in a one per cent AEP storm event were then used to size the assets to convey flow from the retarding basin to either Jacksons Creek or Emu Creek.

4.2.8 Asset Footprints

The DSSs require acquisition of potentially developable land for each stand-alone sediment basin and wetland / retarding basin.

It has generally been assumed that each wetland will be constructed in cut in order to facilitate outlets from upstream development. The identification of land acquisition areas makes allowance for the total treatment area footprint and for matching back to surrounding natural surface levels at 1 in 5 batters. Surrounding natural surface levels were based on LiDAR topographical data.

The following factors have been considered when determining the location of water quality assets:

- The required protection of tributaries, with wetlands located at the upstream end of tributaries that require protection.
- The topography of the area so that assets are located at the low points of the catchment.
- The topography of the area so that assets avoid being constructed on steep terrain, where possible.

4.3 Concept Design Process compliance with Melbourne Water Guidelines

The concept design process for Melbourne Water DSSs is designed to comply with Clause 56.07-4 of the Victoria Planning Provisions. This is to ensure that the stormwater system for residential development is designed to comply with legislated environmental requirements and that sufficient land is allocated for the stormwater system.

The details of how the DSSs comply with Clause 56.07-4 are determined by applying the following Melbourne Water guidelines:

- *Principles for Provision of Waterway and Drainage Services for Urban Growth (Melbourne Water, 2007)*
- *Draft 'Design, construction and establishment of constructed wetlands: design manual' (2016)*
- *'MUSIC Guidelines: Input parameters and modelling approaches for MUSIC users in Melbourne Water's service area' (2016).*

At the time of the preparation of the DSSs within the Lancefield Road PSP, the available MUSIC guidelines were MUSIC Guidelines (Melbourne Water, 2010). This guideline has been superseded by MUSIC Guidelines: Input parameters and modelling approaches for MUSIC users in Melbourne Water's service area (Melbourne Water, 2016). There are some minor differences in the most recent guidelines such as changes to recommended soil store capacity and field capacity.

The MUSIC models developed to size some water quality assets in the DSSs simulate 10 years of rainfall data from a dataset between 2000-2010, which was consistent with rainfall data used in the Sunbury Erosion Potential Investigation (Alluvium, 2015). MUSIC Guidelines: Input parameters and modelling approaches for MUSIC users in Melbourne Water's service area (Melbourne Water, 2016) states that a 10-year rainfall dataset recorded at Melbourne Airport between 1971-1980 should be adopted.

At the time of the preparation of the DSSs within the Lancefield Road PSP, the available 'Design, construction and establishment of constructed wetlands: design manual' was a 2015 draft.

5. CONCLUSION

In response to my instructions I conclude that:

- This report has described the concept design process for the DSS assets within the Lancefield Road PSP, being the Oldbury DSS, Williamsons Road DSS, Sunningdale Avenue DSS and Devon Park DSS, including wetlands and retarding basins.
- The concept design process for the DSS assets in the proposed Lancefield Road PSP complies with relevant guidelines.

6. STATEMENT

I have made all the inquiries that I believe are desirable and appropriate at this time and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

I have read the Planning Panel's Victoria "Guide to Expert Evidence" and agree to be bound by it.

Paul Clemson

Bachelor of Engineering (Civil), Monash University, 2006

APPENDIX A

Paul Clemson's CV

Paul Clemson

Senior Water Resources Engineer

BEng (Civil) (Hons)

SUMMARY

Paul is a senior water resources engineer with eleven years of experience in the water industry. Paul has extensive experience on a diverse range of projects including stormwater drainage and quality studies, flood mapping, potable water supply network planning, recycled water design and sewer network planning and design.

As a senior engineer with Engeny, Paul is involved in a technical and project management role on studies delivered for local councils, Melbourne Water and development industry clients.

Paul has extensive experience in hydraulic modelling including stormwater (1D and 2D), water supply and sewer networks. Paul has expertise in the use of hydrologic and hydraulic modelling software packages including TUFLOW, HEC-RAS, RORB, DRAINS, MUSIC, InfoWorks CS, H20Map and GIS packages MapInfo, QGIS and GeoMedia.

KEY AREAS OF EXPERTISE

- Hydrological / hydraulic modelling and flood mapping
- Urban stormwater planning and design
- Water sensitive urban design
- Integrated water management
- Spatial data analysis (GIS).

EXPERIENCE

2010 - present Senior Water Resources Engineer, Engeny, Melbourne

Development Services Scheme Engineering Reviews, Melbourne Water:

Paul has led Engeny's work with Melbourne Water to review an extensive range of development services schemes. The reviews involve analysing and amending drainage, waterway and water quality treatment works identified to provide the most effective and environmentally sound stormwater management for areas of increased development planned through the Melbourne 2030 Strategy. The emphasis of the scheme reviews is to ensure that works recommended are practical and take into account local constraints and opportunities. The outputs of the scheme reviews include layout plans, costing of each component and the scheme and reporting. Engeny's responsibilities have also included working with relevant stakeholders, including local councils and other asset owners.

Sunbury Growth Area Development Services Scheme, Melbourne Water:

Paul project managed and undertook key technical works for the preparation of developer services schemes (DSS) as part of extensive growth planned in Sunbury. This project required a range of skills and capabilities, including knowledge of Melbourne Water's DSS principles, understanding of Melbourne Water's DSS costing spreadsheet, hydrologic modelling, stormwater quality modelling, stakeholder consultation, catchment planning and knowledge of the impact of development on sensitive downstream waterways. A unique aspect of the Sunbury DSS was the innovative works included to protect steep tributaries that are highly sensitive to erosion.

Troups Road North Wetland and Retarding Basin Functional Design, Melbourne Water: Paul project managed and undertook technical works for functional design of the Troups Road North Wetland and Retarding Basin system as part of the Leakes Road Development Services Scheme (DSS). Paul's work ensured that the assets fit within the allocated land-take for the stormwater assets in the PSP, ensured that the assets are designed and will function in accordance with their intent in the DSS and ensured that the appropriate level of service with respect to flood protection, conveyance and water quality will be provided. Engeny developed a two dimensional hydraulic model (TUFLOW) to analyse the complex hydraulics of the site, which include waterway crossings of a railway and major freeway. The functional design has provided works that are suitable for the complex hydraulics, satisfy environmental requirements including protection of existing vegetation and meet best practice water quality objectives.

Plumpton Road Wetland and Frog Pond Functional Design, Melbourne Water: Paul project managed and undertook technical work for the functional design of a wetland and a Growling Grass Frog (GGF) pond system as part of the Plumpton Road Development Services Scheme (DSS). The functional design has been used as a demonstration of how an integrated design between a stormwater quality asset and a habitat asset can achieve multiple benefits within a GGF corridor. The design work has been undertaken in consultation with both Melbourne Water and DEWLP and has helped to satisfy the requirements of both stakeholders. The wetland design was developed in accordance with the DRAFT Design, Construction and Establishment of Constructed Wetlands: Design Manual (MWC 2014) and informed by WSUD Engineering Procedures: Stormwater (Melbourne Water, 2005). The Growling Grass Frog ponds have been designed in accordance with DELWP requirements and Melbourne Water's draft guidelines. An options analysis was undertaken to determine the optimum arrangement for the frog ponds, including an analysis of the benefits of including a single large pond or two medium sized ponds.

Arden Macaulay Precinct, Melbourne Water, City of Melbourne, Victorian Planning Authority, City West Water: Paul was the project manager and undertook key technical work in the preparation of the flooding and drainage strategy and integrated water management strategy for the Arden Macaulay Precinct. The Arden Macaulay Precinct is one of the largest urban renewal projects in Australia. The objectives of Engeny's work was to work with stakeholders to:

- Allow intensive development of the Arden Macaulay Precinct to occur
- Achieve appropriate flood protection standards for the precinct
- Assess the reliability and benefits of an alternative water supply
- Seize the potential to improve the amenity and public use of Moonee Ponds Creek.

Engeny's study included the following tasks to meet these objectives:

- Development of an understanding of the existing conditions and year 2100 (including climate change) scenario flooding within the precinct through updated two dimensional (TUFLOW) hydraulic modelling
- Communicating the existing conditions and year 2100 scenario flooding outputs with key stakeholders, including preparation of video simulations and easy to understand flood maps
- Identification of a range of potential flood mitigation works in collaboration with key stakeholders
- Assessment of an alternative water supply, through investigation of rainwater harvesting, stormwater harvesting and creek flow extraction, including water balance modelling and hydraulic modelling to determine the benefits that harvesting stormwater has on flooding within the precinct
- Undertaking detailed investigations (including hydraulic modelling) for a selection of the flood mitigation works and refining the works in order to achieve required flooding standards
- Provision of advice on infrastructure required for the flood mitigation and alternative water supply works
- Clear and concise reporting, including flood maps.

Flood Mapping Projects (various), Mornington Peninsula Shire Council: Paul was the project engineer for the development of RORB hydrological and TUFLOW hydraulic models across a number of small to large catchments for the Shire including McCrae, Mount Martha, Gregory Street Drain and Tootgarook catchments. The outputs from these studies have included flood maps showing flood extents for all of the Shire's assets and development of flood mitigation strategies to reduce flood risks in the catchments.

Cranbourne Town Centre Flood Mapping, City of Casey: Paul project managed and provided key technical input for flood modelling of three catchments covering the Cranbourne Town Centre. Engeny undertook a detailed review of available information, conducted hydrological modelling of each catchment and flood mapped the study area for ARIs ranging from 5 years to 500 years. Flood mapping was produced for existing conditions and a projected future development scenario, assuming lots of a certain size would subdivide as has been the case over the last 10 years. Engeny used the outputs from the flood mapping to identify key flooding hotspots in the study area to assist the City of Casey with capital works prioritisation.

Lower Werribee Drains Flood Mapping, Melbourne Water: Paul project managed and provided key technical input in the Lower Werribee Drains catchments flood mapping study. The scope of Engeny's study included a thorough review of available data, development of validated hydrological models for each catchment (RORB), development of a hydraulic model (TUFLOW) including existing underground drainage and production of flood extents and other GIS deliverables for a range of flood extents and a climate change scenario.

Yarragon Flood Modelling and Drainage Strategy, Baw Baw Shire Council: Paul project managed and undertook the majority of technical work for this study, which involved a comprehensive analysis of the Yarragon drainage system based on a range of information, including the results of a 2D hydraulic model produced as part of the project. Paul facilitated two community consultations with residents from Yarragon and other key stakeholders, while a comprehensive collation and review of drainage data formed vital inputs to study. A series of structural and non-structural measures were identified to improve the management and performance of the Yarragon drainage system. The hydraulic model was used to assess the feasibility of future development in Yarragon and to identify works to control the impact of future development on the township.

Brandon Park Reserve Retarding Basin Design Review, City of Monash: The study involved the development of a hydrological (RORB) and two-dimensional hydraulic model (TUFLOW) model build for a catchment before and after the construction of a retarding basin and determining flood extents for design and recorded rainfall events. This allowed Council to gain an understanding of the change in hydraulic performance of the drainage network and flood extents due to the construction of a retarding basin. Additional work involved identification and modelling design refinements to improve the performance of the system.

Mallia Drive Dam Break Analysis, Esler & Associates: The study involved development of a TUFLOW model including a proposed retarding basin, with the model set up to simulate the dynamic failure of a dam wall in storm events up to the probable maximum flood. Key outputs included flood maps and video animations showing differences in flood extents and depths due to the failure of the dam wall compared to the existing scenario.

City of Monash Flood Management Plan, Melbourne Water & City of Monash: Paul undertook project management responsibilities for this project which involved organising and facilitating workshops with Council, Melbourne Water and other key stakeholders to identify gaps and issues with regards to flood management within the City of Monash. With a detailed knowledge of the municipality, an action plan was devised to address the deficiencies and document a Flood Management Plan to be adopted for the following five years.

Hazeldean Road Retarding Basin Detailed Design, Baw Baw Shire Council: Paul project managed and undertook technical works as part of the detailed design for a retarding basin and open channel drainage system adjacent to Hazeldean Road, Yarragon. The design followed previous work undertaken by Engeny at Yarragon that identified the magnitude of an existing flooding problem for a residential development located adjacent to Hazeldean Road. The design objectives for this project were to mitigate the existing flooding problem and to allow future development in the area by intercepting and retarding overland flow. The design included a series of drop structures to reduce flow velocity within the open channel and a retarding basin outlet arrangement that reduced peak catchment flows whilst avoiding impact to a gas transmission pipeline located near the outlet.

Ryans Creek Rehabilitation Detailed Design, City of Melton: Paul project managed and technical work in the detailed design of rehabilitation works for Ryans Creek in Melton. Ryans Creek consists of a winding grassed floodway with a concrete lined channel in the invert and stormwater drains flowing into the creek from both sides via concrete lined channels. The key aspect of the design was the removal of the existing concrete channel, which will be replaced with a natural vegetated pilot channel, as well as improvement of outlets to the creek and the construction of a rock chute within a steep section of the waterway. Paul undertook modelling (CHUTE, HECRAS and MUSIC) and design work to ensure that the project objectives for various stakeholders were met.

Paul's efforts in corresponding with City of Melton and Melbourne Water throughout the project, as well as strong skills in design, resulted in Melbourne Water's response on the first issue of design drawings having no comments on the civil works. The design works were completed within a tight time frame (less than 10 weeks from approval to proceed) in order to assist City of Melton with scheduling the constructions works within the low rainfall period.

Randwick Avenue Bioretention Design, Urban Design Management: Paul project managed and undertook the design of a bioretention system as part of Stage 1 of the Randwick Avenue development in Bacchus Marsh. Engeny's design was in accordance with WSUD Engineering Procedures (CSIRO/Melbourne Water, 2005), Constructed Wetlands Guidelines (Melbourne Water, 2010) and Infrastructure Design Manual Version 4.2 (November 2013). Engeny's tasks included water quality modelling (MUSIC), design calculations of bioretention system key parameters and plans to indicate how the proposed asset will fit within the creek corridor.

Victory Road Drainage Design, City of Kingston: Paul undertook the preliminary design of a new drainage pipeline on Victory Road in Clarinda. The purpose of the pipe is to cater for runoff from the proposed capped Victory Road Landfill and the pipe will receive flow from three detention ponds within the landfill. The pipe alignment was complicated by existing sewer assets and a connection into the Clayton Main Drain. Engeny investigated various options for consideration by council, undertook hydraulic modelling of the pipeline to account for high tail water levels in the main drain and developed preliminary design plans.

Deals Road Drainage Scheme, City of Kingston: Paul project managed and delivered the majority of technical work for the development of the Deals Road Drainage Scheme. The scheme's catchment is dominated by a series of landfills in various stages of development and as the sites are filled and then capped, a drainage system will be required to accommodate the additional runoff this process creates. Paul undertook a detailed review of available data and previous studies, development of a hydrological model of the catchment (RORB), development of several scenarios in a hydraulic model (TUFLOW) and the preparation of design plans and layout plans to clearly communicate the proposed drainage scheme and the key assumptions made in the preparation of the design. Hydraulic modelling included modification of the catchment terrain to replicate future clay capping of landfills, proposed retarding basins and the future Dingley Bypass.

Dunes Drain Floodway Design, WBCM: Paul was the project manager and project engineer for a design of the Dunes Drain. The drain was designed as a 100 year ARI floodway, and satisfied Melbourne Water requirements including freeboard, safety requirements in terms of maximum velocities and flow depths, maintenance access and environmental considerations. The design included three rock chutes in order to slow down flow along the steep floodway. Melbourne Water provided approval of Engeny's design.

EJ Whitten Bridge Water Sensitive Road Design, VicRoads: Responsibilities included the project management of a study analysing the current bridge drainage and the impacts of the proposed widening of the bridge on drainage and water quality. The project involved hydraulic calculations of pit and pipe capacities to determine whether overland flows on the bridge are acceptable and development of water sensitive road design options to treat runoff from the expanded bridge deck.

Merri Creek Bike Trail Hydraulic Assessment, City of Moreland: This project analysed changes to flooding of Merri Creek due to the proposed elevation of the shared bicycle / pedestrian path to improve cyclist and pedestrian safety. Responsibilities included modification of existing HEC-RAS model to take into account the potential blockage from the proposed bike path, field inspections, collation of results and documentation to be provided to Melbourne Water on behalf of Council to seek approval for the works.

Colac-Ballarat Road Drainage Impact Assessment, VicRoads: The study involved an assessment of drainage performance in a rural area before and after a proposed development. A RORB model and TUFLOW model were developed to provide flood maps showing changes to flood extents and provide VicRoads with advice to help base their approval or rejection of the development.

Copelands Road Drainage Strategy, Baw Baw Shire Council: The study investigated the requirements for stormwater works for proposed residential development in the Copelands Road catchment, east of Warragul. Tasks conducted included hydrological (RORB) and MUSIC modelling to ensure that adequate flow retardation is provided by the development, as well as concept design of wetland and retarding basins. Responsibilities also included meetings with Council and developers.

Capital Avenue Overland Flow Investigation, City of Monash: This project looked at high level options to improve flooding at a known problem area for Council, where a Melbourne Water pipe track crosses Capital Avenue. Work involved reviewing plans provided by Melbourne Water, site visit with council to discuss options and a report to provide council with advice on how the drainage situation could be improved.

Mosaic Stage 5 Wetland Safety Audit, Meinhardt Infrastructure and Environment: Project involved review of design plans for proposed wetlands and sedimentation ponds to assess whether Melbourne Water Guidelines and Royal Lifesaving Guidelines are satisfied.

Underbank Farm, Kataland: The study involved a surface water investigation for a large development in Bacchus Marsh. Key tasks included 1-D hydraulic modelling to produce flood extents for internal and adjacent waterways, identification of WSUD measures to achieve Best Management water quality objectives and reporting of suitable quality and detail to submit to Council and regulatory authorities for approval.

Highlands Estate Raingarden Testing, Stockland: The study including field testing of filter media hydraulic conductivity rates to determine whether rates are in the desired range as well as a general assessment of raingardens in order to provide recommendations on whether the raingarden was ready for handover to Council.

2006 - 2010
Engineer, MWH, Melbourne

Employed in the Network Planning Group gaining experience on a wide variety of hydraulic modelling, planning and design projects for sewer, water supply and recycled water systems. While employed with MWH, Paul spent time on secondments at South East Water Limited (Victoria), Gladstone Regional Council (Queensland) and the Utility Services Alliance (capital works delivery alliance incorporating South East Water, Thiess Services, Siemens Limited and MWH).

EDUCATION

2006

Bachelor of Engineering (Civil) (Hons), Monash University, Melbourne

APPENDIX B

Instructions

HARWOOD ANDREWS

Our ref: 4TED 21702183
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Principal: Greg Tobin

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14 July 2017

Paul Clemson
Engeny Water Management

Email: Paul.Clemson@engeny.com.au

Subject to legal professional privilege

Certified B Corporation

Dear Paul,

Amendment C207 to the Hume Planning Scheme – Sunbury South PSP
Amendment C208 to the Hume Planning Scheme – Lancefield Road PSP

We act for the Victorian Planning Authority (**VPA**) in relation to the above two amendments, which propose to incorporate the Sunbury South PSP and Lancefield Road PSP into the Hume Planning Scheme.

The amendments are listed to be heard at a Panel hearing commencing on 21 August 2017, with the VPA appearing for five days in the first week.

The VPA is working with Melbourne Water in relation to the drainage aspects of the PSPs. Melbourne Water will present together with the VPA during the first week of the hearing.

We have been instructed to brief you to:

1. review this letter and the enclosed brief of documents;

2. advise if you are in a position to provide expert drainage evidence on behalf of the VPA and Melbourne Water at the hearing:
    a. in support of the amendments as exhibited; or
    b. subject to any issues you consider should be addressed by way of post-exhibition changes; and

3. provide a fee proposal to prepare an expert witness statement and present evidence at the hearing, having regard to the scope described in this letter.

We request that you maintain availability during the week of 21 August 2017 pending your consideration of the amendments and consideration of your fee proposal by Melbourne Water.

Expert witness statements are required to be circulated by 2pm on Monday 14 August 2017. We will require draft reports to be provided to us by Wednesday 9 August 2017.

In the event you are instructed to prepare an expert witness statement, we have enclosed a copy of the Planning Panels Victoria Guide to Expert Evidence in your brief of documents.

Background

Amendments

The VPA is the planning authority in respect of the amendments.

Also exhibited with the amendments and being considered at the hearing are three planning permit applications within the PSP areas:

- P18858 by Villawood relating to land at 3-5 Macedon Street, Sunbury known as 'Sherwood Heights' and described as the Racecourse Road site;

- P18854 by Villawood relating to land at 675 Sunbury Road, 40 Redstone Hill Road and 80 Redstone Hill Road, Sunbury, known as 'Redstone Hill'; and

- P18855 by Wincity relating to land at 170 Lancefield Road, Sunbury.

The VPA received 94 submissions in response to exhibition of the Sunbury South PSP and 93 submissions in response to exhibition of the Lancefield Road PSP. Of these, 52 submitters have requested to be heard at the Panel hearing. The hearing is anticipated to be scheduled for approximately 8 weeks.

Copies of all submissions are included in your brief, as well as summary tables prepared by the VPA in respect of the submissions. The summary tables may be filtered by category, including 'drainage'.

DSSs

The exhibited PSPs contain working versions of Melbourne Water's Development Services Schemes (**DSSs**), which indicate the conceptual locations of waterways and drainage infrastructure within the PSP areas.

We are instructed that Engeny was commissioned by Melbourne Water as part of the preparation of the DSSs. Melbourne Water has now completed a review of the drainage infrastructure required to service the two PSP areas, which will form the basis of the draft DSSs. There will consequently be minor post-exhibition changes proposed to the PSPs.

We are instructed that Melbourne Water is currently obtaining approval to commence formal public consultation on the concept designs and rates for the DSSs, which will involve Melbourne Water sending letters to all affected landowners and authorities before the Panel hearing.

Scope

You are requested to prepare an expert witness statement in two stages. The first stage may be commenced upon approval of your fee proposal. The second stage should not be commenced until you are specifically instructed to proceed.

Both stages relate to ensuring sufficient land take in the DSS concept designs to allow for detailed design.

The first stage is to:

1. outline the process undertaken by Engeny to determine the total asset footprint of the conceptual assets in the DSSs, including wetlands and retarding basins; and

2. assess this process against current relevant Melbourne Water guidelines, including the:
    a. Draft 'Design, construction and establishment of constructed wetlands: design manual' (2016); and
    b. 'MUSIC Guidelines: Input parameters and modelling approaches for MUSIC users in Melbourne Water's service area' (2016).

The second stage relates specifically to land take for the planning permit applications. It is possible the second stage will not be required. This will depend on the further information we expect to receive from the planning permit applicants, including draft functional design packages. We will provide you with further instructions in the event you are requested to complete the second stage.

Brief

We have provided you with an electronic copy only of the brief of documents at this stage. Please advise if you would like us to provide you with a hard copy.

Your fees

We request that you send your fee proposal directly to Melbourne Water, by email to Michael Prior at Michael.Prior@melbournewater.com.au, copied to Greg Tobin at gtobin@ha.legal and Tessa D'Abbs at tdabbs@ha.legal.

We confirm that you should not commence any substantive work on this matter until you have received confirmation that your fee proposal has been approved.

Melbourne Water will remain responsible for your fees. We require that any tax invoices be addressed to Melbourne Water, by email to Michael Prior.

Legal professional privilege

We confirm that your professional opinion is sought in the context of us providing legal advice in relation to these amendments. Our advice, and your advice by virtue of you being engaged by us, attracts legal professional privilege. Our client is therefore not required to disclose any advice provided by you to any other party unless that legal professional privilege is waived.

To ensure that legal professional privilege is maintained, we request that you do not advise anyone, other than our client or Harwood Andrews, that you have been requested to provide expert advice in relation to this matter.

We will notify you if legal professional privilege is waived in respect of your advice.

Next steps

If you have any queries or require any further information, please contact Greg Tobin on 5225 5252 or Tessa D'Abbs on 9611 0117.

Yours sincerely,

HARWOOD ANDREWS

Encl.

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4.	C207 Planning Scheme ordinance
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6.	Lancefield Road PSP
7.	C208 Explanatory report and instruction sheet
8.	C208 Planning Scheme ordinance
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Planning permit applications (section 96A)	
10.	'Sherwood Heights', 3-5 Macedon Street, Sunbury (Villawood) a. Permit application b. Draft permit P18858
11.	'Redstone Hill', 675 Sunbury Road, 40 Redstone Hill Road and 80 Redstone Hill Road, Sunbury (Villawood) a. Permit application b. Draft permit P18854
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17.	VPA summary table of Lancefield Road submissions
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18.	PPV appointment letter