DALTON CONSULTING ENGINEERS

PAKENHAM EAST STORMWATER HARVESTING INVESTIGATION - PROJECT REPORT

JUNE 2016

Melbourne Water

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Executive Summary

This report presents a summary of the Pakenham East stormwater harvesting investigation. The investigation involved:

- Detailed MUSIC modelling of stormwater quality and stormwater harvesting options
- Two functional designs of stormwater transfer pipelines
- Full costing (operational and capital) of all options.

A total of eight (8) stormwater options for stormwater management in the Pakenham East Precinct Structure Plan (PSP) area were investigated. The options were assessed against current Best Practice Environmental Management (BPEM) standards as well as against adopted performance objectives to meet State Environmental Protection Plan (SEPP-F8) standards that are specified for Western Port. BPEM and SEPP-F8 standards are compared in Table 1.

The SEPP-F8 targets ensure that the significant RAMSAR wetlands located in Western Port are protected.

Table 1: Comparison of BPEM and SEPP-F8 stormwater quality targets

Target	Total Suspended Solids (TSS) % Removal	Total Phosphorus (TP) % Removal	Total Nitrogen (TN) % Removal
BPEM	80%	45%	45%
SEPP-F8 for Western Port	93%	66%	63%

The options are summarised in Table 2. A variety of options including business as usual (BAU) constructed wetlands and sedimentation basins as well as options incorporating stormwater harvesting schemes were considered. Section 2.1 includes complete information about the stormwater options.

The project was run by Melbourne Water, and it involved a variety of external stakeholders:

- Cardinia Shire Council
- South East Water (SEW)
- Victorian Department of Environment, Land, Water and Planning (DELWP).

The project began with a stakeholder meeting where stakeholders shared their hopes and concerns about the project. At a second stakeholder meeting 26 February 2016, four options were short-listed

for a cost benefit analysis. The short-listed options (Option 1A, 2A, 3-G and 3-P) have the following key criteria in common:

- The rural catchment upstream of but external to the PSP area was not included in the treatment infrastructure.
- Stormwater was treated to SEPP-F8 standards for Western Port (the treatment standards are summarised in Table 1) which aims to preserve a RAMSAR wetland of international importance.

Table 2: Investigated stormwater management options

Option	Treatment type	Stormwater quality	Ext. catchment treated	Notes
1	Sedimentation basins and constructed wetlands	BPEM	Yes	Based on Stormy Water Solutions model (October 2015)
1A	Sedimentation basins and constructed wetlands. External catchment untreated.	BPEM	No	Based on original option 1
2	Sedimentation basins and constructed wetlands	SEPP-F8 for TSS	Yes	Based on the model for Option 1
2A	Sedimentation basins and constructed wetlands. External catchment untreated.	SEPP-F8 for TSS	No	Based on original option 2
3-G	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline	SEPP-F8 for TSS	No (but harvested)	Stormwater harvesting model
3-P	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a primed stormwater transfer pipeline	SEPP-F8 for TSS	No (but harvested)	Stormwater harvesting model
4-G	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline. External catchment treated to BPEM at W1.	SEPP-F8 for TSS	Yes (to BPEM)	Stormwater harvesting model
4-P	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a primed stormwater transfer pipeline. External catchment treated to BPEM at W1.	SEPP-F8 for TSS	Yes (to BPEM)	Stormwater harvesting model

The cost benefit analysis indicates that if SEPP-F8 stormwater quality standards are to be achieved in the catchment, the most efficient method of achieving water quality objectives in the Pakenham East PSP is Option 3-P. This option uses a combination of 'business as usual' sedimentation basins and constructed wetlands and a stormwater harvesting scheme to achieve the stormwater quality treatment goals. Option 3-P has $ 8.1 M of CAPEX savings ($2.4 M of NPC savings) vs. Option 2A.

Contents

1. Introduction

This report presents a brief history and the results of the Pakenham East stormwater harvesting investigation. The investigation was undertaken by Dalton Consulting Engineers (DCE) for Melbourne Water. The investigation explored alternative drainage and stormwater management options (some incorporating stormwater harvesting) in the area covered by the Pakenham East Precinct Structure Plan (PSP). The investigation involved

- Detailed MUSIC modelling of stormwater quality and stormwater harvesting options
- Two functional designs of stormwater transfer pipelines
- Full costing (operational and capital) of all options.

The project was run by Melbourne Water. Additional input was sought from a variety of external stakeholders:

- Cardinia Shire Council
- South East Water (SEW)
- Victorian Department of Environment, Land, Water and Planning (DELWP).

Several documents have been prepared and issued as part of the investigation. The documents are included in the appendices of this report for reference:

- MUSIC modelling assumptions and methodology (DCE, 2016) (Appendix A)
- Cost-Benefit report (DCE, 2016) (Appendix B)
- Capital (construction) costs (DCE, 2016) (Appendix C)
- Operational (maintenance) costs (DCE, 2016) (Appendix D)
- 30-year Net-Present costs (Melbourne Water, 2016) (Appendix E)
- Functional designs of two stormwater harvest transfer pipelines (DCE, 2016) (Appendix F).

1.1 Background

The Pakenham East PSP is located east of the Melbourne CBD near Pakenham township. An aerial image of the PSP area showing it in the undeveloped condition is shown in Figure 1. The land is generally flat and slopes gently from north to south. The Pakenham East PSP area covers approximately 621 ha. The PSP area is bounded by the Princes Freeway to the south and Deep Creek to the west. The PSP area includes the Princes Highway and two existing waterways Handcocks Gully and McDonalds Road Drain.

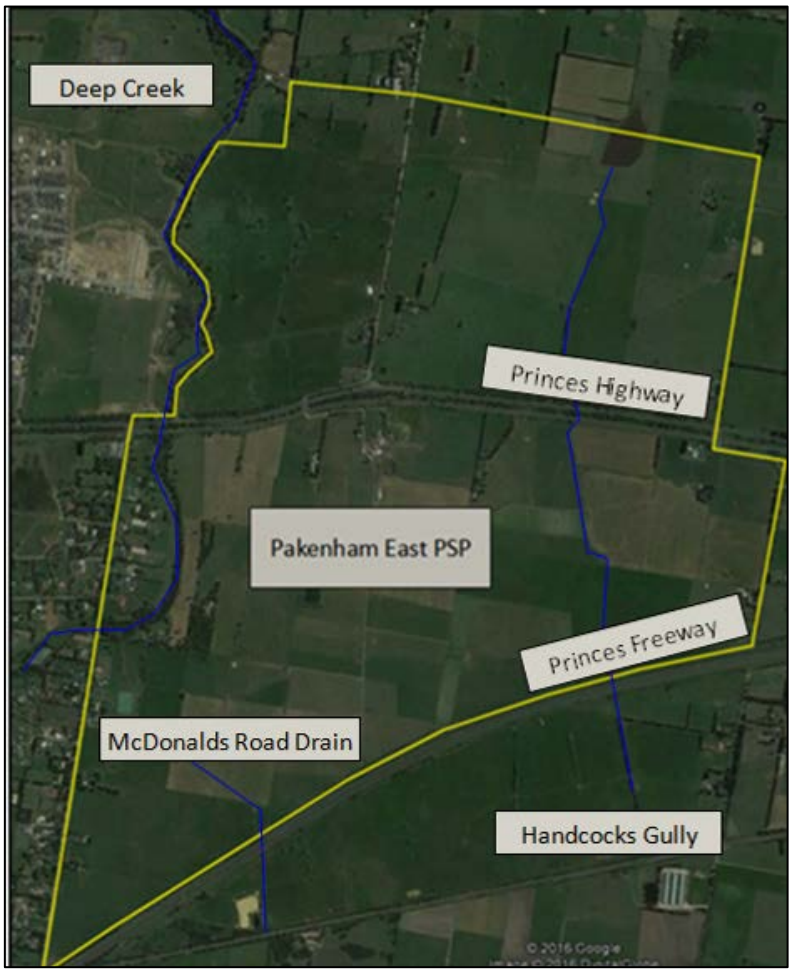

Figure 1: Pakenham PSP area (pre-development)

1.2 Stormwater quality standards

The Pakenham East PSP drains to Western Port. As Melbourne grows, additional environmental pressure is being placed on catchments such as Western Port. The State Environmental Protection Policy (SEPP-F8) has identified increased nutrients, suspended solids and altered flow regimes as the greatest threats to Victoria's water environments.

As the catchment manager, Melbourne Water is responsible for meeting water quality targets for Western Port as specified in SEPP-F8. SEPP-F8 states that runoff from urban areas must not compromise the identified beneficial use of the receiving waterways. For Western Port, elevated concentrations of total suspended solids (TSS) have been identified as the most critical risk to the environmental quality of Western Port. Research undertaken by Biosis Research provided advice to Melbourne Water as to appropriate performance objectives for Western Port to achieve SEPP-F8 as shown in Table 3.

Table 3: Comparison of BPEM and SEPP-F8 stormwater quality targets

Target	Total Suspended Solids (TSS) % Removal	Total Phosphorus (TP) % Removal	Total Nitrogen (TN) % Removal
BPEM	80%	45%	45%
SEPP-F8 for Western Port	93%	66%	63%

For this project, Melbourne Water advised that options achieving SEPP-F8 were to meet the target for TSS only. This is due the higher impact TSS has on Western Port compared to nutrient loads. If in achieving the SEPP-F8 target for TSS, the targets for TP and TN are also achieved, Melbourne Water would view this as an additional positive outcome.

1.3 Previous work

The project was based on previous reports that identified the potential to re-use stormwater within the Pakenham East PSP. Previous studies of the Pakenham East PSP utilised in this investigation are:

- Pakenham East Drainage Strategy – TSS F8 Modelling (Stormy Water Solutions, November 2015)
- Pakenham East Drainage Strategy Review and Changes (Stormy Water Solutions, October 2015)
- Pakenham East Growth Area Extension Whole of Water Cycle Assessment (GHD, July 2015)
- Pakenham East Precinct Structure Plan Proposed Drainage Strategy Draft Report Revision C (Stormy Water Solutions, March 2015)
- Pakenham East Growth Area Extension Whole of Water Cycle Assessment Draft (GHD, September 2014)

1.4 Project goal

The goal of the Pakenham East stormwater harvesting investigation was to compare the costs and benefits provided by various stormwater management options. A stormwater harvesting scheme incorporating a transfer pipeline from the Pakenham East PSP to Bald Hill Reservoir was compared to 'Business As Usual' (BAU) stormwater management that provides treatment by constructed wetlands and sedimentation basins. By assessing the stormwater options in MUSIC, the water and nutrient residual loads from each option could be compared. Completion of the functional design(s) of the stormwater transfer pipeline allowed all stormwater options to be fully and accurately costed, making a comparison of the options simple.

The entire project has the goal of assessing stormwater options for the Pakenham East PSP and providing recommendations as to which options best suit the unique area.

1.5 Project history

The Pakenham East stormwater harvesting investigation has been a complex project. A brief summary of major events associated with the investigation are included here.

1.5.1 Stakeholder meeting 1

The project kicked off with a full stakeholder meeting that included attendees from:

- Melbourne Water
- DCE
- DELWP
- SEW
- Cardinia Shire Council.

The stakeholders discussed the potential for the Pakenham East PSP achieving SEPP-F8 stormwater quality standards, issues regarding land-take and the necessity for an agreement between Melbourne Water and SEW for an agreement regarding stormwater overflow to the sewerage system.

1.5.2 Functional designs of stormwater transfer pipelines

DCE discussed the location of the 3.8-km transfer pipeline with Melbourne Water. Following discussions, two functional designs were prepared—one was the functional design of a gravity pipeline from the Pakenham East PSP to Bald Hill Reservoir. The second functional design was for a primed pipeline operating under pressure but following the same route. The advantage of the primed pipeline is additional safety (see Section 4) and approximately $1 M in capital (CAPEX) cost savings. Full details of the functional design and functional design process are included in Section 4.

1.5.3 Detailed stormwater quality treatment modelling

Detailed stormwater quality treatment modelling was undertaken using MUSIC software to simulate the amount of stormwater quality treatment each option would provide. The investigation initially involved modelling three (3) options. During the modelling process, DCE discussed the results and methodology with the Melbourne Water project team. The discussions and collaborations led to the addition of options to the investigation. Six options were assessed at this stage of the project. See Section 2.2 for full details on the timing of the addition of options to the project.

1.5.4 Costing

Once the MUSIC modelling was complete, DCE undertook a complete costing of the capital (CAPEX) and operational (OPEX) costs associated with all options. The cost estimates were as detailed as possible to provide maximum accuracy. Following on from DCE's work, Melbourne Water prepared

30-year Net-Present Costs (NPC's) for all modelled options. Section 5 provides full details on the costing portion of the project.

1.5.5 Stakeholder meeting 2

The results of the MUSIC modelling and costing were presented by Melbourne Water and DCE at Stakeholder meeting 2. Once again, the meeting included attendees from:

- Melbourne Water
- DCE
- DELWP
- SEW
- Cardinia Shire Council.

The stakeholders discussed the modelling and costing results for the various stormwater options for the Pakenham East PSP. In the meeting, it was identified that additional modelling and costing should be undertaken for two (2) additional options (eight options in total were modelled and costed during the entire Pakenham East stormwater harvesting investigation) to make sure that the comparisons were fair. The issue of an agreement regarding stormwater overflow from the sewerage system and a need for an agreement between SEW and Melbourne Water was also noted.

1.5.6 Additional modelling and costing

Additional modelling and costing of the two (2) additional options identified in Stakeholder meeting 2 was completed by DCE. Full details on all modelled scenarios are included in Section 2.2. Section 5 provides details on the costing portion of the project.

1.5.7 Cost-Benefit Report

DCE prepared a cost-benefit report summarising the cost comparisons of the various stormwater options for the Pakenham East PSP. The cost-benefit report is included as Appendix B.

2. Investigated options

The Pakenham East stormwater harvesting investigation has resulted in the modelling and costing of eight (8) stormwater options for the PSP area.

2.1 Investigated options

Table 4 summarises the options investigated. The individual options are detailed in this section of the report. The evolution of the options is detailed in Section 2.2.

Table 4: Investigated stormwater options

Option	Treatment type	Stormwater quality standard required	External catchment treated	Notes
1	Sedimentation basins and constructed wetlands	BPEM	Yes	Based on Stormy Water Solutions model dated October 2015
1A	Sedimentation basins and constructed wetlands. External catchment untreated.	BPEM	No	Based on original option 1
2	Sedimentation basins and constructed wetlands	SEPP-F8 for TSS	Yes	Based on the model for Option 1
2A	Sedimentation basins and constructed wetlands. External catchment untreated.	SEPP-F8 for TSS	No	Based on original option 2
3-G	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline	SEPP-F8 for TSS	No (but harvested)	Stormwater harvesting model
3-P	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a primed stormwater transfer pipeline	SEPP-F8 for TSS	No (but harvested)	Stormwater harvesting model
4-G	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline. External catchment treated to BPEM at W1.	SEPP-F8 for TSS	Yes (to BPEM)	Stormwater harvesting model
4-P	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a primed stormwater transfer pipeline. External catchment treated to BPEM at W1.	SEPP-F8 for TSS	Yes (to BPEM)	Stormwater harvesting model

2.1.1 Option 1

Option 1 is based on the original Stormy Water Solutions model for the Pakenham East PSP. In Option 1, current BAU stormwater quality treatment infrastructure (shown in Figure 2), is used to treat stormwater to BPEM standards. The stormwater quality infrastructure provides treatment to the external catchment north of the Pakenham East PSP.

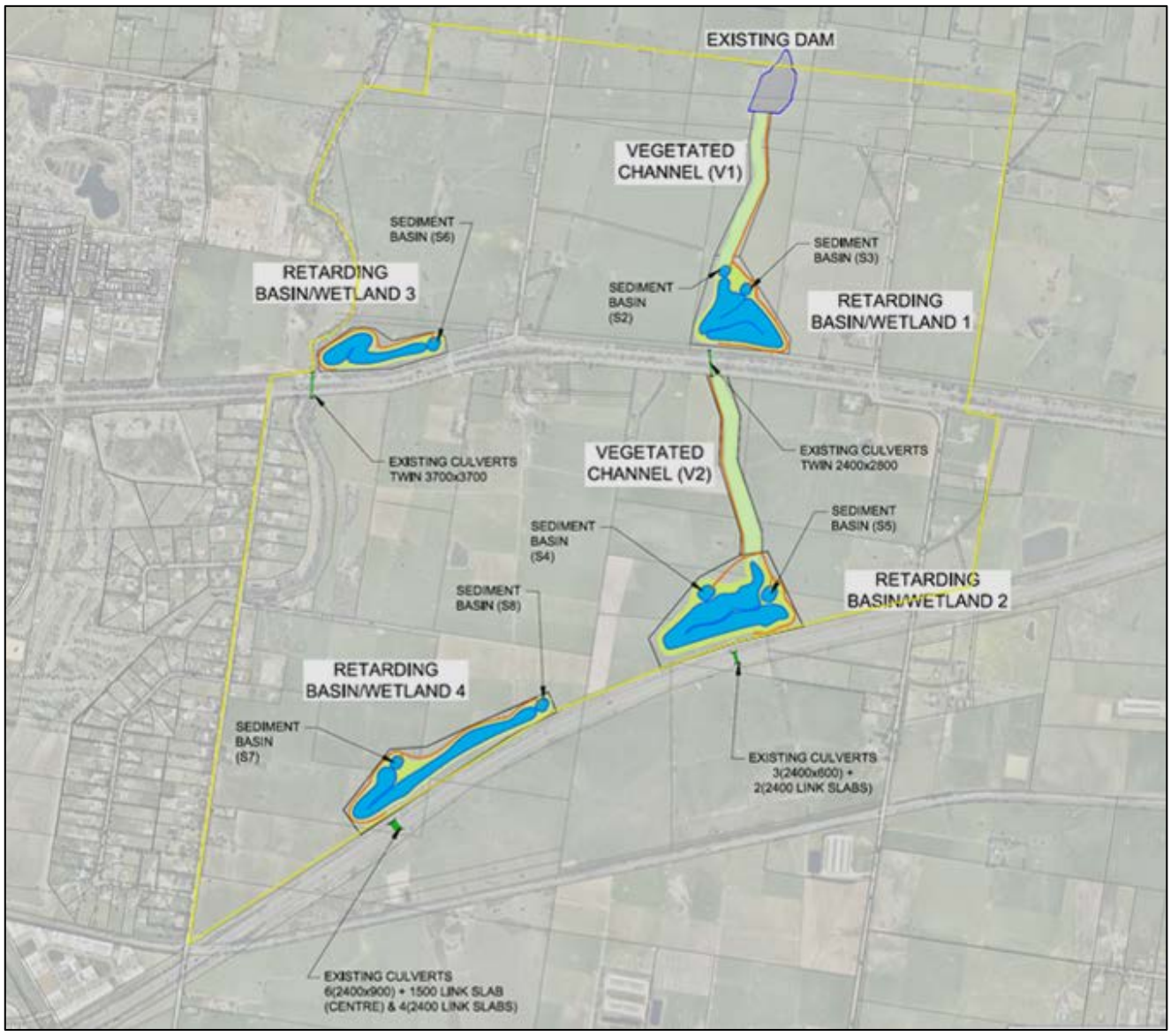

Figure 2: Option 1 infrastructure plan

A catchment plan of Option 1 is shown in Figure 3. Full details of the MUSIC modelling (including modifications to the original models for use in the investigation) are included in Appendix A. Modelling results are included in Section 3. Costing results are included in Section 5.

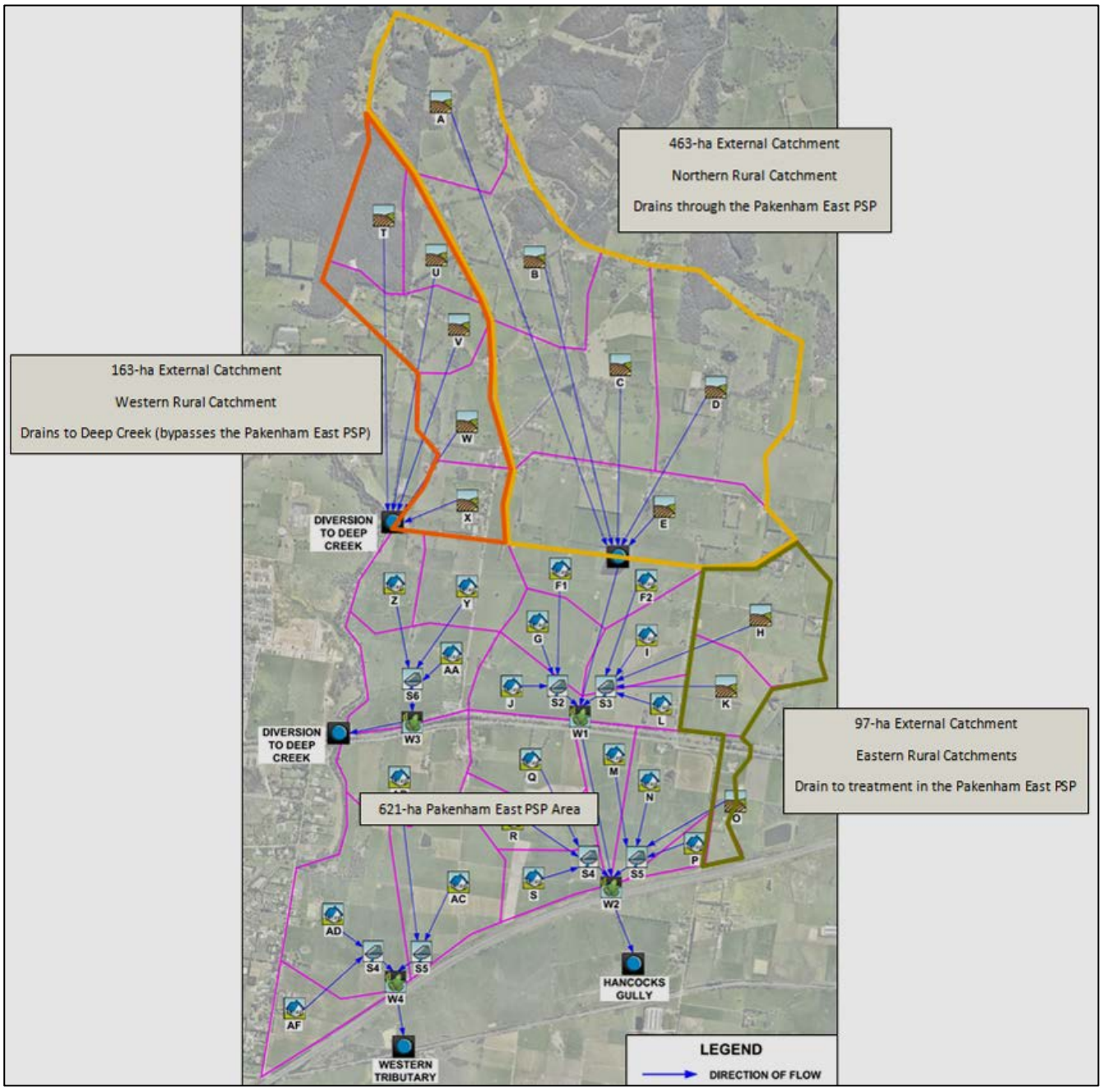

Figure 3: Option 1 catchment plan

2.1.3 Option 1A

Option 1A is based on the model created for Option 1. In Option 1A, BAU stormwater quality treatment infrastructure, as shown in Figure 4, is used to treat stormwater to BPEM standards. The stormwater quality infrastructure provides treatment only to the Pakenham East PSP.

Figure 4: Option 1A infrastructure plan

A catchment plan of Option 1A is shown in Figure 5. Full details of the MUSIC modelling (including modifications to the original models for use in the investigation) are included in Appendix A. Modelling results are included in Section 3. Costing results are included in Section 5.

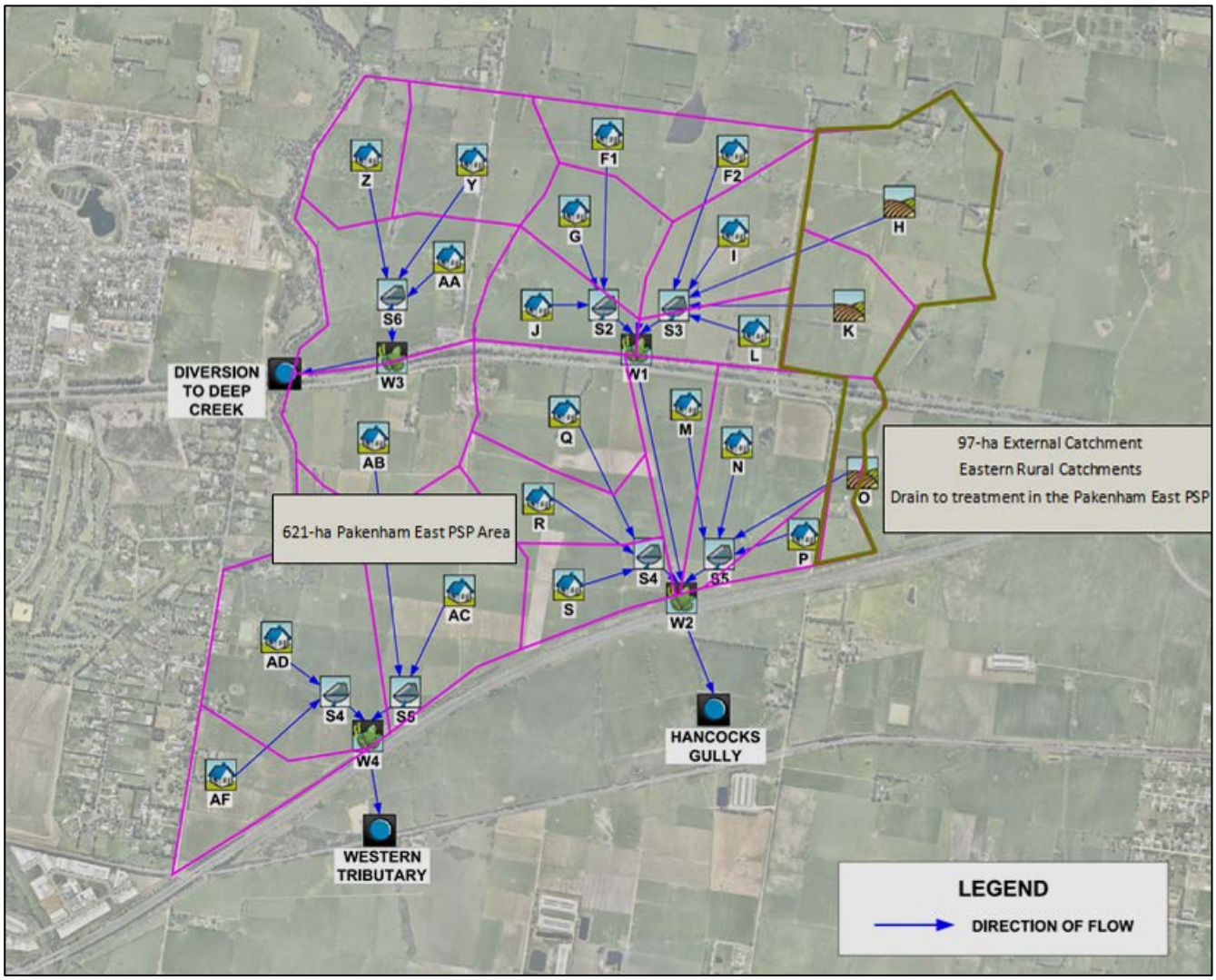

Figure 5: Option 1A catchment plan

2.1.4 Option 2

In Option 2, current BAU stormwater quality treatment infrastructure is used to treat stormwater to achieve the SEPP-F8 standards for TSS reduction, as shown in Figure 6. In achieving the SEPP-F8 standards for TSS reduction, the SEPP-F8 standards for TP reduction are also achieved. The stormwater quality infrastructure provides treatment to the external catchment north of the Pakenham East PSP.

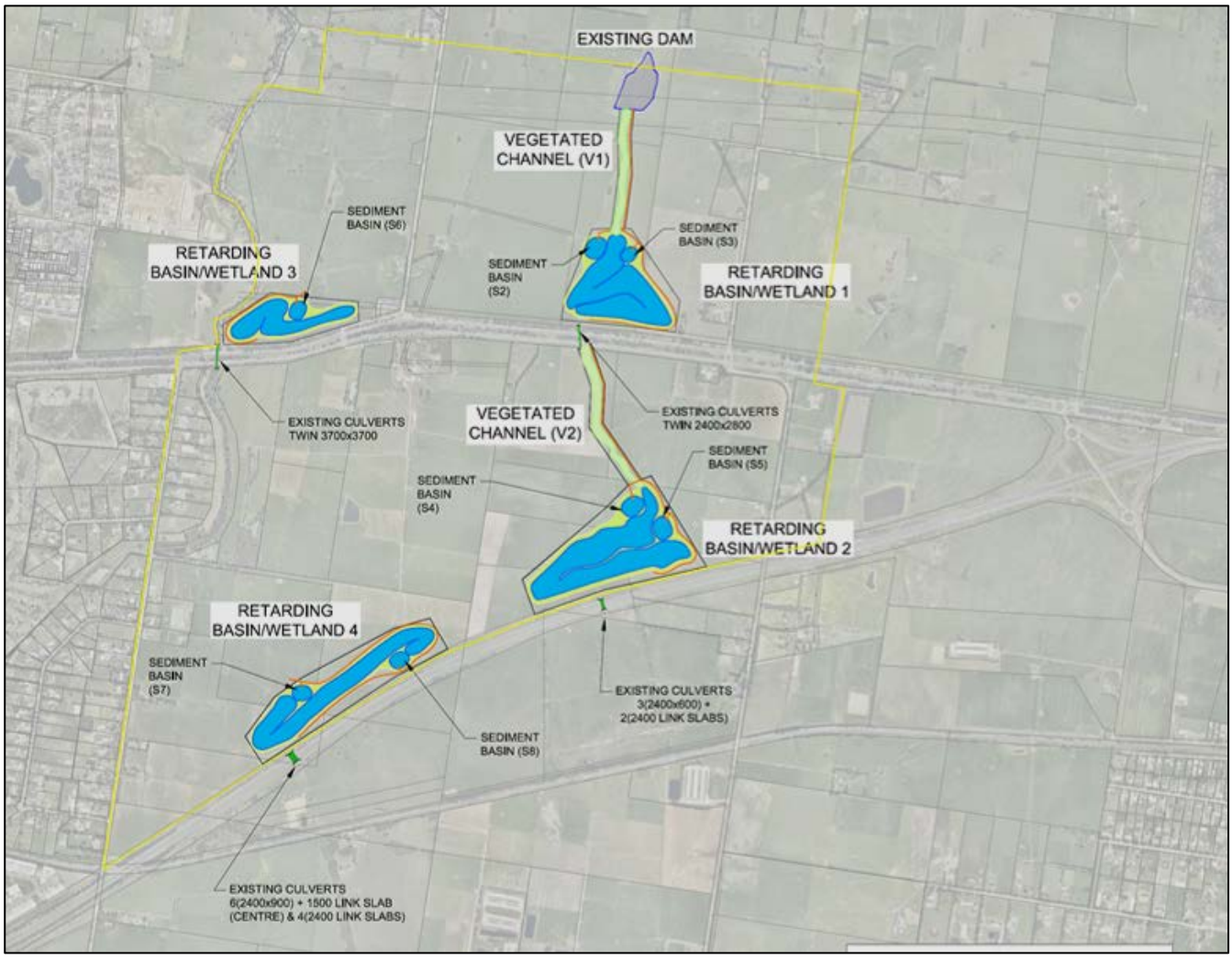

Figure 6: Option 2 infrastructure plan

A catchment plan of Option 2 is shown in Figure 7. Full details of the MUSIC modelling (including modifications to the original models for use in the investigation) are included in Appendix A. Modelling results are included in Section 3. Costing results are included in Section 5.

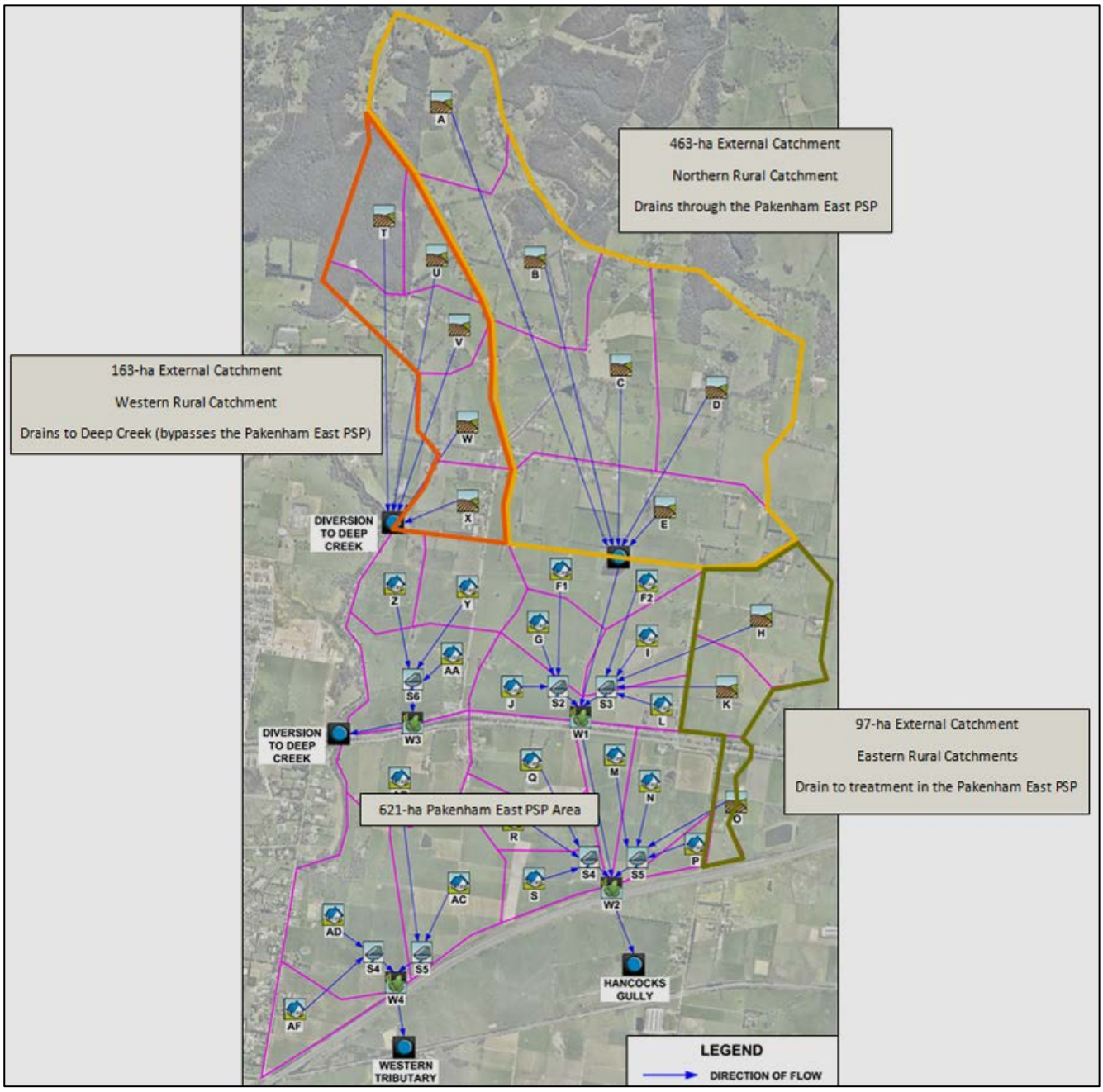

Figure 7: Option 2 catchment plan

2.1.5 Option 2A

In Option 2A, current BAU stormwater quality treatment infrastructure is used to treat stormwater to achieve the SEPP-F8 standards for TSS reduction, as shown in Figure 8. In achieving the SEPP-F8 standards for TSS reduction, the SEPP-F8 standards for TP reduction are also achieved. The stormwater quality infrastructure provides treatment only to the Pakenham East PSP.

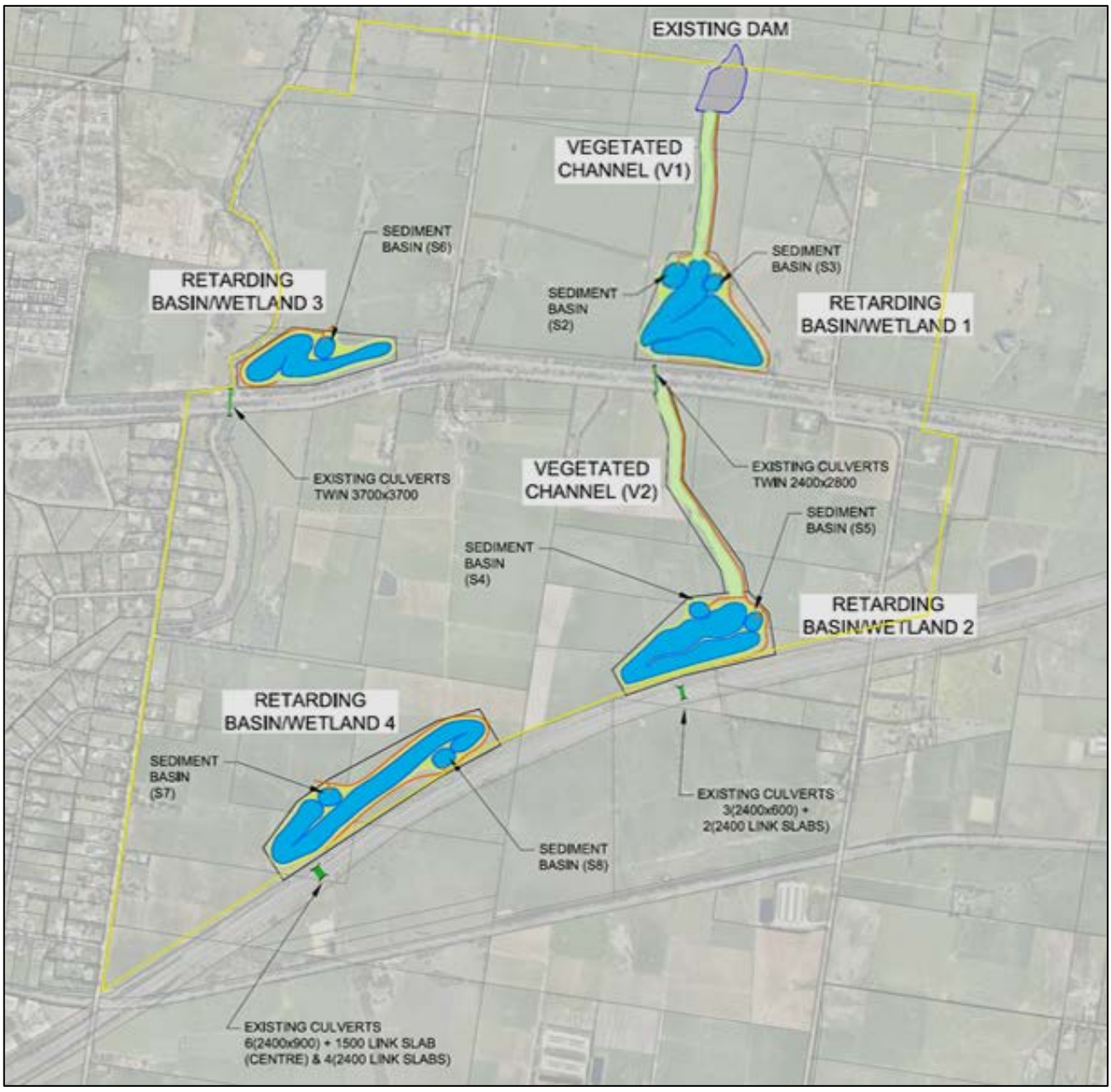

Figure 8: Option 2A infrastructure plan

A catchment plan of Option 2A is shown in Figure 9. Full details of the MUSIC modelling (including modifications to the original models for use in the investigation) are included in Appendix A. Modelling results are included in Section 3. Costing results are included in Section 5.

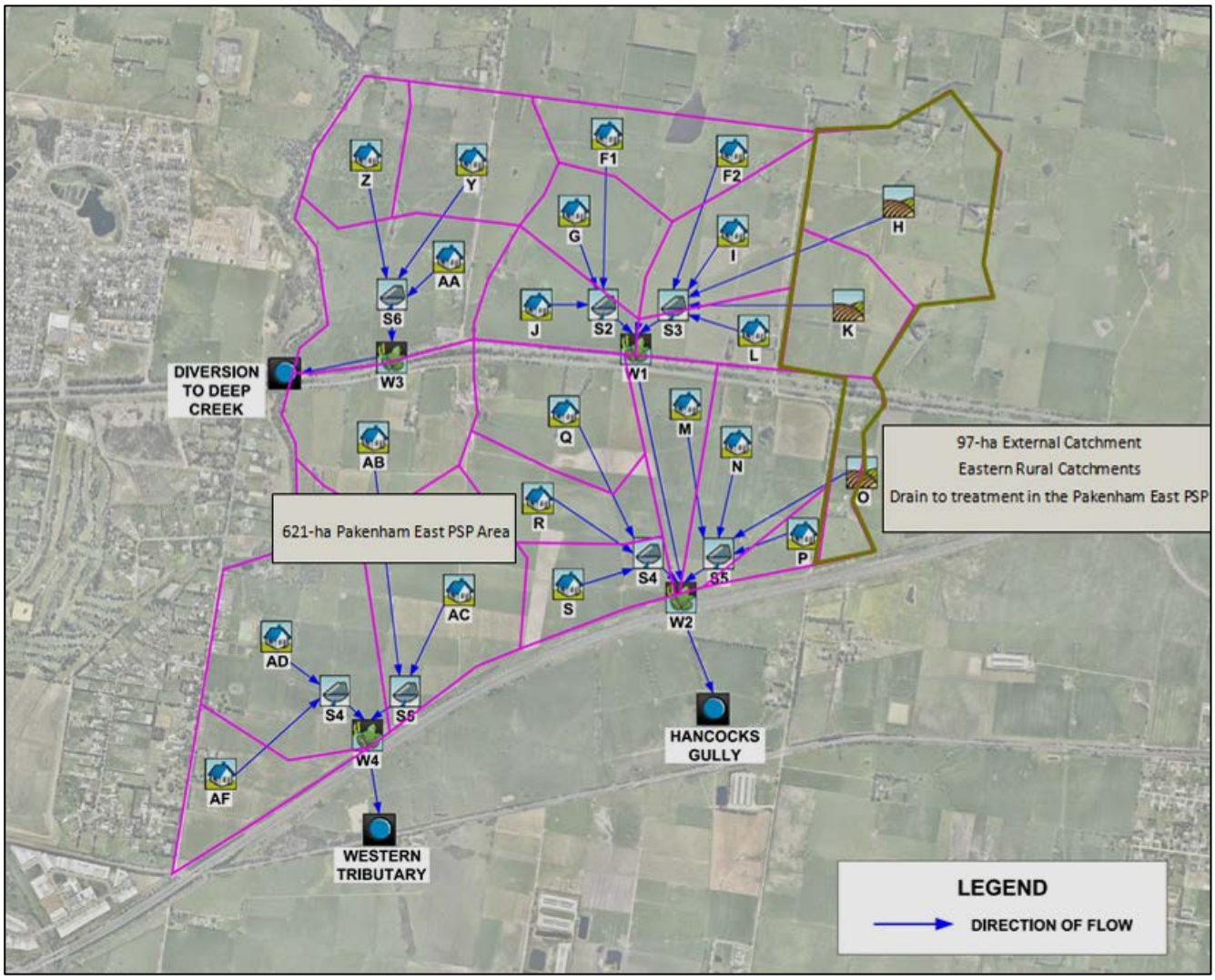

Figure 9: Option 2A catchment plan

2.1.6 Option 3-G

Option 3-G incorporates stormwater harvesting. In Option 3-G, the stormwater quality treatment infrastructure is a combination of a stormwater harvesting scheme and BAU treatment infrastructure, as shown in Figure 10. A gravity pipeline connects the stormwater collected in Retarding Basin/Wetland 2 (RB 2) and Retarding Basin/Wetland 4 (RB 4) to the stormwater storage at Bald Hill Reservoir. See Section 4 for more details about the transfer pipeline.

Figure 10: Option 3-G infrastructure plan

The combination of treatment methods achieves the SEPP-F8 standards for TSS reduction. In achieving the SEPP-F8 standards for TSS reduction, the SEPP-F8 standards for TP and TN reduction are also achieved. The stormwater quality infrastructure provides treatment only to the Pakenham East PSP, although runoff from the external catchment is harvested for re-use.

A catchment plan of Option 3-G is shown in Figure 11. Full details of the MUSIC modelling (including modifications to the original models for use in the investigation) are included in Appendix A. Modelling results are included in Section 3. Costing results are included in Section 5.

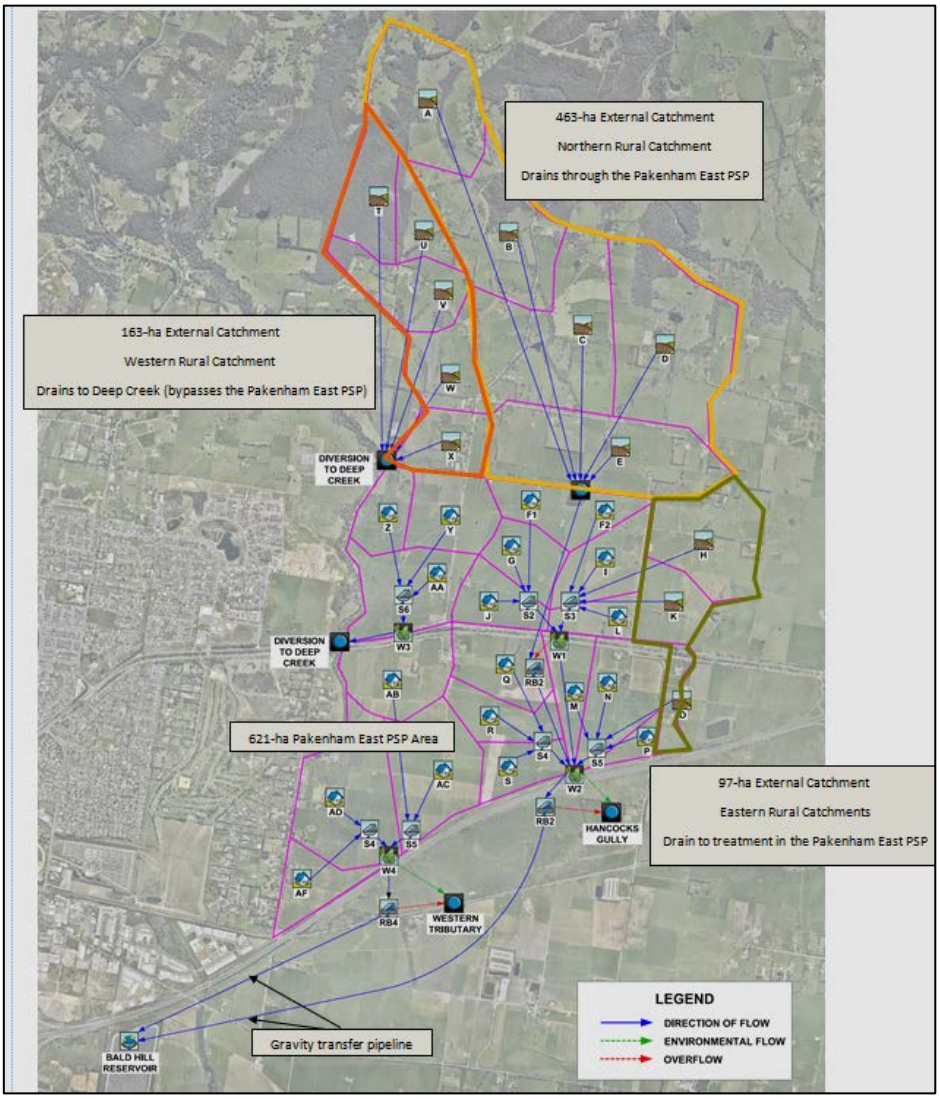

Figure 11: Option 3-G catchment plan

2.1.7 Option 3-P

Option 3-P incorporates stormwater harvesting. In Option 3-P, the stormwater quality treatment infrastructure is a combination of a stormwater harvesting scheme and BAU treatment infrastructure, as shown in Figure 12. A primed pipeline connects the stormwater collected in RB 2 and RB 4 to the stormwater storage at Bald Hill Reservoir. See Section 4 for more details about the transfer pipeline.

Figure 12: Option 3-P infrastructure plan

The combination of treatment methods achieves the SEPP-F8 standards for TSS reduction. In achieving the SEPP-F8 standards for TSS reduction, the SEPP-F8 standards for TP and TN reduction are also achieved. The stormwater quality infrastructure provides treatment only to the Pakenham East PSP, although runoff from the external catchment is harvested for re-use.

A catchment plan of Option 3-P is shown in Figure 15. Full details of the MUSIC modelling (including modifications to the original models for use in the investigation) are included in Appendix A. Modelling results are included in Section 3. Costing results are included in Section 5.

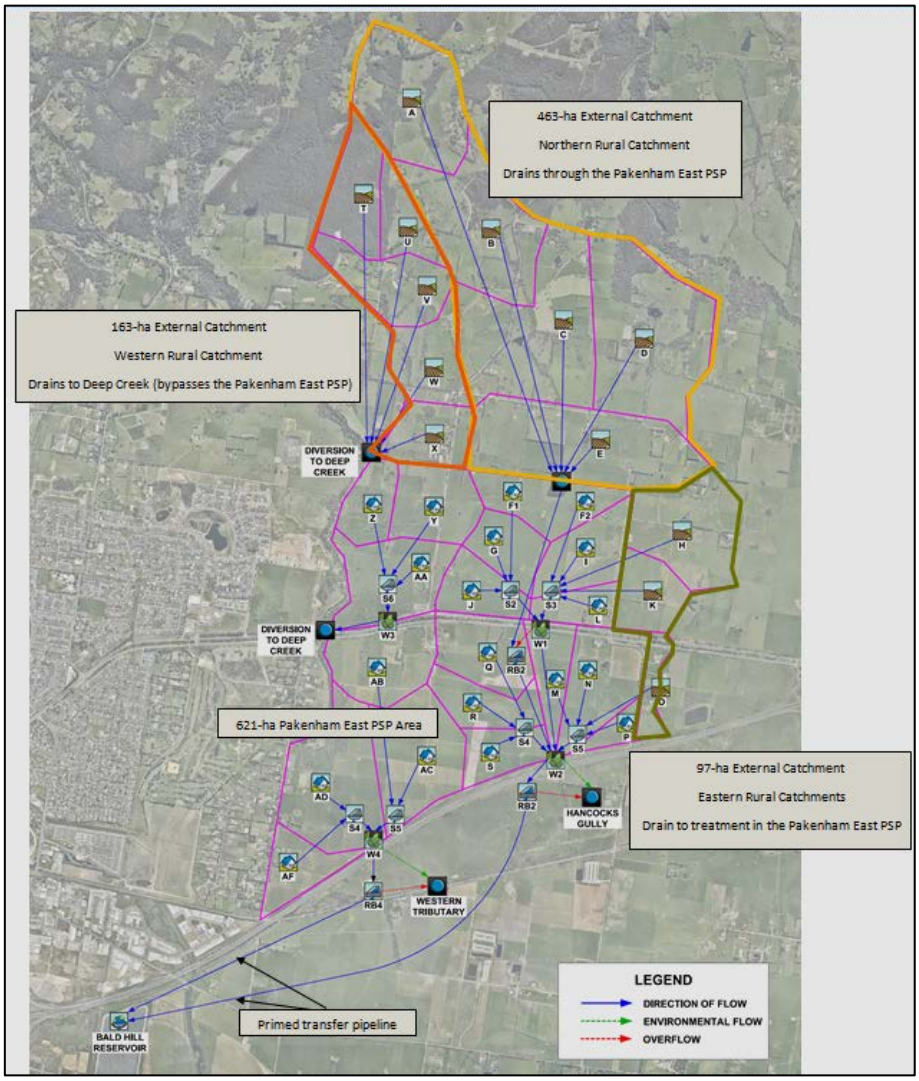

Figure 13: Option 3-P catchment plan

2.1.8 Option 4-G

Option 4-G incorporates stormwater harvesting. In Option 4-G, the stormwater quality treatment infrastructure is a combination of a stormwater harvesting scheme and BAU treatment infrastructure, as shown in Figure 14.

Wetland 1 (W1) has been sized to treat runoff from the 463-ha external catchment to BPEM standards. As a result, the water quality in the future constructed waterway within the Pakenham East PSP meets current Melbourne Water standards. Options 4-G and 4-P provide the maximum amount of stormwater quality treatment. A gravity pipeline connects the stormwater collected in RB 2 and RB 4 to the stormwater storage at Bald Hill Reservoir. See Section 4 for more details about the transfer pipeline.

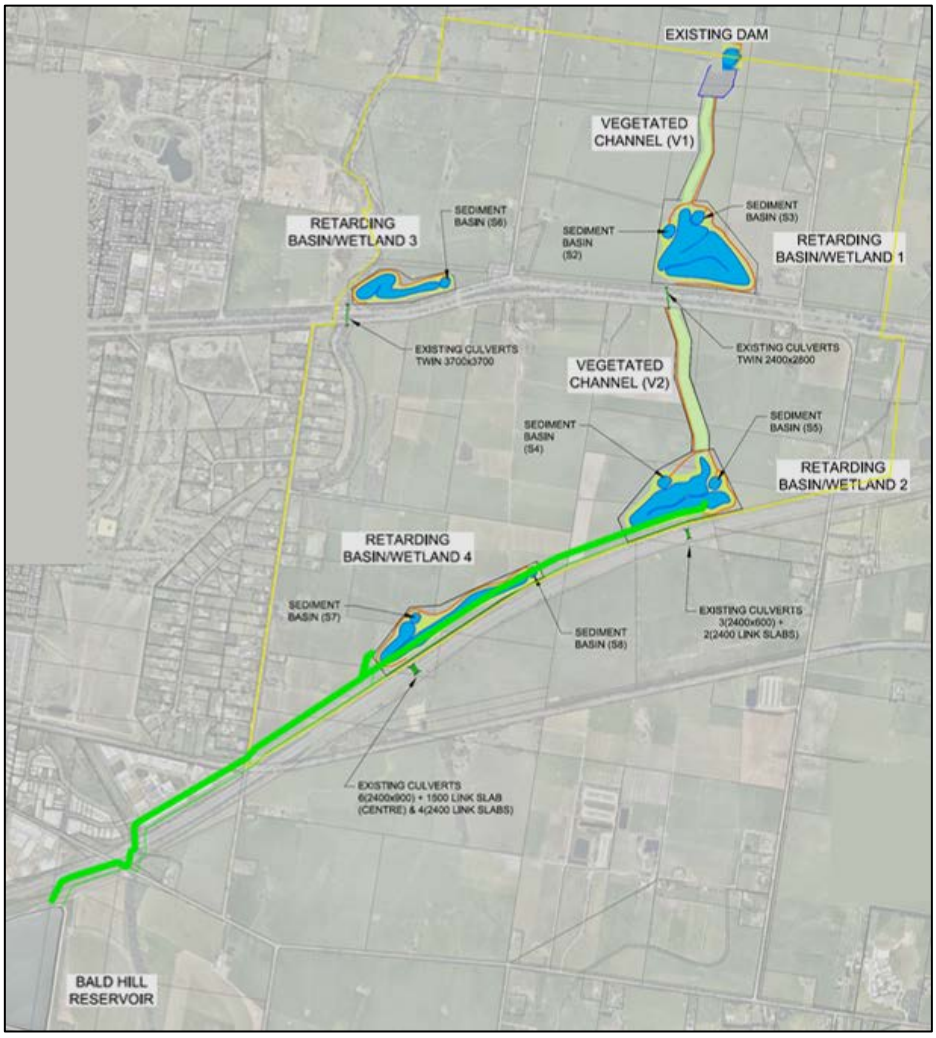

Figure 14: Option 4-G infrastructure plan

The combination of treatment methods achieves the SEPP-F8 standards for TSS reduction. In achieving the SEPP-F8 standards for TSS reduction, the SEPP-F8 standards for TP and TN reduction are also achieved. The stormwater quality infrastructure provides treatment both to the external catchment north of the Pakenham East PSP and to the Pakenham East PSP. Runoff from the external catchment is harvested for re-use.

A catchment plan of Option 4-G is shown in Figure 15. Full details of the MUSIC modelling (including modifications to the original models for use in the investigation) are included in in Appendix A. Modelling results are included in Section 3. Costing results are included in Section 5.

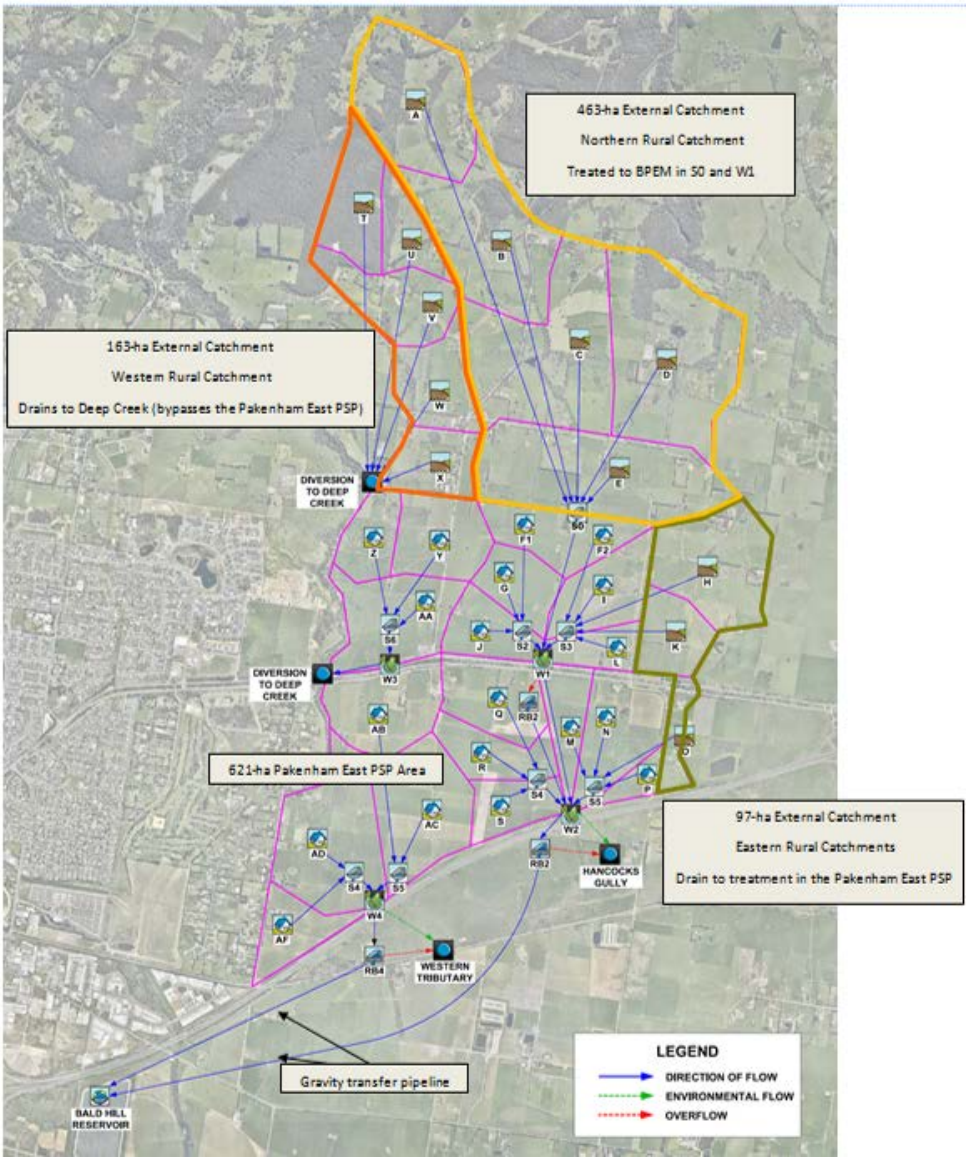

Figure 15: Option 4-G catchment plan

2.1.9 Option 4-P

Option 4-P incorporates stormwater harvesting. In Option 4-P, the stormwater quality treatment infrastructure is a combination of a stormwater harvesting scheme and BAU treatment infrastructure, as shown in Figure 16.

W1 has been sized to treat runoff from the 463-ha external catchment to BPEM standards. As a result, the water quality in the future constructed waterway within the Pakenham East PSP meets current Melbourne Water standards. Options 4-G and 4-P provide the maximum amount of stormwater quality treatment. A primed pipeline connects the stormwater collected in RB 2 and RB 4 to the stormwater storage at Bald Hill Reservoir. See Section 4 for more details about the transfer pipeline.

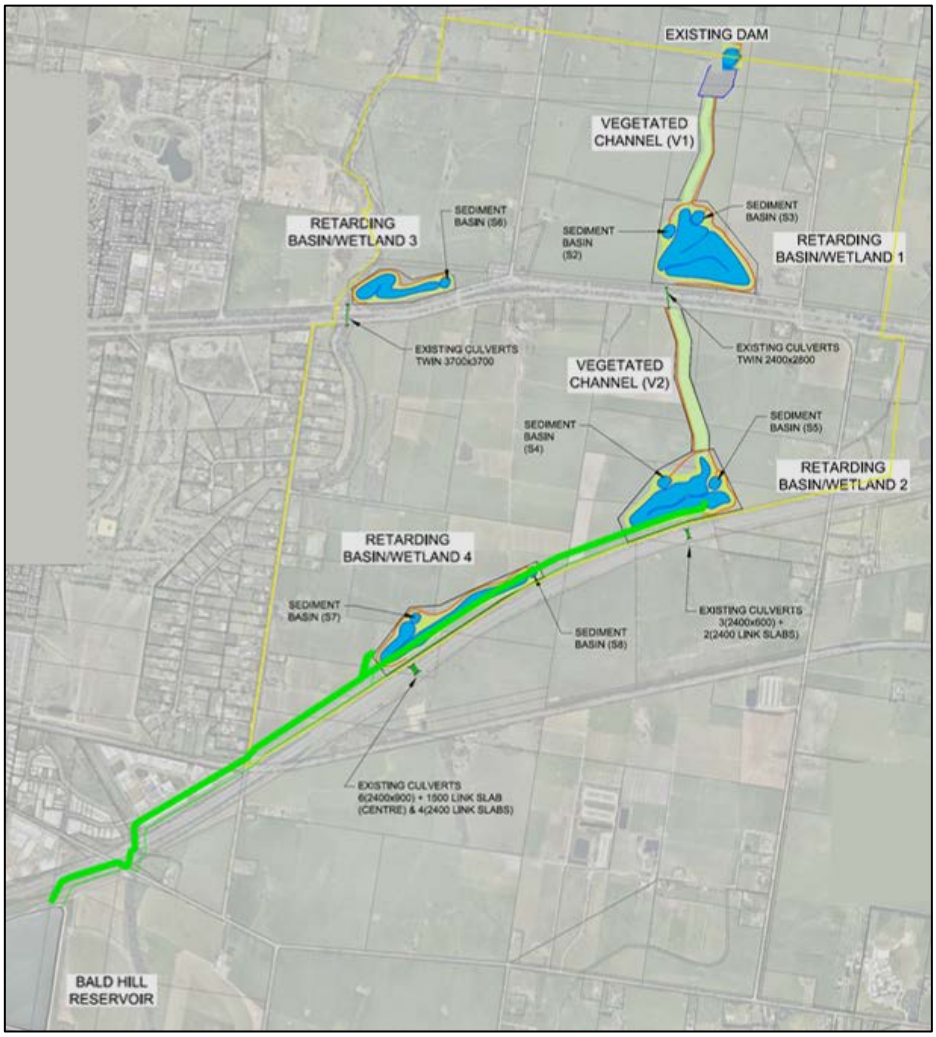

Figure 16: Option 4-P infrastructure plan

The combination of treatment methods achieves the SEPP-F8 standards for TSS reduction. In achieving the SEPP-F8 standards for TSS reduction, the SEPP-F8 standards for TP and TN reduction are also achieved. The stormwater quality infrastructure provides treatment both to the external catchment north of the Pakenham East PSP and to the Pakenham East PSP. Runoff from the external catchment is harvested for re-use.

A catchment plan of Option 4-P is shown in Figure 17. Full details of the MUSIC modelling (including modifications to the original models for use in the investigation) are included in Appendix A. Modelling results are included in Section 3. Costing results are included in Section 5.

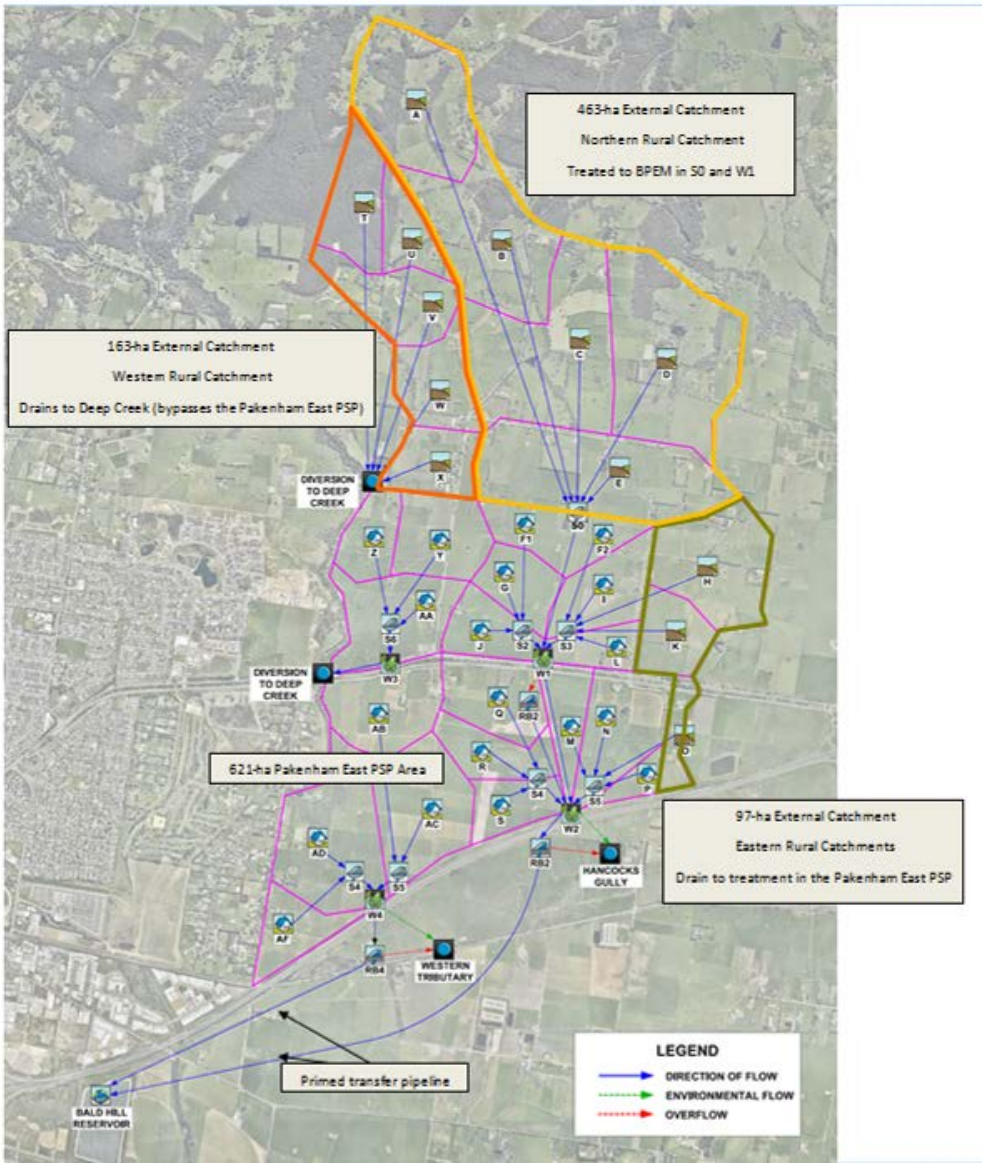

Figure 17: Option 4-P catchment plan

2.2 Options history

At the beginning of the project, it was anticipated that modelling three (3) options would be sufficient. However, the number of required options increased as the project progressed.

2.2.1 Original options

Three (3) options were originally identified for modelling, costing and comparison. The original models are summarised in Table 5.

Table 5: Original stormwater options

Option	Treatment type	Stormwater quality standard achieved	Notes
1	Sedimentation basins and constructed wetlands	BPEM	Based on Stormy Water Solutions model dated October 2015
2	Sedimentation basins and constructed wetlands	SEPP-F8 for TSS	Based on the model for Option 1
3	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline	SEPP-F8 for TSS	Stormwater harvesting model

Of the original models, Options 1 and 2 remained unchanged throughout the investigation. Details of the investigated options are presented in Section 2.1.

2.2.2 Additional options

Following discussions with the Melbourne Water project team, some additional modelling options were added. Option 3 was split to reflect the two options for the stormwater transfer pipeline (gravity or primed). Option 4 was added to determine the amount of additional treatment required to treat the northern external catchment within the PSP area. Table 6 summarises the options that were included in the investigation at this point.

Table 6: Additional stormwater options

Option	Treatment type	Stormwater quality standard achieved	Notes
1	Sedimentation basins and constructed wetlands	BPEM	Based on Stormy Water Solutions model dated October 2015
2	Sedimentation basins and constructed wetlands	SEPP-F8 for TSS	Based on the model for Option 1
3-G	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline	SEPP-F8 for TSS	Stormwater harvesting model
3-P	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a primed stormwater transfer pipeline	SEPP-F8 for TSS	Stormwater harvesting model
4-G	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline. External catchment treated to BPEM at northern boundary of the PSP.	SEPP-F8 for TSS	Stormwater harvesting model
4-P	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a primed stormwater transfer pipeline. External catchment treated to BPEM at northern boundary of the PSP.	SEPP-F8 for TSS	Stormwater harvesting model

All of the additional options remained unchanged throughout the investigation. Details of each option are presented in Section 2.1.

2.2.3 Stakeholder meeting 2 options

In stakeholder meeting 2, it was identified that additional modelling should be undertaken. The original Stormy Water solutions model for the Pakenham East PSP included treatment of the 463-ha external rural catchment within the water quality treatment infrastructure. The stakeholders wanted to compare Option 3-G and Option 3-P with business-as usual treatment of the PSP area only. Table 7 summarises the final adopted modelling options. A total of eight options were selected for modelling and detailed costing.

Table 7: Ultimate stormwater options (following stakeholder meeting 2)

Option	Treatment type	Stormwater quality standard achieved	Notes
1	Sedimentation basins and constructed wetlands	BPEM	Based on Stormy Water Solutions model dated October 2015
1A	Sedimentation basins and constructed wetlands. External catchment untreated.	BPEM	Based on original option 1
2	Sedimentation basins and constructed wetlands	SEPP-F8 for TSS	Based on the model for Option 1
2A	Sedimentation basins and constructed wetlands. External catchment untreated.	SEPP-F8 for TSS	Based on original option 2
3-G	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline	SEPP-F8 for TSS	Stormwater harvesting model
3-P	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a primed stormwater transfer pipeline	SEPP-F8 for TSS	Stormwater harvesting model
4-G	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a gravity stormwater transfer pipeline. External catchment treated to BPEM at northern boundary of the PSP.	SEPP-F8 for TSS	Stormwater harvesting model
4-P	Combination of Sedimentation basins and constructed wetlands and Stormwater harvesting with a primed stormwater transfer pipeline. External catchment treated to BPEM at northern boundary of the PSP.	SEPP-F8 for TSS	Stormwater harvesting model

2.2.4 Cost-benefit report options

For the cost-benefit report, the Melbourne Water project team requested that the number of options included be limited to ones that treated the same amount of area. Therefore only options 1A, 2A, 3-G and 3-P were included in the cost-benefit report. Section 6 presents the results of the Cost-Benefit Report.

3. MUSIC modelling results

MUSIC modelling was undertaken during the project to determine key results:

- The size of stormwater quality treatment (sedimentation basins and constructed wetlands)
- Water balances for all options
- Nutrient balances for all options
- Runoff volume changes vs. pre-development for all options
- The capacity of the stormwater transfer pipeline
- Assess (broadly) the reliability of stormwater harvesting.

Six (6) MUSIC models were created as part of the project. As the gravity and primed pipelines have the same capacity, Options 3-G and 3-P were assessed simultaneously (using a single model to simulate both 3-G and 3-P options) in MUSIC. The same method was used for Options 4-G and 4-P. This section presents the results of the MUSIC modelling for all options.

3.1 Stormwater quality treatment

The primary reason for MUSIC modelling was to size the stormwater quality treatment to achieve the treatment goal(s) for each option. Table 8 provides a detailed comparison of the area of stormwater quality treatment required for each option. Infrastructure plans for each option are included in Section 2.1 and Appendix G.

Table 8: Required stormwater treatment by option

Option	S0 Area (sq. m)	S2 Area (sq. m)	S3 Area (sq. m)	W1 Area (sq. m)	S4 Area (sq. m)	S5 Area (sq. m)	W2 Area (sq. m)	S6 Area (sq. m)	W3 Area (sq. m)	S7 Area (sq. m)	S8 Area (sq. m)	W4 Area (sq. m)
1	n/a	1,490	3,030	45,200	2,400	2,400	55,500	1,600	21,500	1,500	1,500	42,500
1A	n/a	955	1,940	28,930	1,775	1,775	35,520	2,150	21,500	2,125	2,125	42,500
2	n/a	2,865	5,725	85,880	5,550	5,550	111,000	3,870	38,700	3,825	3,825	76,500
2A	n/a	1,685	3,380	50,625	3,110	3,110	62,160	3,870	38,700	3,825	3,825	76,500
3-G	n/a	2,420	2,420	48,365	2,970	2,970	59,385	2,300	23,005	2,275	2,275	45,475
3-P	n/a	2,420	2,420	48,365	2,970	2,970	59,385	2,300	23,005	2,275	2,275	45,475
4-G	2,650	2,650	2,650	79,550	2,775	2,775	55,500	2,150	21,500	2,125	2,125	42,500
4-P	2,650	2,650	2,650	79,550	2,775	2,775	55,500	2,150	21,500	2,125	2,125	42,500

Table 9 provides a summary of the required stormwater quality treatment and the total area of drainage reserve (including retarding basins and constructed waterways) associated with each option. It should be noted that the sizes associated with the stormwater quality treatment are conceptual only.

Sedimentation basins should be sized using the Fair and Geyer equations during functional design. The wetland size is also likely to change somewhat during functional design, however, the conceptual areas are suitable for use in costing and assessment.

Table 9: Summary of required land-take for stormwater quality and drainage

Option	Total stormwater quality infrastructure area (sq. m)	Total drainage reserve area (ha)
1	178,620	43
1A	141,295	40
2	343,290	65
2A	250,785	51
3-G	193,850	43
3-P	193,850	43
4-G	218,960	51
4-P	218,960	51

3.2 Water balances

Water balances were calculated for each option based on total inflows and total outflows. A summary of the water balances for each option is included in Table 10. Detailed water balances for each option are included in the MUSIC modelling report included as Appendix A. The stormwater harvest options (Options 3-G, 3-P, 4-G and 4-P) best match pre-development flows.

Table 10: Summary of water balances

Option	Total inflow (ML/2004)	Total outflow (ML/2004)	Outflow vs. pre-development (2,591 ML/2004 inc. ext. catchment)	Outflow vs. pre-development (1,559 ML/2004 for PSP area only)
1	9,410	4,264	159%	n/a
1A	5,721	3,158	n/a	205%
2	9,410	4,035	151%	n/a
2A	5,721	3,024	n/a	194%
3-G	9,410	2,129	78%	135%
3-P	9,410	2,129	78%	135%
4-G	9,410	2,096	78%	n/a
4-P	9,410	2,096	78%	n/a

3.3 Nutrient balances

Nutrient balances were calculated for each option based on total inflows and total outflows. A summary of the nutrient balances for each option is included in Table 11. Detailed nutrient balances for each option are included in the MUSIC modelling report included as Appendix A. The stormwater quality treatment standards achieved by each option are also included on the summary table.

Table 11: Summary of nutrient balances

Option	Stormwater quality treatment achieved	TSS % removal	TP % removal	TN % removal
1	BPEM	81%	69%	46%
1A	BPEM	84%	70%	45%
2	SEPP-F8 (TSS and TP)	93%	81%	60%
2A	SEPP-F8 (TSS and TP)	93%	80%	58%
3-G	SEPP-F8 (all nutrients)	93%	84%	69%
3-P	SEPP-F8 (all nutrients)	93%	84%	69%
4-G	SEPP-F8 (all nutrients)	93%	84%	69%
4-P	SEPP-F8 (all nutrients)	93%	84%	69%

3.4 Environmental flows

The stormwater harvesting schemes modelled in options 3-G, 3-P, 4-G and 4-P needed to be modelled realistically. Melbourne Water has requirements concerning environmental flows. Environmental flows preserve stream flow downstream of the Pakenham East PSP. The environmental flows must be treated so that the entire catchment achieves the required stormwater quality standards.

Pre-development environmental flow was calculated based MUSIC modelling. The total volume of outflow from the PSP area was determined. The pre-development environmental flow (all land use considered to be rural with 0.1 fraction impervious) is shown in Table 12.

Table 12: Pre-development environmental flows

Pre-development outflow (ML/2004)	Average outflow (cu. m/2004)	Average Daily outflow (cu. m/day)	Average Daily outflow (low flow bypass) (cu. m/s)
2,591	2,681,533	7,327	0.085

In the developed condition, environmental flow came from two sources:

- A low-flow bypass on the stormwater harvesting pipeline (based on the average daily flow as shown in Table 12)
- A high-flow bypass on the stormwater harvesting pipeline (based on the design capacity of the pipeline) diverting all flow about 0.415 cu. m/s to the downstream waterways

In addition, stormwater that cannot be harvested (when the Bald Hill Reservoir is full) is diverted to the waterway and is considered environmental flow. It should be noted that all sources of environmental flow have stormwater quality treatment provided. Providing treatment to the environmental flows necessitates the inclusion of sedimentation basins and constructed wetlands even in the options incorporating stormwater harvesting schemes.

3.5 Stormwater harvesting

The reliability of the stormwater harvesting scheme is dependent on the amount of runoff reaching the stormwater storage (Bald Hill Reservoir). The reliability of the stormwater harvesting scheme depends on the capacity of the stormwater transfer pipeline. The average reliability of the stormwater harvesting scheme in the modelling year of 2004 is summarised in Table 13. Determining the reliability of the stormwater harvesting scheme more accurately will require utilising additional years of modelling data and including likely SEW operating levels in Bald Hill Reservoir. Such work was outside the scope of this project but should be undertaken in the future to fully understand the benefits of stormwater harvesting in the Pakenham East PSP catchment.

Table 13: Stormwater harvesting scheme reliability

Stormwater transfer pipeline capacity (based on functional designs) cu. m/s	Stormwater storage in Bald Hill Reservoir (ML)	Stormwater demand on Bald Hill Reservoir (ML/day)	Option 3-G and 3-P Stormwater harvesting scheme reliability for 2004 modelling year	Option 4-G and 4-P Stormwater harvesting scheme reliability for 2004 modelling year
0.415	200	4	81%	80%

The reliability between Options 3-G and 3-P and Options 4-G and 4-P differs because the volume of stormwater in Options 4-G and 4-P is slightly reduced by evaporation associated with the additional stormwater quality treatment.

4. Functional design of stormwater transfer pipelines

Accurately costing the stormwater harvest options 3-G, 3-P, 4-G and 4-P involved accurately costing the stormwater transfer pipeline connecting RB2 and RB4 in the Pakenham East PSP to SEW's existing Bald Hill Class C Reservoir. To achieve this, two functional designs of the stormwater transfer pipeline were prepared:

- Gravity pipeline
- Primed pipeline

The reason two functional designs were produced was DCE's identification of an opportunity for innovation. The stormwater transfer pipeline had originally been proposed to be a gravity pipeline; however the required depth of the gravity pipeline was identified early in the project as having the potential to be costly and unsafe. Therefore, a second pipeline where the stormwater would be driven by a primed pump, reducing the depth of the pipeline, was also designed.

The Melbourne Water project team have advised that the functional designs of the pipelines will only be used for the costing of the investigated stormwater options.

4.1 Gravity pipeline

A gravity pipeline 630 mm in diameter is proposed and has been designed. It has inlets at both RB2 and RB4, as shown in Figure 18. The full functional design plans are included in Appendix F. The pipeline is driven by gravity head for approximately 3,800 m (3.8 km), under the Princes Freeway and railway, across Deep Creek via a pipe bridge, and finally into Bald Hill Reservoir via a syphon. The design has been undertaken to maximise safety in design and allow for safe maintenance.

As noted, the gravity pipeline requires approximately 610 linear m of deep excavation. Deep excavation in the context of this study has been considered to be any excavation deeper than 6 m. The excavation depth limit of an excavator is approximately 6 m. Trench shields and benching can be used to provide safety for workers during the construction process, however greasyback soils in Melbourne's south-east are notorious for collapse. Excavation deeper than 6 m in this area poses a safety risk.

Minimising the risks of trench collapse requires a change in construction methodology. Trench shields are appropriate for up to 6 m of excavation depth, but the deep excavation will likely require benching. Benched excavation increases the construction zone area and increases the volume (and therefore cost) of backfill material. In addition, the large amount of excavation means that benched excavations

require additional construction time. The change in methodology increases the construction (CAPEX) cost of this option by approximately $1 Million (see Table 14).

From a safety in design perspective, deep excavations should be minimised. The primed pipeline option was created to address this issue and minimise the costs (time and money) associated with the change in methodology resulting from deep excavations.

The gravity pipeline design does have advantages after construction. It will be simpler to operate and maintain, although maintenance costs are similar when compared to the primed pipeline option (see Section 5 for full capital and operational costs). However, any maintenance work on the pipeline will be performed deeper underground, increasing the risks associated with pipeline maintenance.

Figure 18 shows a plan of the pipeline route from RB2 and RB4 to Bald Hill Reservoir. Full functional design plans for the gravity pipeline are included in Appendix F.

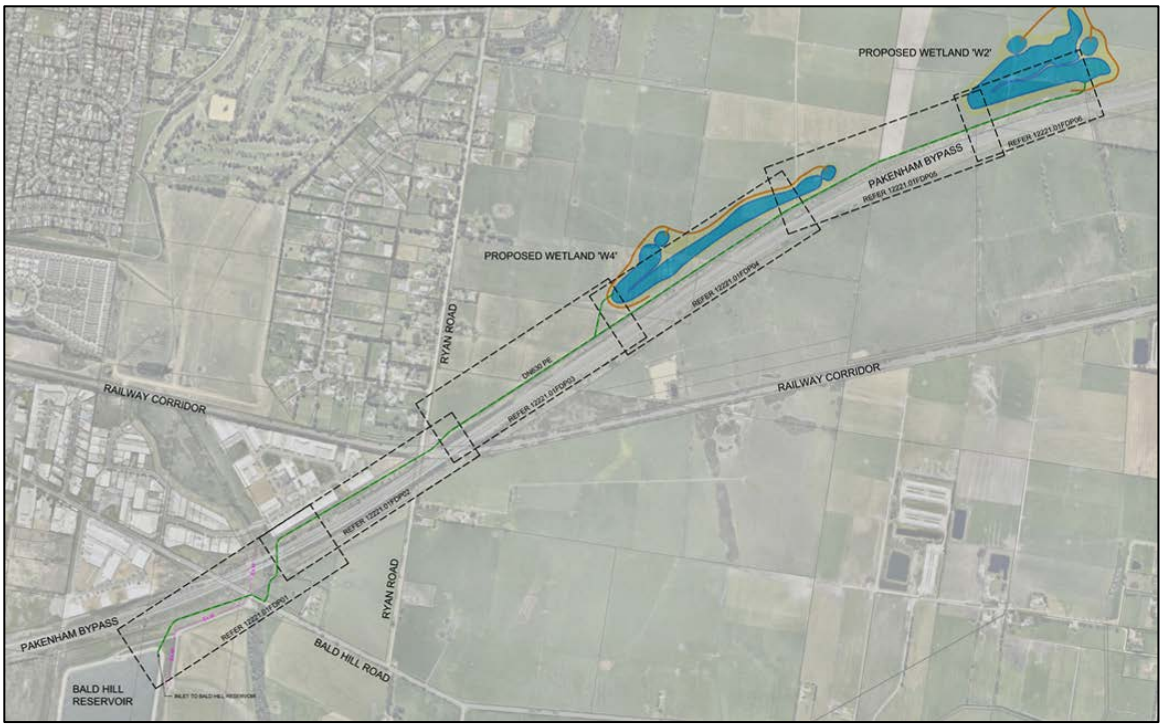

Figure 18: Plan of the pipeline route

4.2 Primed pipeline

The design of the primed pipeline was developed to provide an alternative to the deep excavation associated with the gravity pipeline.

The primed pipeline is 630 mm in diameter. It has inlets at both RB2 and RB4 as shown in Figure 18. The pipeline is driven by head generated by priming the system using a pump. The inlets of the primed pipeline have been designed with valves that will shut before water levels drop below the inlet of the pipeline, preserving the pressure charge within the pipeline. The pipeline continues for approximately 3,800 m (3.8 km), under the Princes Freeway and railway, across Deep Creek via a pipe bridge, and finally into Bald Hill Reservoir via a syphon. The design has been undertaken to maximise safety in design and allow for safe maintenance.

Figure 18 shows a plan of the pipeline route from RB2 and RB4 to Bald Hill Reservoir. Full functional design plans for the gravity pipeline are included in Appendix F.

5. Costing

All options were fully costed to allow for a complete comparison. The costings included both capital (CAPEX) and operational (OPEX) costs. In addition to the CAPEX and OPEX costs prepared by DCE, the Melbourne Water project team completed a 30-year Net-Present Cost (NPC) analysis of all options. The costs are included as Appendices C, D and E.

5.1 Capital costs

DCE prepared an estimate of the total capital costs associated with each investigated option. The capital costs of all options are included as Appendix C. Where possible, the costs were estimated using Melbourne Water reimbursement rates. However, where it was not possible to accurately cost components using the Melbourne Water rates, DCE used rates from tenders for recent constructed wetland projects.

For additional accuracy, the footprints of the sedimentation basins, wetlands and retarding basins were 'cut' from Melbourne Water-provided LiDAR surface data using 12d design software. The resulting bulk earthworks volumes take into account the existing topography within the Pakenham East PSP.

The Melbourne Water project team has questioned the rate used for the wetland outlet structures; it is somewhat higher than expected. However, the project team has advised DCE to retain the price for the wetland outlet structures as it has minimal impact on the total cost of each option. Table 14 summarises the capital and operational costs associated with each option.

5.2 Operational costs

DCE prepared an estimate of the total operational costs (considered annually over the design life of the infrastructure) associated with each investigated option. The operational costs of all options are included as Appendix D. Where possible, the costs were estimated using maintenance rates provided by Melbourne Water. In some cases, Melbourne Water was able to provide more recent information regarding rates, such as the mowing rate, and the operational costs have been updated accordingly. Table 14 summarises the capital and operational costs associated with each option.

Table 14: Capital and operational costs of each option

Option	Total Capital Cost ($ M)	Total Operational Cost ($ M/year)
1	$ 49.4 M	$ 1.3 M
1A	$ 45.3 M	$ 1.3 M
2	$ 79.1 M	$ 2.1 M
2A	$ 61.0 M	$ 1.9 M
3-G	$ 54.0 M	$ 1.6 M
3-P	$ 53.0 M	$ 1.6 M
4-G	$ 61.3 M	$ 1.8 M
4-P	$ 60.3 M	$ 1.8 M

5.3 Melbourne Water NPC

Melbourne Water used the capital and operational cost estimates prepared by DCE to produce detailed 30-year NPC's for each option. A summary of the Melbourne Water work is included in Appendix E.

6. Cost-benefit report and final options

During the preparation of the cost-benefit report (included as Appendix B), Melbourne Water advised DCE to limit the assessed options to those that excluded the northern external catchment from the stormwater quality treatment. A short-list of 4 options resulted and is summarised in Table 15.

Table 15: Summary of short-listed options

Option	Water treatment at PSP boundary	Treatment of external rural catchment	Stormwater harvesting?
1A	BPEM	Untreated	No
2A	SEPP-F8 (for TSS and TP only)	Untreated	No
3-G	SEPP-F8	Untreated but Harvested	Yes
3-P	SEPP-F8	Untreated but Harvested	Yes

In the cost-benefit report, several recommendations were made. The options were assessed based on the following key achievements:

- The standard(s) to which the stormwater is treated
- The relative cost of achieving the outcomes

6.1 Stormwater treatment standards

As catchment manager, Melbourne Water is required to comply with SEPP-F8 standards for Western Port. However, whether this is achieved at the development scale or through other works within the catchment is assessed on a case-by-case basis.

For this assessment, Melbourne Water assumed that SEPP-F8 will be achieved on the development scale. Therefore, the option incorporating BPEM treatment (Option 1A) is not viable as it does not sufficiently treat stormwater from the Pakenham East PSP. Option 2A achieves SEPP-F8 treatment for TSS and TP.

Options 3-G and 3-P achieve full SEPP-F8 treatment of TSS, TP and TN for runoff from the Pakenham East PSP. Options 3-G and 3-P are less costly (based on NPC, capital costs and operational costs) than Option 2A. Achieving SEPP-F8 treatment standards by using a stormwater harvesting scheme is more efficient than using business as usual stormwater quality treatment methodology.

6.2 Cost

The most efficient option in terms of NPC is Option 1A which treats the Pakenham East PSP to BPEM, a stormwater quality standard lower than that adopted by Melbourne Water for this study. If cost were the sole driver of the project, Option 1A would be preferred.

For this assessment, Melbourne Water has assumed that SEPP-F8 will be achieved on the development scale. Therefore, a higher stormwater quality standard is required. The most cost-effective of the options that achieves SEPP-F8 treatment is Option 3-P which incorporates a stormwater harvest. In this option, a primed pipeline is used to convey stormwater to storage at Bald Hill Reservoir.

6.3 Benefits

A challenge of preparing the cost-benefit report was assessing the potential benefits of the stormwater harvesting scheme. Potential benefits of inclusion of a stormwater harvesting scheme in the Pakenham East PSP include:

- Integrating urban water cycle management within the precinct,
- Increased drought resilience,
- Improved liveability,
- Protection of beneficial uses of the waterways.

These potential benefits are enumerated in the cost-benefit report, but a full assessment of their actual impact was beyond the scope of this investigation.

7. Remarks and conclusions

The Pakenham East stormwater harvesting investigation has been a thorough investigation of the options available for managing stormwater in the Pakenham East PSP. It is expected that the level of detail in this investigation will allow the project to continue with a degree of confidence around the options for stormwater management.

Detailed MUSIC modelling was undertaken to size the required stormwater quality treatment. The MUSIC modelling also allowed for water and nutrient balances to be assessed for each option. Functional design plans of two versions of the stormwater transfer pipeline were prepared. Both the MUSIC modelling outputs and the functional design plans were used when preparing detailed cost estimates of capital and operational costs. The prepared costs were used by the Melbourne Water project team to perform a 30-year NPC assessment of all options.

Throughout the project, DCE has worked closely with the Melbourne Water project team to incorporate the most accurate and relevant information into the investigation.

7.1 Recommendations

Of the investigated options, the stormwater harvesting options (Options 3-G and 3-P) are the most efficient at treating the Pakenham East PSP to SEPP-F8 water quality standards.

However, in the stakeholder meeting, it was clear that there are a number of issues that need to be addressed to make a stormwater harvest option viable for all of the stakeholders. In particular, an agreement needs to be reached between Melbourne Water and SEW to ensure the scheme can be feasible for these stakeholders. The details of the agreement are beyond the scope of this investigation, however, DCE recommends that Melbourne Water and SEW come to an agreement regarding how the Pakenham East stormwater harvesting scheme will be undertaken.

For this assessment, Melbourne Water has assumed that SEPP-F8 will be achieved on the development scale. The stormwater harvesting options 3-G and 3-P provide an innovative method of achieving SEPP-F8 treatment.

7.2 Conclusions

Incorporating stormwater harvesting into the Pakenham East PSP can allow it to have sedimentation basins and constructed wetlands sized for BPEM (business as usual) treatment and still achieve the more restrictive SEPP-F8 treatment standards without additional land take.

The costs (capital, operational and NPC) of a stormwater harvesting scheme combined with constructed sedimentation basins and wetlands are substantially lower than the cost of upsizing the sedimentation basins and constructed wetlands to achieve SEPP-F8 stormwater quality treatment standards.

8. Appendices

8.1 Appendix A: MUSIC Modelling Report

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PAKENHAM EAST STORMWATER HARVESTING INVESTIGATION
MUSIC MODELLING REPORT
JUNE 2016

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Contents

1. Introduction

This report presents detailed technical information regarding the MUSIC modelling undertaken as part of the Pakenham East Stormwater Harvesting Investigation. The investigation modelled and costed eight stormwater options for the Pakenham East Precinct Structure Plan (PSP). MUSIC modelling was undertaken to size the stormwater quality treatment required for each option and to provide water and nutrient balance for all investigated options.

1.1 Background

The investigation into stormwater options for the Pakenham East PSP is the result of a number of factors. The external forces contributing to the investigation will be briefly summarised. Figure 1 shows a plan of the Pakenham East PSP area.

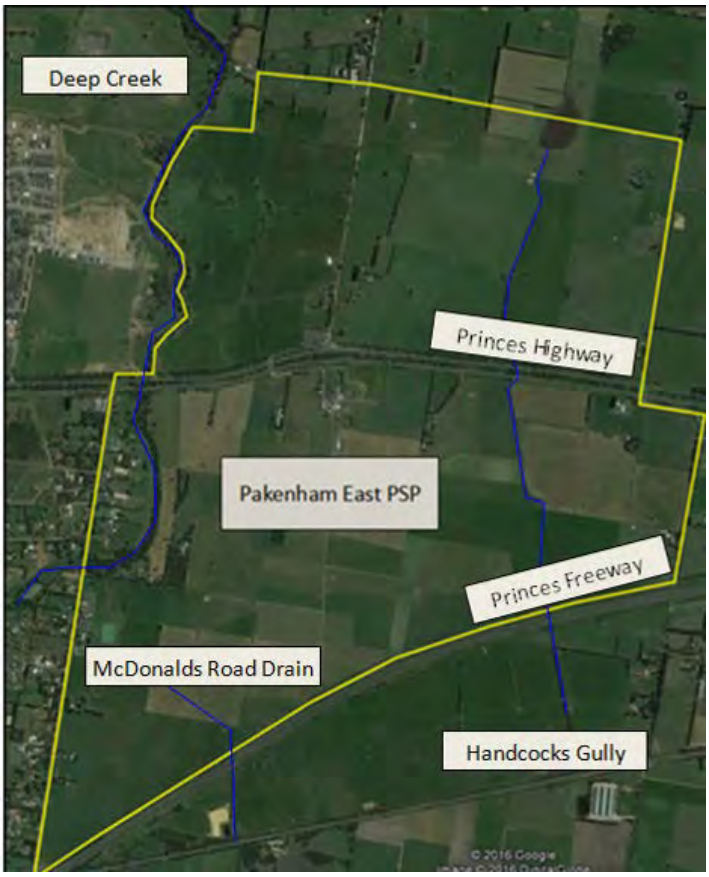


Figure 1: Pakenham PSP area (pre-development)

The future Pakenham East PSP is a recent inclusion to Melbourne's growth boundaries. As Melbourne grows, additional environmental pressure is being placed on catchments such as Western Port. The State Environmental Protection Policy (SEPP) (Waters of Victoria), section F8 (SEPP-F8) has identified increased nutrients, suspended solids and altered flow regimes as the greatest threats to Victoria's water environments.

As the catchment manager, Melbourne Water is responsible for meeting the water quality targets for Western Port specified in SEPP-F8. Runoff from urban areas must not compromise the identified beneficial use of the receiving waterways. For Western Port, elevated concentrations of both total suspended solids (TSS) and nutrients such as total nitrogen (TN) and total phosphorus (TP) have been identified as key risks to the environmental quality of Western Port. Research undertaken by Biosis Research provided advice to Melbourne Water as to appropriate performance objectives for Western Port to achieve SEPP-F8. The SEPP-F8 objectives are compared to the best practice environmental management (BPEM) guidelines applied elsewhere in Melbourne in Table 1.

Table 1: Comparison of BPEM and SEPP-F8 Stormwater Quality Targets

Target	Total Suspended Solids (TSS) % Removal	Total Phosphorus (TP) % Removal	Total Nitrogen (TN) % Removal
BPEM	80%	45%	45%
SEPP-F8	93%	66%	63%

Modelling to achieve both these standards was requested by Melbourne Water. Melbourne Water advised that options achieving SEPP-F8 were to meet the target for TSS only. This is due the higher impact TSS has on Western Port compared to nutrient loads. If in achieving the SEPP-F8 target for TSS the targets for TP and TN were also achieved, Melbourne Water views this as an added bonus.

Eight stormwater options were examined during the Pakenham East PSP stormwater harvesting investigation. Table 2 summarises the investigated options.

Table 2: Pakenham East PSP stormwater harvesting investigation options

Option	Stormwater quality infrastructure	External catchment treated?	Stormwater quality standard achieved
1	Sedimentation basins Constructed wetlands	Yes	Best Practice Environmental Mgmt. (BPEM)
1A	Sedimentation basins Constructed wetlands	No	BPEM
2	Sedimentation basins Constructed wetlands	Yes	State Environmental Protection Plan Section F8 (SEPP-F8) for (TSS and TP) TN treated above BPEM but below SEPP-F8
2A	Sedimentation basins Constructed wetlands	No	SEPP-F8 (TSS and TP) TN treated above BPEM but below SEPP-F8
3-G	Sedimentation basins Constructed wetlands Stormwater harvesting scheme Gravity stormwater transfer pipeline	No	SEPP-F8
3-P	Sedimentation basins Constructed wetlands Stormwater harvesting scheme Primed stormwater transfer pipeline	No	SEPP-F8
4-G	Sedimentation basins Constructed wetlands Stormwater harvesting scheme Gravity stormwater transfer pipeline	Yes (to BPEM)	SEPP-F8
4-P	Sedimentation basins Constructed wetlands Stormwater harvesting scheme Primed stormwater transfer pipeline	Yes (to BPEM)	SEPP-F8

1.2 MUSIC modelling

DCE created six MUSIC models as part of the Pakenham East PSP investigation. The modelled area is based on the October 2015 Stormy Water Solutions MUSIC model of the Pakenham East PSP area. Section 2 describes how the October 2015 model contributed to the models created for the investigation. Section 3 details MUSIC modelling assumptions and inputs.

2. Received MUSIC models

DCE received two MUSIC models as part of the Pakenham East Stormwater Harvest investigation:

- Pakenham East PSP stormwater strategy MUSIC model Option 1 (Stormy Water Solutions, October 2015)
- Pakenham East PSP model for SEPP-F8 (Stormy Water Solutions, November 2015)

2.1 Pakenham East PSP Stormwater Strategy MUSIC model (October 2015)

The Pakenham East PSP Stormwater Strategy MUSIC model was prepared by Stormy Water Solutions to inform the drainage strategy for the Pakenham East PSP. The model comprises a total area of 1,344 ha. The Pakenham East precinct covers approximately 621 ha of land, a 463-ha external catchment to the north is modelled and treated and an additional 97 ha of external rural area drains naturally to the stormwater quality treatment planned for the PSP. In addition to this area, a further 163 ha of external catchment that does not drain to the Pakenham East PSP has been included in the MUSIC model. The October 20015 MUSIC model is illustrated in Figure 2.

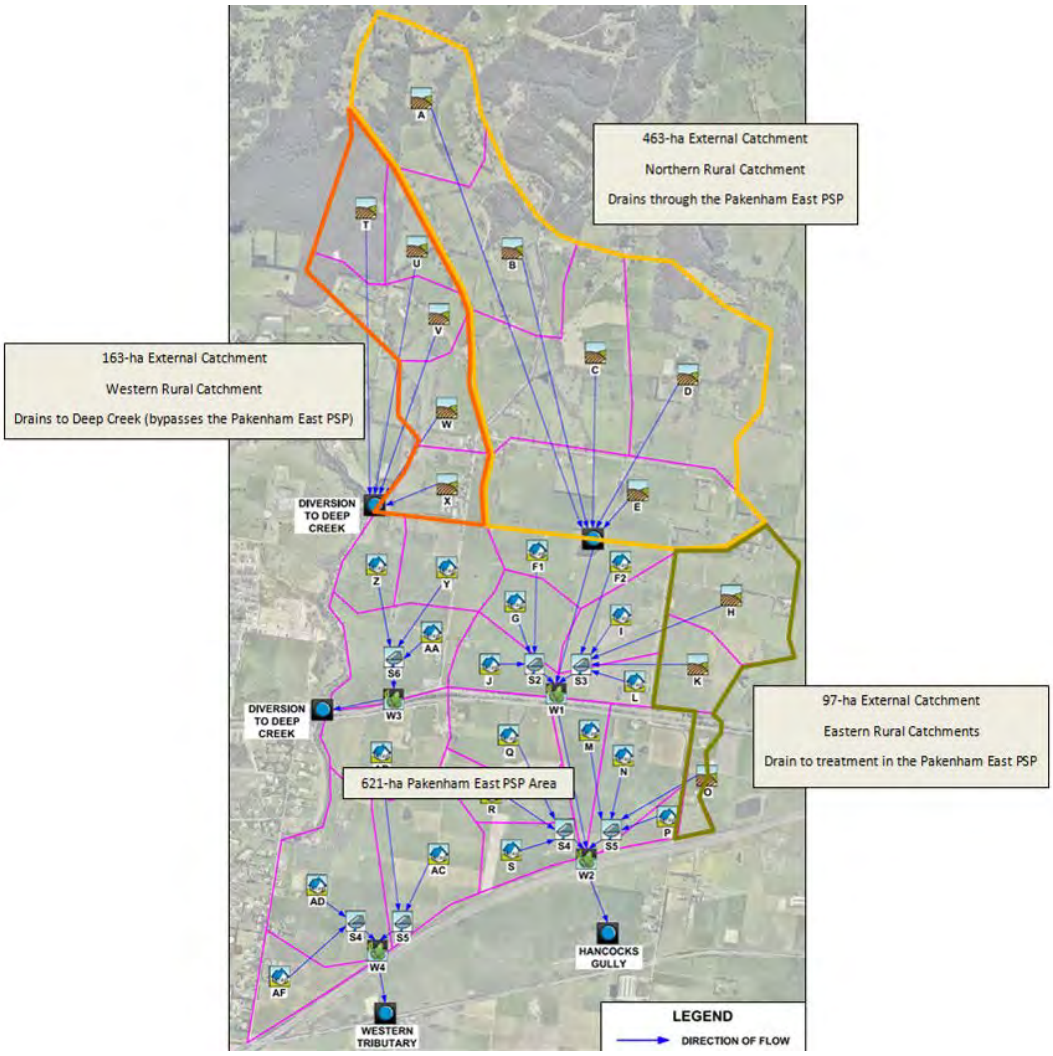


Figure 2: Pakenham East PSP area and external catchments

In the October 2015 model, stormwater quality infrastructure comprises sedimentation basins and constructed wetlands. The infrastructure has been sized to treat runoff from the Pakenham East PSP area and the Northern Rural Catchment to BPEM standards. A comparison of BPEM and SEPP-F8 stormwater quality targets for Western Port is shown in Table 1. The October 2015 model was modified (see Section 3) to represent stormwater harvesting investigation Option 1.

2.2 Pakenham East PSP Stormwater Strategy SEPP-F8 MUSIC model (November 2015)

The Pakenham East PSP Stormwater Strategy MUSIC model was prepared by Stormy Water Solutions. The model was created to demonstrate the ability of the planned sedimentation basins and constructed wetlands to achieve SEPP-F8 treatment for Western Port if the 463-ha external

catchment was excluded. DCE reviewed the model and prepared a letter report for Melbourne Water. The letter report is included as Appendix A.

Ultimately, Melbourne Water does not accept that the model illustrates SEPP-F8 for Western Port treatment of the Pakenham East PSP. Therefore, the model has not been incorporated into DCE's modelled options.

3. MUSIC modelling assumptions

To create MUSIC models suitable for use in the Pakenham East PSP stormwater harvesting investigation, assumptions and modelling decisions needed to remain constant across all the models. This section of the report details the technical decisions incorporated into the MUSIC modelling.

It should be noted that the MUSIC modelling component of the investigation took place prior to the release of the *MUSIC Guidelines Draft Update* (Melbourne Water, January 2016). Therefore, the MUSIC models created for the Pakenham East PSP stormwater harvesting investigation have been created in line with the *MUSIC Guidelines* (Melbourne Water, 2010).

3.1 Rainfall data

The October 2015 Stormy Water Solutions model and the six DCE investigation models were built using the Melbourne Water rainfall template for Koo Wee Rup 2004. The Koo Wee Rup 2004 template simulates an 'average' year with no large storm events in the Pakenham East PSP area. It is suitable for modelling the effectiveness of stormwater quality treatment in the Pakenham East precinct. The rainfall data is in 6-minute intervals, and the potential evapo-transpiration (PET) is a monthly average. The selected rainfall template is based on advice provided in the 2010 *MUSIC Guidelines*.

The 2016 draft *MUSIC Guidelines* recommend using rainfall templates that comprise ten years of rainfall data. The 10-year rainfall template for Koo Wee Rup covers the years 1971-1980. The average annual rainfall from 1971-1980 is 790 mm/year; less than the 809 mm/2004. However, during the 1971-1980 period, ninetieth percentile monthly totals are exceeded 28 times. In 2004, the ninetieth percentile monthly total is exceeded one time. It is likely that creating MUSIC models of the Pakenham East PSP stormwater options using the 10-year rainfall template will result in a slight increase in required stormwater quality infrastructure area so that the larger flows can be captured and treated.

During the functional design of the stormwater quality treatment infrastructure in the Pakenham East PSP, it is recommended that the MUSIC model be run using the 10-year Koo Wee Rup rainfall template and that the stormwater quality infrastructure be resized as necessary.

The reliability of the stormwater harvesting scheme is best assessed by utilising multiple years of rainfall data. Using the 10-year Melbourne Water rainfall templates will likely result in a more accurate stormwater harvesting reliability. However, the purpose of this investigation was the sizing of stormwater quality treatment. The exact reliability of the stormwater harvesting scheme is ancillary to the project.

3.2 Pollutant generation

The October 2015 Stormy Water Solutions model uses stochastic methodology to generate pollutant concentrations. The use of stochastic methodology is in line with both the 2010 *MUSIC Guidelines* and the 2016 draft *MUSIC Guidelines*. Stochastic methodology adds an 'uncertainty' factor into the model as a different pollutant concentration is selected every time the model is opened. Ideally, when using stochastic methodology, the MUSIC models will be run at least 10 times and an average pollutant reduction taken to ensure that infrastructure is sized appropriately.

Both Melbourne Water and eWater guidelines recommend the use of mean methodology to generate pollutant concentrations when modelling to compare different catchment-level stormwater quality treatment scenarios. The mean methodology constantly selects the mean pollutant concentration value, allowing various scenarios to be compared and the modelling results to remain constant.

Therefore, the models created for and used in the Pakenham East PSP stormwater harvesting investigation all use mean pollutant generation. The mean pollutant generation allows for results to be constant across model runs and for treatment options to be compared.

3.3 Soil properties

In the October 2015 Stormy Water Solutions model and in the Pakenham East Stormwater Harvesting Investigation model, the soil properties adopted for use in the model's source nodes are based on the Melbourne soil properties nominated in the 2010 *MUSIC guidelines*.

The 2016 draft MUSIC guidelines nominate very different soil properties for Melbourne, as shown in Table 3.

Input	2010 MUSIC Guidelines	2016 draft MUSIC Guidelines
Soil storage capacity (mm)	30	120
Field capacity (mm)	20	50

Table 3: Recommended MUSIC modelling inputs for Melbourne soils

It should be noted that the adopted soil properties are more conservative than the newly recommended soil properties. More runoff will be generated using the 2010 soil properties. During the functional design of the stormwater quality treatment infrastructure in the Pakenham East PSP, it is recommended that the MUSIC model be run using the updated soil properties and that the stormwater quality infrastructure be resized as necessary.

Neither the 2010 or 2016 soil properties have been calibrated to the soils in the Pakenham East PSP area. As such neither set of inputs will likely simulate actual flows in the Pakenham East PSP.

However, the large amount of urbanised area within the PSP area makes the soil properties less relevant to the modelling results as only pervious areas have stormwater interaction with the soils.

3.4 Source nodes

The October 2015 Stormy Water Solutions model uses the default MUSIC nodes for urban and agricultural areas. After discussions with Melbourne Water, DCE has retained these nodes (and their default pollutant values) in the options modelling.

While MUSIC contains a default node for agricultural areas, the pollutants generated by the node are an average of agricultural land across Australia. In the case of the Pakenham East PSP, the amount of TSS controls the treatment sizing required to achieve SEPP-F8 for Western Port. Using such a rough estimate of incoming pollutants may result in incorrectly sizing stormwater quality treatment.

The agricultural areas have the most impact on Options 1, 2 and 4, where treatment is provided to the 463-ha northern rural external catchment. If any of these options are considered for the Pakenham East PSP, it is recommended that detailed water quality sampling be undertaken to better gauge the amount of pollutants actually generated by the 463-ha catchment.

The agricultural area to the east of the PSP does impact all the options. Approximately 93 ha or agricultural land drains to stormwater quality treatment in the PSP as shown in Figure 2. However, this is a relatively small portion of the total modelled area, and as such, the smaller catchment does not have the same impact that the larger rural area does.

3.5 Fraction impervious

The fraction impervious adopted for the different land-use types are in line with both the 2010 and 2016 draft *MUSIC guidelines*. A fraction Impervious of 0.1 was adopted for all rural areas, and a fraction impervious of 0.6 was adopted for all developed (urbanised) areas.

3.6 Rainfall threshold

The default MUSIC rainfall threshold of 1 mm was retained from the October 2015 Stormy Water Solutions model and adopted for all of the investigation models. The rainfall threshold is likely low for the rural areas included in the model where additional vegetation may intercept additional rainfall volume. However, without scientific corroboration, the conservative default value was retained.

3.7 Groundwater

3.7.1 Default modelling inputs

The October 2015 Stormy Water Solutions model retains MUSIC default values for baseflow and deep seepage. While there is definitely some sort of baseflow and seepage within the Pakenham East precinct, it is naïve to assume that the MUSIC default values (uncalibrated and based on an Australia-wide average) simulate baseflow and seepage within the Pakenham East precinct accurately.

In a model of an urban area, soil properties have little impact. DCE have performed sensitivity analyses for previous projects to assess the impact of adjusting soil properties on stormwater runoff quantity. In short, when the soil is mostly covered by impervious area, there is little potential for infiltration of stormwater into the soil.

However, in Options 1, 2 and 4, approximately 35% of the Pakenham East MUSIC model (the 463-ha external rural northern catchment) is 'agricultural' and modelled at 10% impervious. Over this amount of area, the differences in soil properties between default and actual can be magnified. While there was not scope for a geotechnical investigation as part of the Pakenham East Stormwater Harvesting Investigation, inclusion of the large, uncalibrated rural area in an uncalibrated model introduces uncertainty around generated flow volumes. The flow volumes directly impact the size of required stormwater quality treatment.

3.7.2 Transfer of baseflow

The October 2015 Stormy Water Solutions model routes all outflow from the source nodes (including baseflow and runoff) to the downstream stormwater quality treatment. The models for the Pakenham East PSP stormwater harvesting investigation have been set up the same way.

In reality, it is unlikely that baseflow will be captured and treated in sedimentation basins and constructed wetlands. Most stormwater quality infrastructure is lined to prevent groundwater intrusion. However, MUSIC modelling to separate the baseflow from the runoff from the source nodes would overly complicate the model. It is conservative to include the baseflow volume that requires treatment when sizing stormwater quality infrastructure in MUSIC. Therefore, all runoff from the source nodes has been routed directly to modelled treatment.

4. Models

For the Pakenham East PSP stormwater harvesting investigation, DCE prepared six (6) MUSIC models to simulate the eight (8) investigated scenarios. Because the gravity and primed pipelines have the same capacity, two models were able to simulate Options 3-G and 3-P and Options 4-G and 4-P. Table 4 summarises the models

Table 4: Summary of models and the options they represent

Model	Option(s) assessed	Treatment type	Stormwater quality target	External catchment treated
Option 1	Option 1	Sedimentation basins Constructed wetlands	BPEM	Yes
Option 1A	Option 1A	Sedimentation basins Constructed wetlands	BPEM	No
Option 2	Option 2	Sedimentation basins Constructed wetlands	SEPP-F8 for TSS	Yes
Option 2A	Option 2A	Sedimentation basins Constructed wetlands	SEPP-F8 for TSS	No
Option 3	Option 3-G Option 3-P	Sedimentation basins Constructed wetlands Stormwater harvesting scheme	SEPP-F8 for TSS	No (but harvested)
Option 4	Option 4-G Option 4-P	Sedimentation basins Constructed wetlands Stormwater harvesting scheme	SEPP-F8 for TSS	Yes (to BPEM)

5. Results and Conclusions

The results of the MUSIC modelling have informed the Pakenham East PSP stormwater harvesting investigation in a variety of ways. The size of stormwater quality treatment required in MUSIC has been used in costing each option. The water and nutrient balance for each option has assisted in the cost-benefit assessment.

5.1 Results

The complete water and nutrient balance results for each model are included in Appendix B.

Appendix C includes the required stormwater quality infrastructure sizing results for each option. In addition, Appendix C also includes a catchment plan of all modelled options.

5.2 Conclusions

The MUSIC modelling associated with the Pakenham East PSP stormwater harvesting investigation has been undertaken to the relevant MUSIC standards. Although the standards have changed during the investigation, the modelling results are still suitable for use in comparing the stormwater options.

The results of the MUSIC modelling are suitable for use in costing the various options and in assessing the costs and benefits of each option.

The MUSIC modelling results can be further refined using additional data either during the Functional Design process or at the request of Melbourne Water. While revising and rerunning the MUSIC models will result in more accurate results, the level of accuracy achieved in the MUSIC modelling is suitable for the Pakenham East PSP Stormwater Harvesting Investigation.

Appendices

Appendix A

DCE letter report

DCE have received and reviewed the Stormy Water Solutions (SWS) model of the Pakenham East precinct.

The model shows that treatment to SEPP-F8 standards can be achieved using 'business as usual' (BAU) treatment if the northern external catchment is removed. The treatment is achieved by non-standard MUSIC modelling.

The SWS model layout is shown in Figure 1.

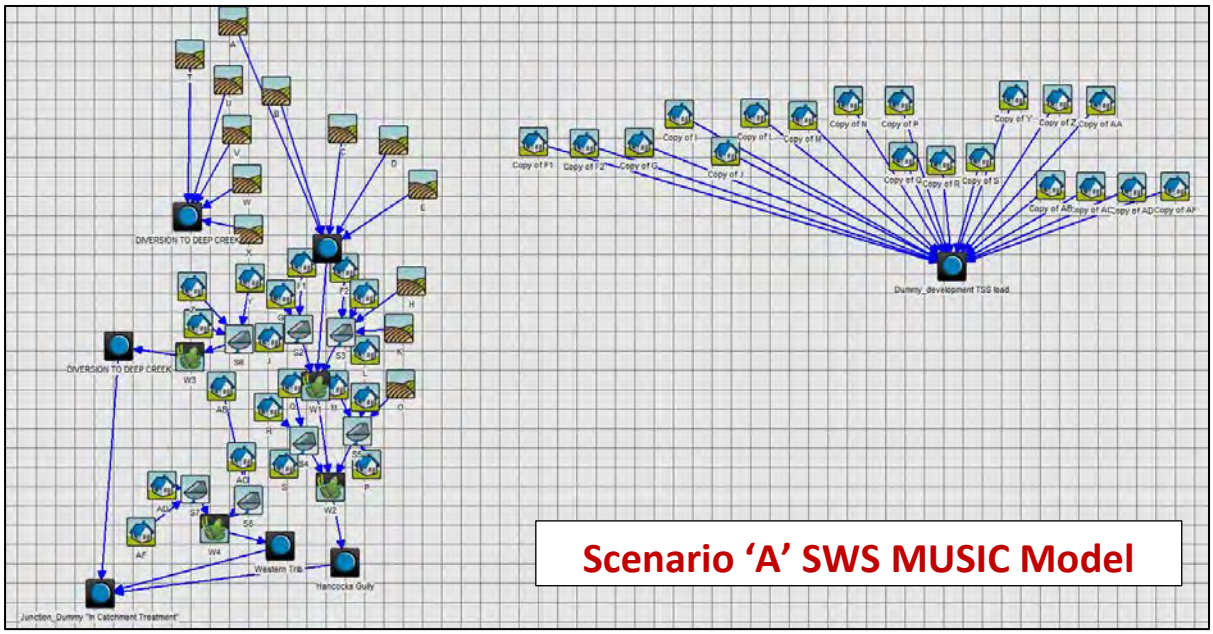


Figure 1: SWS MUSIC Model 'Scenario A'

When the Scenario A MUSIC model is run, the results for 'Treatment Train Effectiveness' at the Junction 'Dummy In Catchment Treatment' do not achieve SEPP-F8 standards, as shown in Table 1:

Table 1: MUSIC Stormwater Treatment Results for SWS 'Scenario A' Pakenham East

Nutrient	Percentage Reduction
Total Suspended Solids (TSS)	79.3
Total Phosphorus (TP)	66.7
Total Nitrogen (TN)	45.5

The northern external catchment can be physically removed from the MUSIC model as shown in Figure 2:

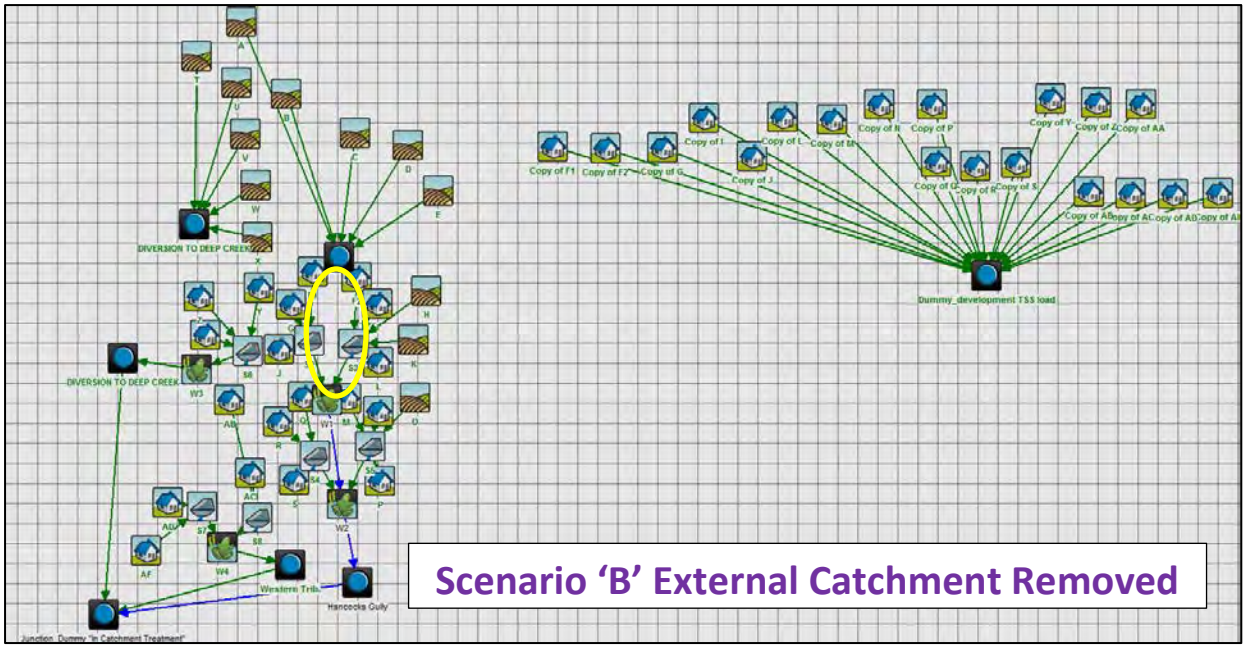


Figure 2: SWS MUSIC Model 'Scenario B'

When the Scenario B MUSIC model is run, the results for 'Treatment Train Effectiveness' at the Junction 'Dummy In Catchment Treatment' do not achieve SEPP-F8 standards, as shown in Table 2:

Table 2: MUSIC Stormwater Treatment Results for Pakenham East without External Catchment

Nutrient	Percentage Reduction
Total Suspended Solids (TSS)	87.7
Total Phosphorus (TP)	74.2
Total Nitrogen (TN)	51.4

DCE believes that SWS is calculating TSS treatment within the Pakenham East precinct using this formula:

TSS Residual load / Total TSS Source Load = TSS percentage reduction

For Scenario A, the formula works like this:

128,000 / 615,820 = 79% TSS Reduction

For Scenario A with the external catchment removed, the formula works like this:

(TSS Residual load – TSS External Load) / Total TSS Developed Source Load = TSS percentage reduction

(128,000 -190,000) / 386,000 = 116% TSS Reduction

The TSS source loads for all modelled areas are summarised in Table 3.

Table 3: TSS Loads (kg/year) for Pakenham East Catchments

Source Area	TSS Load (kg/year)
Dummy Development TSS Load	**386,000**
Northern External Catchment	190,000
Catchment H	23,800
Catchment K	11,100
Catchment O	4,920
TOTAL Non-PSP Area TSS Load	**229,820**
TOTAL Source Area TSS	**615,820**

Is the non-standard stormwater treatment calculation acceptable to Melbourne Water?

If the methodology is acceptable, DCE propose to use it to assess treatment in the stormwater harvest model.

Further Model Review

The SWS model is fundamentally unchanged from the BAU model. Therefore, the same modelling caveats associated with the BAU model apply to this model:

Sedimentation Basins are less than 10% of wetland area as shown in Table 5:

Table 4: Sedimentation Basin Area as a Fraction of Wetland Area

Sedimentation Basin	Downstream Wetland	Area of Sedimentation Basins as a fraction of Wetland area
S2 and S3	W1	6%
S4 and S5	W2	9%
S6	W3	7%
S7 and S8	W4	7%

The irregularity in Sedimentation Basin sizes may be based on more detailed calculations of 125 µm particle settling. However, treating to SEPP-F8 standards may require a different assessment of settling velocities and particle sizes.

The sedimentation basins and wetlands have non-standard notional detention times, as shown in Table 6:

Table 5: Notional Detention Times

Stormwater Quality Treatment Element	Notional Detention Time (hours)	MW Standard Notional Detention Time (hours)
S2	3.08	12
S3	3.08	12
S4	5.06	12
S5	5.06	12
S6	4.95	12
S7	3.01	12
S8	3.01	12
W1	69.0	72
W2	68.0	72
W3	66.6	72
W4	67.7	72

Finally, the SWS model incorporates 100% on-line stormwater quality treatment. DCE are aware that Melbourne Water's preference is for off-line stormwater quality treatment systems. Site constraints at Pakenham East may require on-line treatment. However, in actual practice (i.e. during Functional Design), some sort of bypass will be provided to route stormwater flows above a certain amount directly to the retarding basins, effectively bypassing the wetland.

In MUSIC modelling, the limitation on flow entering the wetland is usually simulated by applying a 'high flow bypass' of the 3-month flow ($Q_{3\ mo}$) to the wetland. None of the wetlands in the SWS model include such a bypass. As a result, the treatment results are somewhat better than they will be once a functional design is prepared. An example using

W3 with no bypass and the estimated 3-month bypass (from the RORB model) is shown in Table 7.

Table 6: Example of reduced treatment when a bypass is added

Location	Treatment provided (high-flow bypass of 100 cu. m/s)	Treatment provided (high-flow bypass of 1.25 cu. m/s)
W3	85.1 %	83.1%

Appendix B

Water and nutrient balances

Option 1:

BAU - BPEMG

WETLAND 3 - DIVERSION TO DEEP CREEK				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	892.383	362.99	529.40	40.7%
TSS (Kg/yr)	82059.1	68408.73	13650.37	83.4%
TP (Kg/yr)	189.051	132.15	56.90	69.9%
TN (Kg/yr)	1443.41	675.49	767.92	46.8%

WETLAND 4 - WESTERN TRIBUTARY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	1609.475	659.42	950.06	41.0%
TSS (Kg/yr)	147999.5	128155.03	19844.47	86.6%
TP (Kg/yr)	340.9545	248.43	92.52	72.9%
TN (Kg/yr)	2603.3	1277.51	1325.79	49.1%

WETLAND 1 & 2- HANCOCKS GULLY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	6907.994	4123.19	2784.80	59.7%
TSS (Kg/yr)	455140.915	366803.52	88337.40	80.6%
TP (Kg/yr)	1155.154	789.75	365.40	68.4%
TN (Kg/yr)	8633.076	3926.78	4706.30	45.5%

CATCHMENT TOTAL				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	9409.852	5145.598	4264.254	54.7%
TSS (Kg/yr)	685199.515	563367.275	121832.24	82.2%
TP (Kg/yr)	1685.1595	1170.3385	514.821	69.4%
TN (Kg/yr)	12679.786	5879.77	6800.016	46.4%

Option 1A:

BAU - BPEMG (No External Catchment)

WETLAND 3 - DIVERSION TO DEEP CREEK

	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	892.383	363.33	529.05	40.7%
TSS (Kg/yr)	82059.1	70083.24	11975.86	85.4%
TP (Kg/yr)	189.051	135.59	53.46	71.7%
TN (Kg/yr)	1443.41	693.14	750.27	48.0%

WETLAND 4 - WESTERN TRIBUTARY

	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	1609.475	658.55	950.93	40.9%
TSS (Kg/yr)	147999.5	130745.26	17254.24	88.3%
TP (Kg/yr)	340.9545	253.59	87.36	74.4%
TN (Kg/yr)	2603.3	1255.68	1347.62	48.2%

WETLAND 1 & 2- HANCOCKS GULLY

	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	3218.95	1541.07	1677.89	47.9%
TSS (Kg/yr)	264665.7	214003.93	50661.77	80.9%
TP (Kg/yr)	627.796	418.06	209.74	66.6%
TN (Kg/yr)	4759.931	2018.65	2741.28	42.4%

CATCHMENT TOTAL

	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	5720.808	2562.944	3157.864	44.8%
TSS (Kg/yr)	494724.3	414832.43	79891.87	83.9%
TP (Kg/yr)	1157.8015	807.2345	350.567	69.7%
TN (Kg/yr)	8806.641	3967.468	4839.173	45.1%

Option 2A:

BAU - SEPP F8

WETLAND 3 - DIVERSION TO DEEP CREEK				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	892.383	386.12	506.27	43.3%
TSS (Kg/yr)	82059.1	77288.84	4770.26	94.2%
TP (Kg/yr)	189.051	153.65	35.40	81.3%
TN (Kg/yr)	1443.41	851.59	591.82	59.0%

WETLAND 4 - WESTERN TRIBUTARY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	1609.475	705.23	904.25	43.8%
TSS (Kg/yr)	147999.5	140944.97	7054.53	95.2%
TP (Kg/yr)	340.966	281.52	59.44	82.6%
TN (Kg/yr)	2603.3	1580.49	1022.81	60.7%

WETLAND 1 & 2- HANCOCKS GULLY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	3218.95	1605.18	1613.78	49.9%
TSS (Kg/yr)	264665.7	241947.35	22718.35	91.4%
TP (Kg/yr)	627.796	491.41	136.39	78.3%
TN (Kg/yr)	4759.931	2629.78	2130.15	55.2%

CATCHMENT TOTAL				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	5720.808	2696.52	3024.29	47.1%
TSS (Kg/yr)	494724.3	460181.16	34543.14	93.0%
TP (Kg/yr)	1157.813	926.58	231.24	80.0%
TN (Kg/yr)	8806.641	5061.86	3744.78	57.5%

Option 3:

SWH - SEPP F8 - 1

WETLAND 3 - DIVERSION TO DEEP CREEK				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	892.383	365.37	527.01	40.9%
TSS (Kg/yr)	82059.1	70415.67	11643.43	85.8%
TP (Kg/yr)	189.051	136.23	52.83	72.1%
TN (Kg/yr)	1443.41	704.13	739.28	48.8%

WETLAND 4 - WESTERN TRIBUTARY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	1609.475	664.28	945.20	41.3%
TSS (Kg/yr)	147999.5	131408.84	16590.66	88.8%
TP (Kg/yr)	340.966	255.45	85.52	74.9%
TN (Kg/yr)	2603.3	1332.74	1270.56	51.2%

WETLAND 1 & 2- HANCOCKS GULLY & WESTERN TRIB				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	3218.95	1598.68	1620.27	49.7%
TSS (Kg/yr)	264665.7	238196.01	26469.69	90.0%
TP (Kg/yr)	627.796	482.84	144.95	76.9%
TN (Kg/yr)	4759.931	2602.51	2157.42	54.7%

STORMWATER HARVESTING SCHEME				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	240547.908	238945.96	1601.95	99.3%
TSS (Kg/yr)	233535.565	210679.23	22856.34	90.2%
TP (Kg/yr)	757.828	625.41	132.41	82.5%
TN (Kg/yr)	7301.158	5286.84	2014.32	72.4%

PAKENHAM EAST PSP CATCHMENT TOTAL				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	5720.808	2628.32	2128.96	62.8%
TSS (Kg/yr)	494724.3	440020.52	34499.77	93.0%
TP (Kg/yr)	1157.813	874.52	185.24	84.0%
TN (Kg/yr)	8806.641	4639.38	2753.59	68.7%

Option 4:

SWH - SEPP F8 - 2

WETLAND 3 - DIVERSION TO DEEP CREEK				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	892.383	363.38	529.01	40.7%
TSS (Kg/yr)	82059.1	69122.04	12937.06	84.2%
TP (Kg/yr)	189.051	133.17	55.88	70.4%
TN (Kg/yr)	1443.41	681.10	762.31	47.2%

WETLAND 4 - WESTERN TRIBUTARY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	1609.475	660.32	949.16	41.0%
TSS (Kg/yr)	147999.5	129564.83	18434.67	87.5%
TP (Kg/yr)	340.966	250.91	90.05	73.6%
TN (Kg/yr)	2603.3	1295.09	1308.21	49.7%

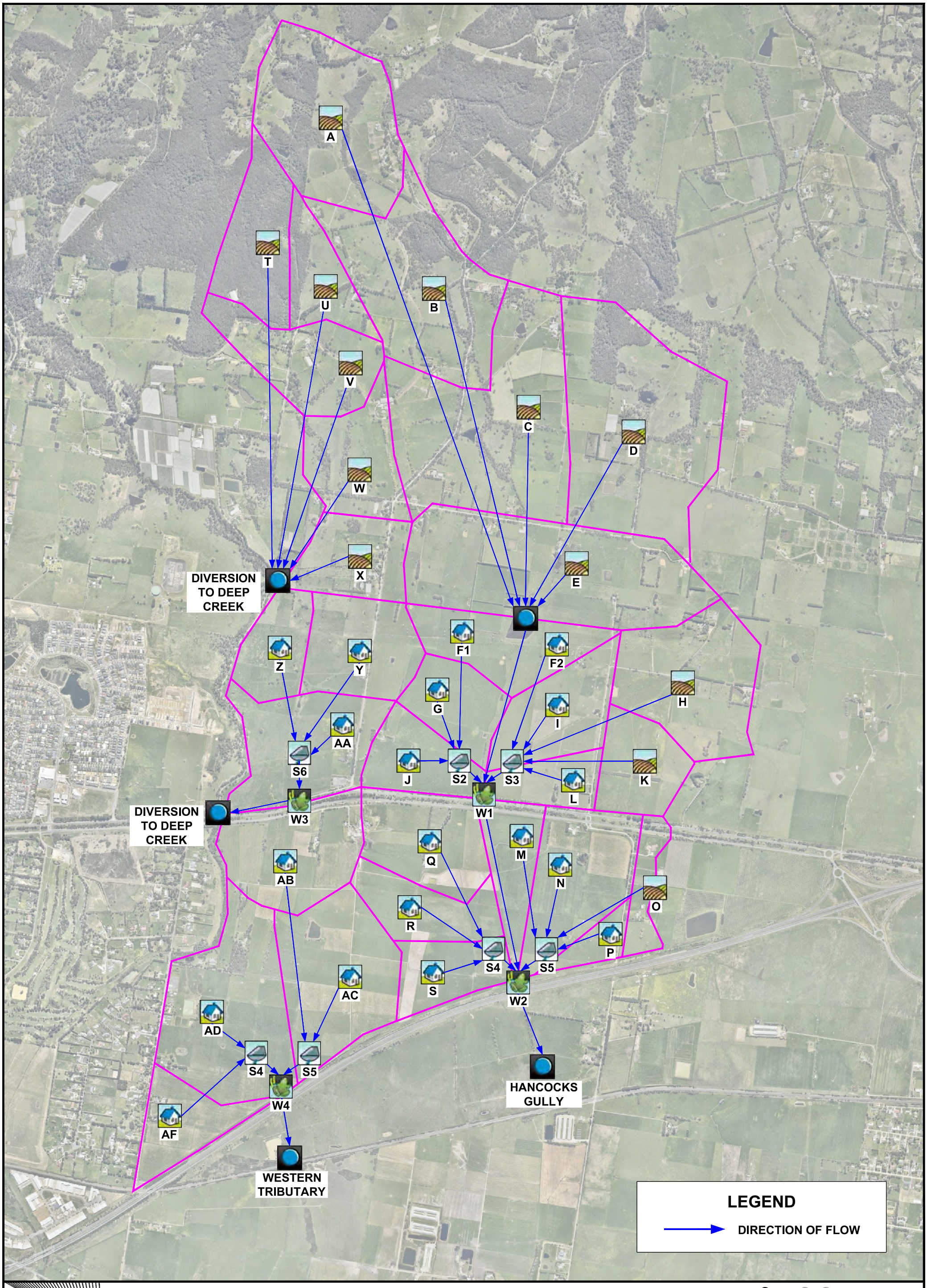
WETLAND 1 & 2- HANCOCKS GULLY & WESTERN TRIB				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	8517.469	5779.01	2738.46	67.8%
TSS (Kg/yr)	455140.7	381079.84	74060.86	83.7%
TP (Kg/yr)	1155.153	822.49	332.67	71.2%
TN (Kg/yr)	8633.071	4146.31	4486.76	48.0%

STORMWATER HARVESTING SCHEME				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	3687.62	1263.64	2423.98	34.3%
TSS (Kg/yr)	92495.53	34633.18	57862.36	37.4%
TP (Kg/yr)	422.719	152.19	270.53	36.0%
TN (Kg/yr)	5794.968	2126.42	3668.55	36.7%

CATCHMENT TOTAL				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	11019.327	8018.46	2952.99	73.2%
TSS (Kg/yr)	685199.3	614399.89	70799.42	89.7%
TP (Kg/yr)	1685.17	1358.76	326.41	80.6%
TN (Kg/yr)	12679.781	8248.92	4430.86	65.1%

Appendix C

Catchment plans



PAKENHAM EAST STORM WATER HARVESTING

BUSINESS AS USUAL - CATCHMENT SCHEMATIC

SCALE 1: 10000 @ A1
REVISION A
DATE: 23/02/16

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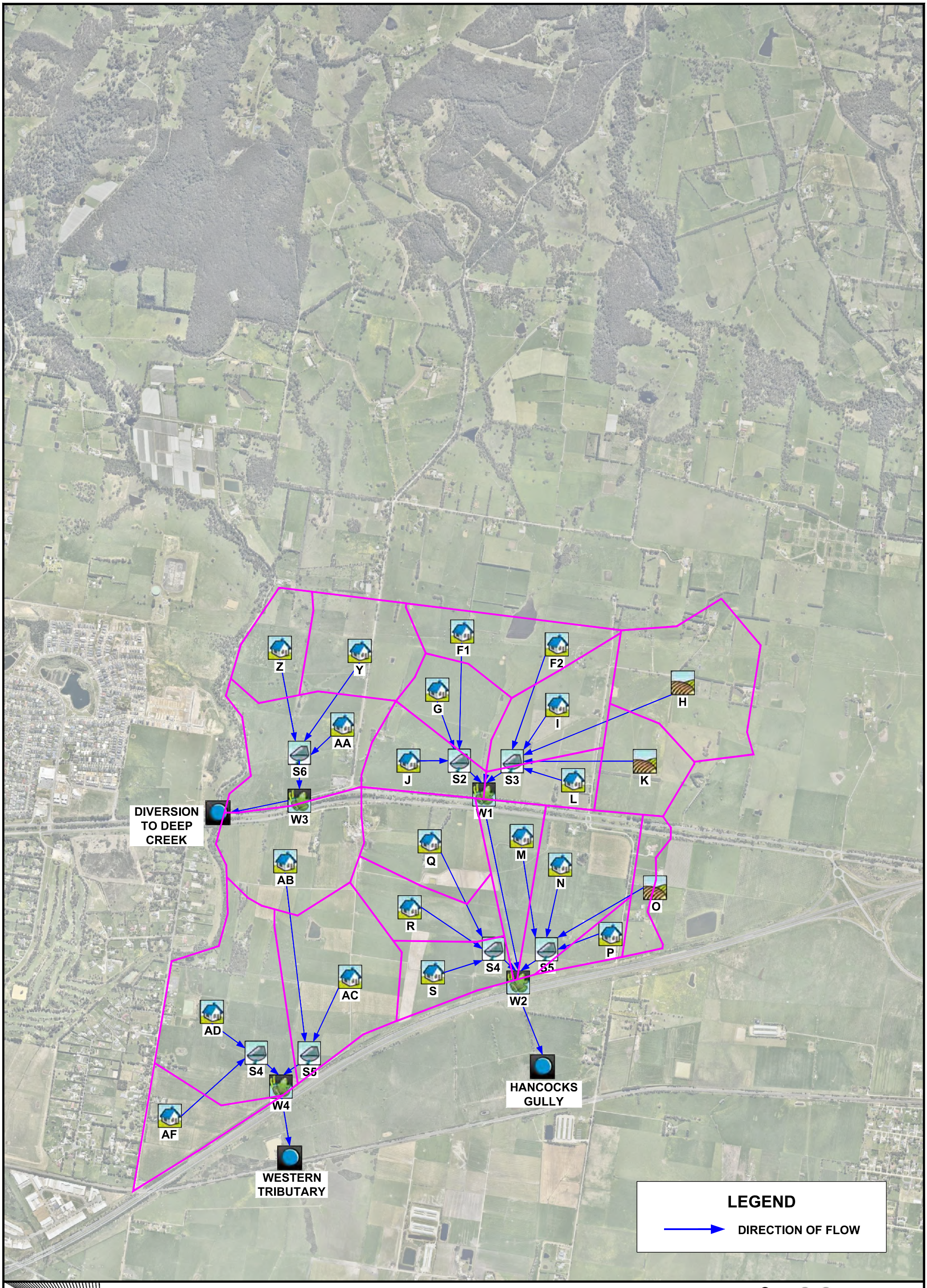
Drawing File: C:\Designdata\12200\12221-Pakenham East SWH\Acad\General\Catchment Plans\12221CP01 - BAU.dwg - 12221CP01 - BAU
Date/Time: Tue Apr 26, 2016 - 9:57am --Julia.Baumann--



PAKENHAM EAST STORM WATER HARVESTING

BUSINESS AS USUAL - CATCHMENT SCHEMATIC

SCALE 1: 10000 @ A1

REVISION A

DATE: 23/02/16

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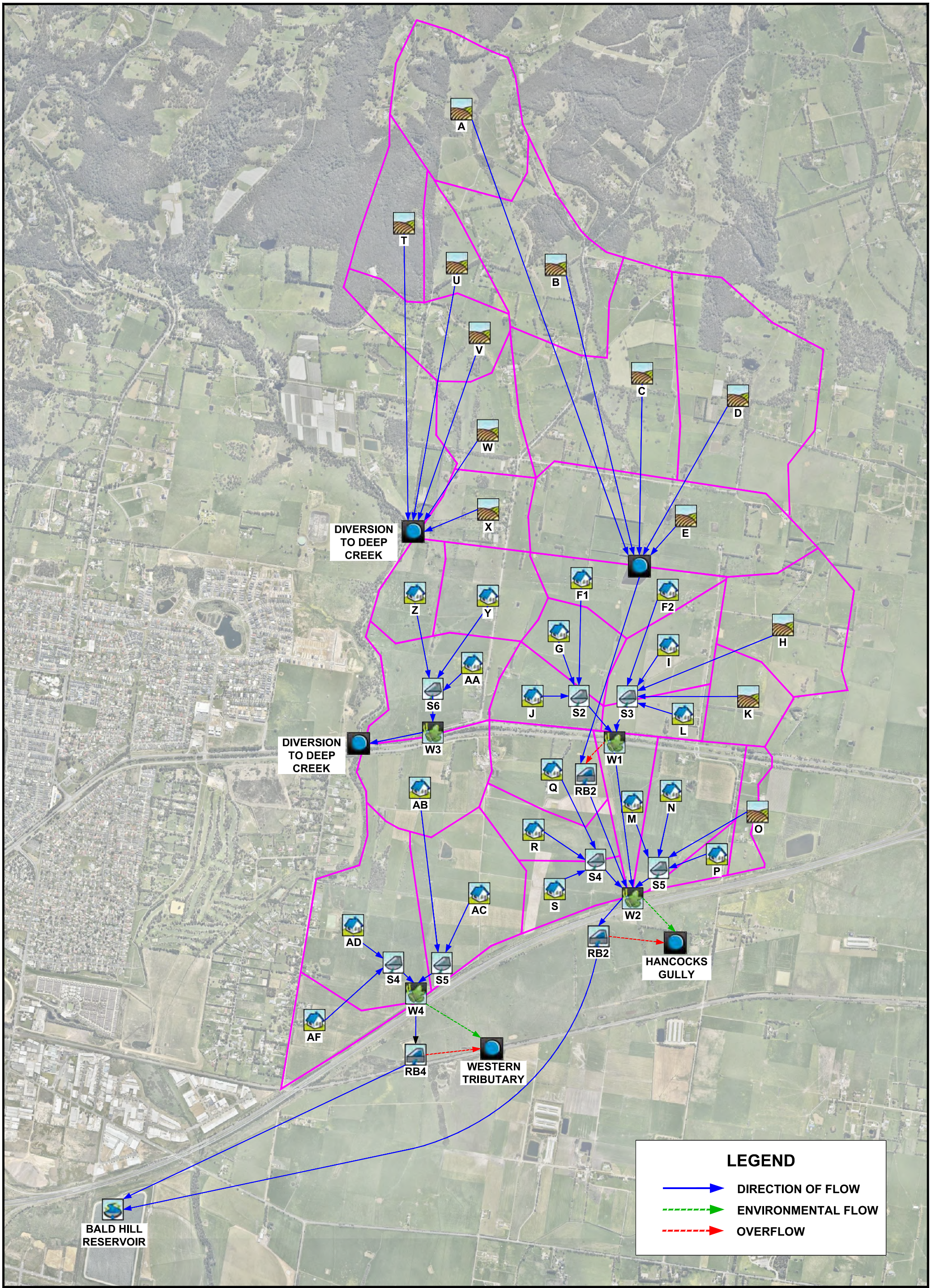
Date/Time: Tue Apr 26, 2016 - 10:40am --Julia.Baumann--



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Date/Time: Wed Apr 27, 2016 - 9:05am --Julia.Baumann--

PAKENHAM EAST STORM WATER HARVESTING

STORMWATER HARVESTING - CATCHMENT SCHEMATIC

SCALE 1: 11000 @ A1

REVISION A

DATE: 23/02/16

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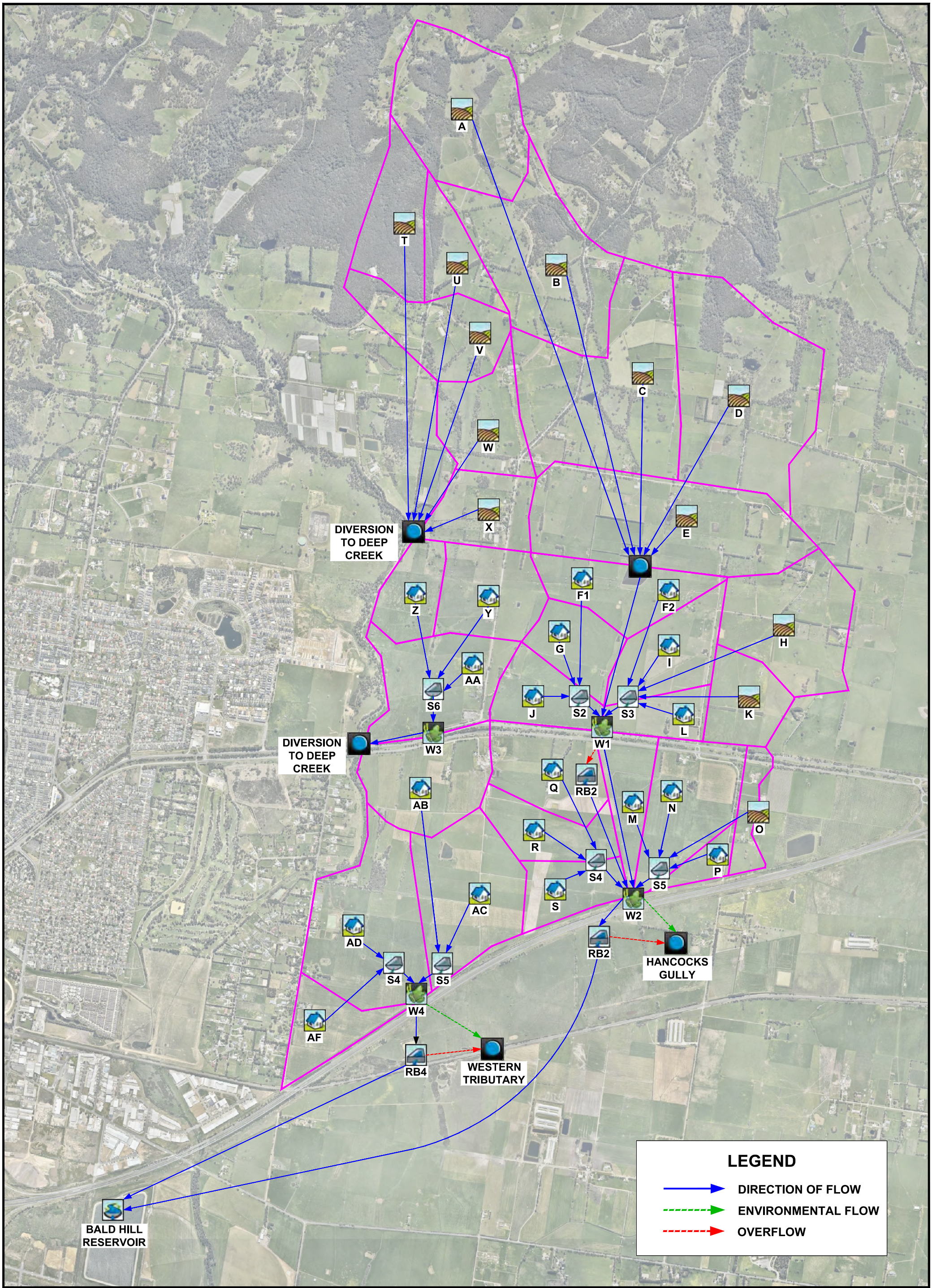

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Date/Time: Tue Apr 26, 2016 - 1:37pm --Julia.Baumann--

PAKENHAM EAST STORM WATER HARVESTING

STORMWATER HARVESTING - CATCHMENT SCHEMATIC

SCALE 1: 11000 @ A1

REVISION A

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8.2 Appendix B: Cost-Benefit Report

DALTON CONSULTING ENGINEERS

PAKENHAM EAST STORMWATER HARVESTING INVESTIGATION
COST-BENEFIT REPORT
JUNE 2016

Melbourne Water

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Prepared:
J Baumann AN: 401106
Reviewed:
J McGrath AN: 371150
Approved:
S Dalton AN: 761901

Executive Summary

This report presents the detailed costing, net-present cost (NPC) and MUSIC modelling results of the Pakenham East stormwater harvesting scheme investigation in a cost-benefit report. The costing and associated stormwater quality results are presented to aid decision-making. Full modelling and project reports have been produced under separate cover.

In the Pakenham East stormwater harvesting scheme investigation, DCE investigated eight (8) stormwater options. Following a stakeholder meeting, four (4) stormwater options were short-listed for cost-benefit assessment. A summary of the four short-listed stormwater options is shown in Table 1.

Table 1—Assessed Stormwater Options

Option	Description	Stormwater quality standard achieved
1A	Business As Usual (BAU)	Best Practice Environmental Mgmt. (BPEM)
2A	BAU to SEPP-F8	State Environmental Protection Plan Section F8 (SEPP-F8) for (TSS and TP) TN treated above BPEM but below SEPP-F8
3-G	Combination of Wetlands and Stormwater harvest (SWH) to SEPP-F8 (Gravity Pipeline)	SEPP-F8
3-P	Combination of Wetlands and SWH to SEPP-F8 (Primed Pipeline)	SEPP-F8

As catchment manager, Melbourne Water is required to comply with SEPP-F8 standards for Western Port. However, whether this is achieved at the development scale or through other works within the catchment is assessed on a case-by-case basis. Melbourne Water have advised that in internal discussions, it has been accepted that SEPP-F8 standards will need to be achieved at Pakenham East as the precinct drains to Western Port.

The method of stormwater treatment also varies between the options. Options 1A and 2A achieve stormwater treatment by 'Business As Usual' (BAU) methodology—the routing of urban runoff through constructed wetlands. In this report, BAU refers to the method of stormwater treatment. Options 3-G and 3-P achieve stormwater treatment by a combination of treatment of urban runoff in constructed wetlands with the addition of a stormwater harvesting scheme.

The stormwater harvesting scheme options vary in the type of pipeline used to convey stormwater. Both a gravity (Option 3-G) and a primed pipeline (Option 3-P) have been considered when costing the stormwater harvesting scheme options.

The total capital and operational costs for each option have been estimated by DCE. Melbourne Water has performed a 30-year NPC analysis on the costs. The results of the costing and NPC analysis are shown in Table 2. The full costing and a summary of the NPC are included in Appendices A, B and C.

Table 2—Capital and Operational Costs (2016)

Option	Description	Total CAPEX	Total OPEX (per year)	NPC (as assessed by MW)*\
1A	BAU stormwater treatment to BPEM	$ 45.3 M	$ 1.3 M	$ 25.4 M
2A	BAU stormwater treatment to SEPP-F8	$ 61.0 M	$ 1.9 M	$37.6 M
3-G	Wetlands and SWH to SEPP-F8 (Gravity)	$ 54.0 M	$ 1.6 M	$35.4 M
3-P	Wetlands and SWH to SEPP-F8 (Primed)	$ 52.9 M	$ 1.6 M	$35.2 M

The cost benefit report led to the following recommendation.

If the SEPP-F8 standards are required to be achieved at Pakenham East, the most cost effective way to achieve SEPP-F8 water quality treatment is to incorporate a stormwater harvesting scheme.

- Option 3-G has $ 7.0 M of CAPEX savings ($2.2 M of NPC savings) vs. Option 2A
- Option 3-P has $ 8.1 M of CAPEX savings ($2.4 M of NPC savings) vs. Option 2A

Contents

1. Introduction

This report presents a cost-benefit assessment of the results of the Pakenham East Stormwater Harvest (SWH) Investigation. The cost-benefit discusses the costs and benefits of the investigated stormwater options for the Pakenham East PSP.

1.1 Background

The investigation into stormwater options for the Pakenham East PSP is the result of a number of factors. The external forces contributing to the investigation will be briefly summarised. Figure 1 shows a plan of the Pakenham East PSP area.

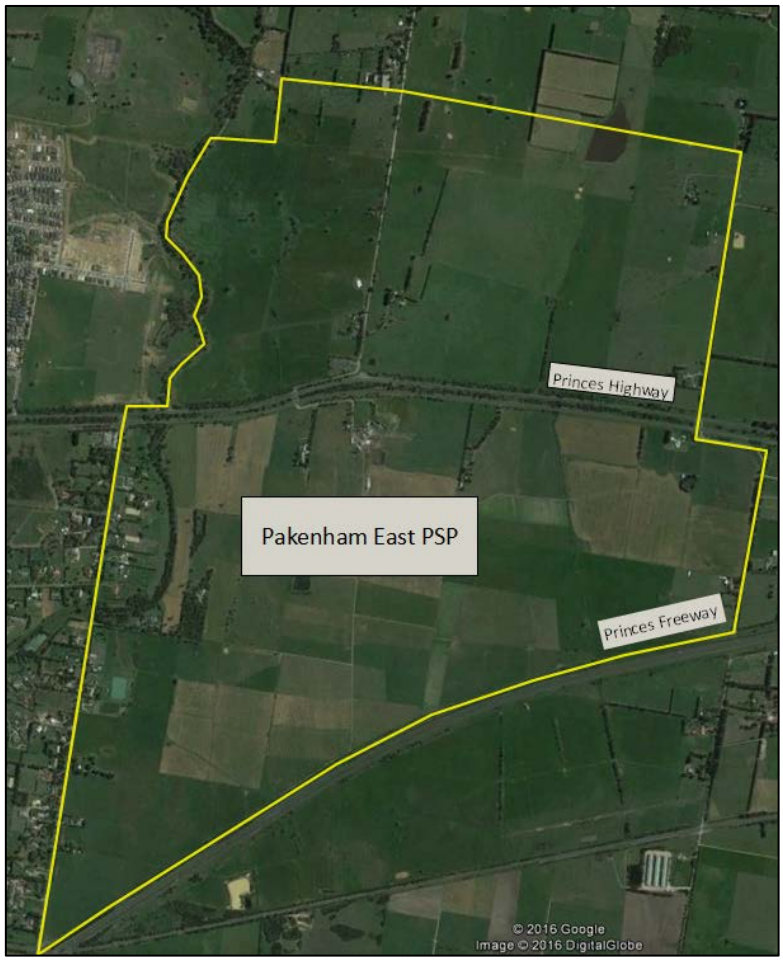

Figure 1—Pakenham PSP area (pre-development)

Melbourne is a city with a growing population. The urban growth boundary (UGB) has been changed to include additional area. The future Pakenham East PSP is a recent inclusion to Melbourne's growth boundaries. As Melbourne grows, additional environmental pressure is being placed on catchments such as Western Port. The State Environmental Protection Policy (SEPP) section F8 (SEPP-F8) has identified increased nutrients, suspended solids and altered flow regimes as the greatest threats to Western Port, specifically.

As the catchment manager, Melbourne Water is responsible for meeting water quality targets for Western Port as specified in the SEPP-F8. SEPP states that runoff from urban areas must not compromise the identified beneficial use of the receiving waterways. For Western Port, elevated concentrations of both suspended solids (TSS) and nutrients have been identified as key risks to the environmental quality of Western Port. Research undertaken by Biosis Research provided advice to Melbourne Water as to appropriate performance objectives for Western Port to achieve SEPP-F8 as shown in Table 3.

Table 3—Comparison of BPEM and SEPP-F8 Stormwater Quality Targets

Target	Total Suspended Solids (TSS) % Removal	Total Phosphorus (TP) % Removal	Total Nitrogen (TN) % Removal
BPEM	80%	45%	45%
SEPP-F8	93%	66%	63%

Modelling to achieve both these standards was requested by Melbourne Water. Melbourne Water advised that options achieving SEPP-F8 are to meet the target for TSS only. This is due the higher impact TSS has on Western Port compared to nutrient loads. If in achieving the SEPP-F8 target for TSS the targets for TP and TN are also achieved, Melbourne Water views this as an added bonus.

1.2 Stormwater options

In the Pakenham East stormwater harvesting scheme investigation, DCE investigated eight (8) stormwater options. The eight investigated options are summarised in Table 4.

Table 4—All investigated stormwater options

Option	Description	External catchment treated?	Stormwater quality standard achieved
1	Business As Usual (BAU)	Yes	Best Practice Environmental Mgmt. (BPEM)
1A	Business As Usual (BAU)	No	BPEM
2	BAU for SEPP-F8	Yes	State Environmental Protection Plan Section F8 (SEPP-F8) for (TSS and TP) TN treated above BPEM but below SEPP-F8
2A	BAU for SEPP-F8	No	SEPP-F8 (TSS and TP) TN treated above BPEM but below SEPP-F8
3-G	Stormwater harvest (SWH) for SEPP-F8 (Gravity Pipeline)	No	SEPP-F8
3-P	SWH for SEPP-F8 (Primed Pipeline)	No	SEPP-F8
4-G	SWH for SEPP- F8 (Gravity Pipeline)	Yes (to BPEM)	SEPP-F8
4-P	SWH for SEPP- F8 (Primed Pipeline)	Yes (to BPEM)	SEPP-F8

* In Option 4, Wetland W1 (and associated sedimentation basins) has been sized to ensure that water exiting the W1 system (including flow from the external catchment) achieves BPEM standards. The external catchment has been excluded from the water quality assessment of the Pakenham East precinct.

1.3 Stakeholder meeting

At the stakeholder meeting, the results of the MUSIC modelling, and the CAPEX, OPEX NPC costs were presented by Melbourne Water and DCE to South East Water (SEW) and Cardinia Shire Council. Several decisions came out of the stakeholder meeting:

- The stormwater quality treatment should be sized to treat runoff from the Pakenham East PSP area only. No treatment should be sized to include the external catchment.
- Modelling options 1A and 2A were created so that business-as-usual (BAU) stormwater options that only treat runoff from the PSP area can be compared.
- The need for an agreement between Melbourne Water and SEW regarding treatment of harvested stormwater (see Section 2.4).

Following the stakeholder meeting, DCE modelled options 1A and 2A in MUSIC and fully costed the CAPEX and OPEX associated with the options. Melbourne Water performed a 30-year NPC analysis on options 1A and 2A. The four (4) stormwater options short-listed for inclusion in this cost-benefit report provide stormwater quality treatment only to the Pakenham East PSP area.

A summary of the four short-listed stormwater treatment and harvesting options is shown in Table 5.

Table 5—Assessed Stormwater Options

Option	Description	Stormwater quality standard achieved
1A	Business As Usual (BAU)	Best Practice Environmental Mgmt. (BPEM)
2A	BAU to SEPP-F8	State Environmental Protection Plan Section F8 (SEPP-F8) for (TSS and TP) TN treated above BPEM but below SEPP-F8
3-G	Combination of Wetlands and Stormwater harvest (SWH) to SEPP-F8 (Gravity Pipeline)	SEPP-F8
3-P	Combination of Wetlands and SWH to SEPP-F8 (Primed Pipeline)	SEPP-F8

The cost-benefit report will assess the costs and benefits of the proposed stormwater options for Melbourne Water and key stakeholders. The key external stakeholders are:

- South East Water (SEW)
- Cardinia Shire Council
- Victorian Department of Environment, Land, Water and Planning (DEWLP)
- Land developers.

The cost-benefit report will also assess the costs and benefits of the proposed stormwater options for:

- The environment (specifically the Western Port catchment)
- The community (specifically future residents of the Pakenham East PSP).

A 30-year NPC assessment of the capital and operational costs of each option have been prepared by Melbourne Water and is included as Appendix A. The NPC assessment is based on a detailed costing prepared by DCE and included in Appendix B (capital expenses) and Appendix C (operational expenses). The Melbourne Water NPC assessment only included quantifiable benefits to offset the costs of the Pakenham East stormwater options. However, some unquantifiable benefits were identified.

2. Cost Estimates and Apportionment

The costs of the investigated options have been fully estimated. A 30-year NPC analysis by Melbourne Water (included as Appendix A) has further elaborated on the costs. This section sets forth the costs likely to be borne by the key stakeholders.

2.1 Total Costs

The total costs associated with all of the investigated options are the capital and operational costs of stormwater infrastructure. Table 6 shows the total capital and operational costs and the calculated 30-year NPC associated with each of the investigated options.

Table 6—Capital and Operational Costs (2016)

Option	Description	Total CAPEX	Total OPEX (per year)	NPC (as assessed by MW)*
1A	BAU (Wetlands) to BPEM	$ 45.3 M	$ 1.3 M	$ 25.4 M
2A	BAU (Wetlands) to SEPP-F8	$ 61.0 M	$ 1.9 M	$37.6 M
3-G	Wetlands and SWH to SEPP-F8 (Gravity Pipe)	$ 54.0 M	$ 1.6 M	$35.4 M
3-P	Wetlands and SWH to SEPP-F8 (Primed Pipe)	$ 52.9 M	$ 1.6 M	$35.2 M

* Land acquisition is not included in the MW NPC as developers will gift the encumbered land.

Option 1A has the lowest total costs. Option 1A treats urban runoff to BPEM standards. Treating to a lower stormwater quality standard requires less infrastructure. The relatively low amount of infrastructure required makes Option 1A the cheapest option to construct and maintain.

However, using BAU methodology (constructed wetlands) to comply with SEPP-F8 standards, as in Option 2A, incurs a higher total cost than a combination of wetlands and a stormwater harvesting scheme, as in Options 3-G and 3-P. This is illustrated in Table 7.

Table 7—Costs vs. business as usual (Option 2A)

Option	CAPEX (Stormwater quality and drainage)	CAPEX (% of Option 2A)	OPEX costs	OPEX (% of Option 2A)
1A	$ 45.3 M	n/a	$ 1.3 M	n/a
2A	$ 61.0 M	100%	$ 1.9 M	100%
3-G	$ 54.0 M	89%	$ 1.6 M	84%
3-P	$ 52.9 M	87%	$ 1.6 M	84%

Melbourne Water has noted that some additional stormwater quality treatment may be required in the undeveloped areas of the waterways outside of the Pakenham PSP area. The additional treatment would be the responsibility of Melbourne Water, and the costs associated with this additional treatment are beyond the scope of this investigation.

2.2 Costs to Melbourne Water

In a traditional development services scheme (DSS), Melbourne Water estimates and distributes the cost of the system to developers. Melbourne Water and Council then maintain the infrastructure. Note that in this cost-benefit analysis, in Option 3 it is assumed that Melbourne Water will fund the stormwater transfer pipeline.

The 30-year NPC analysis by Melbourne Water enumerated the costs for each option. The NPC costs borne by Melbourne Water for each option are shown in Table 7. The costs for Melbourne Water associated with each option are shown in Table 8 along with the increase relative to using business-as-usual methodology to achieve the SEPP-F8 treatment standards. Melbourne Water notes that the NPC of options 3-G and 3-P was practically identical. Therefore, Table 8 shows only the calculations based on 3-G.

Table 8—Melbourne Water NPC Costs

Option	Melbourne Water NPC Cost
1A	$ 13.0 M
2A	$ 21.1 M
3-G	$ 18.0 M
3-G with Developer contributions to pipeline to meet SEPP-F8	$ 14.9 M

2.3 Costs to South East Water (SEW)

In a traditional DSS, SEW would not be responsible for any costs. However, the stormwater harvesting options (Options 3-G and 3-P) involve SEW treating harvested stormwater to Class A standards. The stormwater that cannot be stored in the Bald Hill Reservoir will be discharged to the waterways. However, excess sewage that would have been used for recycled water will be returned to the sewer and treated at Eastern Treatment Plant (ETP).

The cost to SEW of discharge to ETP is approximately $500/ML. A previous study (GHD, July 2015) estimates that the introduction of a stormwater harvest scheme may result in an additional 810 ML/year of sewage being discharged, a total cost to SEW of $405,000 per year. The effluent from the Pakenham Recycled Water Plant (RWP) will be a combination of Class C and treated stormwater, so while the discharge has a flow impact, it has a minimal pollutant load impact on ETP. Nevertheless, the increased fees are a significant cost to SEW. An agreement between Melbourne Water and SEW may be a means of reducing the financial cost of the stormwater harvest options on SEW.

SEW's board has approved the implementation of 'third-pipe' recycled water infrastructure within the Pakenham East PSP. However, the source of the recycled water (sewage or stormwater treated to Class A) is yet to be determined. Therefore, costs associated with Class A treatment, distribution and storage of water at Bald Hill were excluded from the NPC. These costs are consistent for all options regardless of whether a stormwater harvesting scheme is implemented or not.

The implementation of a stormwater harvesting option (Option 3-G or 3-P) postpones the required construction of a RO plant by SEW. This benefit has been considered in the NPC analysis. The stormwater harvesting options present opportunities for SEW to:

- Lower salt concentration in source of recycled water
- Postpone construction of an RO plant at the Pakenham wastewater treatment plant
- Negotiate transport and treatment charges with Melbourne Water.

All of the stormwater harvesting options will involve some cost to SEW. To ensure that the stormwater harvesting scheme is viable, it is recommended that an agreement be reached between Melbourne Water and SEW regarding cost recovery for the additional treatment of effluent at ETP incurred by SEW. Table 9 shows the costs to SEW associated with each option, based on the Melbourne Water NPC analysis.

Table 9—Estimated SEW Costs

Option	SEW component	NPC Cost
1A	RO plant built	$ 2.6 M
2A	RO plant built	$ 2.6 M
3-G and 3-P	Cost of increased effluent discharged to ETP	$ 5.7 M

2.4 Costs to Cardinia Shire Council

In a traditional DSS, Cardinia Shire Council would not be responsible for any capital costs. However, should a traditional (BAU) DSS be required to achieve SEPP-F8 stormwater treatment targets through constructed wetlands, there is a significant increase in land-take. The stormwater harvesting Options 3-G and 3-P achieve the SEPP-F8 targets with no additional land-take. At the stakeholder workshops, Council have indicated the importance of no increase in land-take when achieving SEPP-F8.

The stormwater harvest options present opportunities to Cardinia Shire Council to:

- Have no additional land-take in the Pakenham East PSP while meeting enhanced stormwater quality standards

2.5 Costs to Developers

In a traditional DSS, the land developers pay for stormwater quality treatment infrastructure through DSS contribution rates. The likely cost to developers has been assessed by Melbourne Water as part of the NPC investigation. The 30-year NPC cost to developers for each option is shown in Table 10. The NPC cost estimates assume that all drainage infrastructure will be funded by the developer.

Table 10—Developer Costs

Option	Description	NPC Cost
1A	BAU – exclude external	$ 9.8 M
2A	BAU for SEPP-F8 – exclude external	$ 14.0 M
3-G	SWH for SEPP-F8 (gravity pipeline)	$ 11.8 M
3-G with contributions	SWH for SEPP-F8 (gravity); developer contributes to pipeline to achieve SEPP-F8	$ 14.8 M

3. Benefits and Impact

3.1 Major Benefits

The stormwater harvesting options have increased infrastructure and associated costs associated with them. The benefits of the stormwater harvesting options (Options 3-G and 3-P) may be split across a variety of stakeholders (e.g. Melbourne Water and Cardinia Shire Council), and it may be possible for Melbourne Water to share some of the additional costs associated with the stormwater harvesting options.

The quantifiable benefits associated with Options 3-G and 3-P, the options that incorporate a stormwater harvesting scheme, are

- TSS reduction to achieve SEPP-F8 standards
- TP and TN reduction beyond that which is required
- Flow reduction and less-altered flow regime
- Deferment of the SEW reverse osmosis (RO) plant at the existing Pakenham Recycled Water Plant (RWP).

However, there are also a number of potential and unquantifiable benefits from adopting a stormwater harvesting scheme as part of the stormwater quality treatment infrastructure in the Pakenham East PSP:

- Protection of Ramsar wetlands in Western Port
- Protection of beneficial uses of the existing waterways (including protection of their aquatic ecosystems, amenity and recreation value for local residents)
- Alternative water resource for SEW.

These benefits should be noted even though they cannot be directly included in the cost-benefit assessment.

3.2 Impact on the Environment

All stormwater from the Pakenham East PSP discharges to Deep Creek, McDonalds Road Drain and Handcocks Gully. From there, the stormwater eventually enters Western Port. Therefore, all water quality benefits from the investigated options will ultimately impact water quality within Western Port.

The impact of each option on the environment can be seen in the resultant water balance and nutrient balance. Full water and nutrient balances for each option are included in Appendix D. A summary of the water and nutrient impacts of each option is shown in Table 12.

In Table 12, the Runoff vs. Pre-development (%) is somewhat complicated for Options 3-G and 3-P that incorporate stormwater harvesting. The stormwater harvesting options harvest stormwater from the external catchment to the north of the Pakenham East PSP. When the developed runoff from options 3-G and 3-P is compared to pre-development runoff for the Pakenham East PSP area, an increase in flows is seen. The increase is the result of the additional flow from the external catchment that is not harvested.

When the developed runoff from options 3-G and 3-P is compared to pre-development runoff for the Pakenham East PSP area *and* the external catchment, a decrease in flows is seen. The decrease is a result of harvesting stormwater runoff from the external catchment. Both comparisons are shown in Table 12. It can be argued that both assessment methods indicate that options 3-G and 3-P better mimic pre-development flow when compared to the business as usual stormwater options.

Table 11—Costs to the Environment

Option	Pre-development runoff (ML/2004)	Runoff to environment (ML/2004)	Runoff vs. Pre-development (%)	TSS to environment (kg/2004)	TP to environment (kg/2004)	TN to environment (kg/2004)
1A	1,559	3,200	205 %	79,890	350	4,800
2A	1,559	3,000	195 %	34,545	230	3,700
3-G	1,559	2,100	135 % *	34,500	190	2,800
3-P	1,559	2,100	135 % *	34,500	190	2,800
3-G	2,591	2,100	80 % **	34,500	190	2,800
3-P	2,591	2,100	80 % **	34,500	190	2,800

* Compared to Pre-Development runoff from the Pakenham East PSP area only

** Compared to Pre-Development runoff from the Pakenham East PSP area *and* the external catchment

Table 13 shows a table of positive environmental impacts from each option.

Table 12—Benefits to the Environment

Option	Runoff to environment (ML/2004)	Total runoff reduction vs. BAU Option 1A (ML)	Total runoff reduced vs. BAU Option 1A (%)	TSS (kg/2004) removed	TP (kg/2004) removed	TN (kg/2004) removed
1A*	3,200	n/a	n/a	414,830	810	3,970
2A*	3,000	200	6%	460,180	930	5,060
3-G**	2,100	1,100	51%	460,225	970	6,050
3-P**	2,100	1,100	51%	460,225	970	6,050

3.3 Forecast Environmental Improvements

Increasing stormwater quality treatment will have a positive impact on the receiving waterways and Western Port through the reduction of TSS and nutrient loads. Therefore, implementing a stormwater harvesting scheme will ensure this development is not contributing to the environmental degradation of Western Port. Detailing the environmental effects of increased stormwater quality treatment is outside the scope of this investigation. However, previous work prepared by the Environmental Protection Authority (EPA) of Victoria has quantified the benefit to the environment of adopting SEPP-F8 targets.

As noted in Section 3.1, positive improvements for the environment may include:

- Improved protection of Ramsar wetlands in Western Port
- Improvement to the existing waterways allowing for more beneficial uses (including protection of their aquatic ecosystems and amenity and recreation value for local residents)
- Alternative water resource for SEW that allow for environmental improvements elsewhere.

As shown in Table 14, the environmental improvement resulting from each of the assessed options can be briefly summarised:

Table 13—Summary of Environmental Impact

Option	Water treatment at PSP boundary	Treatment of external rural catchment	Impact on Western Port	Mean Annual Flow (% of Rural Flow)
1A	BPEM	Untreated	Degradation	205 %
2A	SEPP-F8 (TSS and TP only)	Untreated	Neutral	195 %
3-G	SEPP-F8	Untreated but Harvested	Improvement	135 %*
3-P	SEPP-F8	Untreated but Harvested	Improvement	135 %*

* Compared to Pre-Development runoff from the Pakenham East PSP area only

The stormwater harvesting options (Options 3-G and 3-P) are the only options that will likely have a positive impact on the health of Western Port. In addition, Options 3-G and 3-P are the only options that reduce developed runoff to something approximating current existing, rural conditions.

3.4 Estimated benefits of Stormwater Harvesting

Not all benefits can be quantified. Therefore, not all benefits have been incorporated into the NPC assessment. The stormwater harvesting schemes benefit the existing and future Pakenham East PSP community in the following ways:

- Reduction in runoff frequency (to receiving systems)
- Reduction in runoff volume (often to near pre-development levels)
- Reduction in nutrients beyond current BPEM and SEPP-F8 for TSS standards.

The stormwater harvesting scheme benefits the community and the environment in the Pakenham East PSP. While not all of these benefits can be quantified and incorporated into the NPC assessment, the stormwater harvesting scheme provides:

- An opportunity for integrated water cycle management and the creation of a water-sensitive community.
- Increased resilience to drought and climate change.
- The environmental benefits of SEPP-F8 quality stormwater without additional or unsightly infrastructure.
- Improved protection of Ramsar wetlands in Western Port
- Improvement to the existing waterways allowing for more beneficial uses (including protection of their aquatic ecosystems and amenity and recreation value for local residents)
- Alternative water resource for SEW that allow for environmental improvements elsewhere.

Melbourne Water will receive benefits from the stormwater harvest scheme:

- Achievement of SEPP-F8 water quality targets without additional stormwater quality infrastructure
- Achievement of SEPP-F8 water quality targets without the additional costs associated with increased infrastructure to treat stormwater to SEPP-F8 using BAU (constructed wetlands alone) methods.

SEW will benefit from the stormwater harvest scheme:

- Inflow to the existing Pakenham RWP will have a lower salinity than alternative sources
- Postponement of RO plant construction
- Alternative water resource for SEW

4. Evaluation of Proposed Options

The options will be assessed based on the following key achievements:

- The standard(s) to which the stormwater is treated
- The amount of stormwater treated—inclusion/exclusion of the external catchment
- The relative cost of achieving the outcomes

4.1 Stormwater treatment standards

As catchment manager, Melbourne Water is required to comply with SEPP-F8 standards for Western Port. However, whether this is achieved at the development scale or through other works within the catchment is assessed on a case-by-case basis.

For this assessment, Melbourne Water assumed that SEPP-F8 will be achieved on the development scale. Therefore, the option incorporating BPEM treatment (Option 1A) is not viable as it does not sufficiently treat stormwater from the Pakenham East PSP. Option 2A achieves SEPP-F8 treatment for TSS and TP.

Options 3-G and 3-P achieve full SEPP-F8 treatment of TSS, TP and TN for runoff from the Pakenham East PSP. Options 3-G and 3-P are less costly (based on NPC, capital costs and operational costs) than Option 2A. Achieving SEPP-F8 treatment standards by using a stormwater harvesting scheme is more efficient than using business as usual methodology.

4.2 Cost

The most efficient option in terms of NPC is Option 1A which treats the Pakenham East PSP to BPEM, a stormwater quality standard lower than that adopted by Melbourne Water. If cost were the sole driver of the project, Option 1A would be preferred.

For this assessment, Melbourne Water has assumed that SEPP-F8 will be achieved on the development scale. Therefore, a higher stormwater quality standard is required. The most cost-effective of the options that achieves SEPP-F8 treatment is Option 3-P. Option 3-P incorporates a stormwater harvest. A primed pipeline is used to convey stormwater to storage at Bald Hill Reservoir.

Table 15 shows the 30-year NPC to each of the key stakeholders as determined by Melbourne Water:

Table 14—NPC for each key stakeholder

Option	Total	Developer	MW	SEW
1	$ 28.4 M	$ 11.4 M	$ 14.5 M	$ 2.6 M
1A	$ 25.4 M	$ 9.8 M	$ 13.0 M	$ 2.6 M
2	$ 45.5 M	$ 20.3 M	$ 22.7 M	$ 2.6 M
2A	$ 37.8 M	$ 14.0 M	$ 21.1 M	$ 2.6 M
3-G	$ 35.4 M	$ 11.8 M	$ 18.0 M	$ 5.7 M
3-G (Developer contributes to pipeline to meet SEPP-F8)	$ 35.4 M	$ 14.8 M	$ 14.9 M	$ 5.7 M

4.3 Recommendations

Of the investigated options, the stormwater harvesting options (Options 3-G and 3-P) are the most efficient at treating the Pakenham East PSP to SEPP-F8 water quality standards.

However, in the stakeholder meeting, it was clear that there are a number of issues that need to be addressed to make a stormwater harvest option viable for all of the stakeholders. In particular, an agreement may need to be reached between Melbourne Water and SEW to ensure the scheme is financially viable for SEW. The details of the agreement are beyond the scope of this investigation.

For this assessment, Melbourne Water has assumed that SEPP-F8 will be achieved on the development scale. The stormwater harvesting options 3-G and 3-P provide an innovative method of achieving SEPP-F8 treatment.

5. Appendices

5.1 Appendix A: Melbourne Water NPC Summary

NPV Summary

Option	NPC ($M)
Option 1 - BAU (BPEMG with external catchment)	$ 28.4
Option 1A - BAU (BPEMG with NO external catchment)	$ 25.4
Option 2 Option 2 - BAU (SEPP-F8 with external catchment)	$ 45.6
Option 2 Option 2A - BAU (SEPP-F8 with no external catchment)	$ 37.6
Option 3 Stormwater Harvesting with Gravity Pipeline (SEPP-F8) Option 1	$ 35.4
Option 3 Stormwater Harvesting with Primed Pipeline (SEPP-F8) Option 1	$ 35.2
Option 4 Stormwater Harvesting with Gravity Pipeline (SEPP F8) Option 2	$ 41.6
Option 4 Stormwater Harvesting with Primed Pipeline (SEPP F8) Option 2	$ 40.3

Notes:
Land Acquisition not included as developers gift this encumbered land
Options that don't include the external catchment would likely require MW to build an additional asset to treat runoff from the upstream catchment

Distributional Analysis

Option	Total	Developer	MW	SEW
Option 1 - BAU (BPEMG with external catchment)	$ 28.4	$ 11.4	$ 14.5	$ 2.6
Option 1A - BAU (BPEMG with NO external catchment)	$ 25.4	$ 9.8	$ 13.0	$ 2.6
Option 2 Option 2 - BAU (SEPP-F8 with external catchment)	$ 45.5	$ 20.3	$ 22.7	$ 2.6
Option 2 Option 2A - BAU (SEPP-F8 with no external catchment)	$ 37.8	$ 14.0	$ 21.1	$ 2.6
Option 3 Stormwater Harvesting with Gravity Pipeline (SEPP-F8) Option 1	$ 35.4	$ 11.8	$ 18.0	$ 5.7
Option 3 Stormwater Harvesting with Gravity Pipeline (Developer contribute to pipeline to meet SEPP-F8)	$ 35.4	$ 14.8	$ 14.9	$ 5.7

Notes:
The NPC total doesn't add to the sum of the distrbution due to rounding throughout the NPV calculation
Small differences have occurred in the total NPV between the initial analysis and distributional analysis. This is due to some settings within the spreadsheet and not the inputs. The inputs have been checked. The differences are not significant and can be ignored.
The distributional analysis has not been completed for the other pipeline options. The primed pipeline would give similar results, so there is minimal benefit to completing it. Option 4 pipeline is not preferred to be taken forward as per council comments at the workshop, so hasn't been completed here.

Comments:
SEW cost associated with harvesting is the fee charged by MW to discharge to ETP. A larger volume is discharged to ETP in Option 3 due to stormwater displacing the effluent in the recycled water. This cost is greater than the cost of the proposed RO plant.
If SEPP-F8 is the required standard at the development site, the pipeline is the lowest cost solution

5.2 Appendix B: Capital Costs

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SUMMARY

12221 - PAKENHAM EAST SWH COSTING

REVISION: 3 DATE: 8/3/2016

OPTION 1A - BAU - BPEMG (no external catchment)

1	Earthworks	$	6,020,000
2	Drainage works	$	1,210,000
3	Landscaping	$	7,670,000
4	Access Track/Footpaths	$	350,000
5	Land Acquisition	$	30,000,000
	TOTAL	**$**	**45,250,000** **(exc.GST)**

OPTION 2A - BAU - SEPP F8 (no external catchment)

1	Earthworks	$	9,640,000
2	Drainage works	$	1,390,000
3	Landscaping	$	11,700,000
4	Access Track/Footpaths	$	350,000
5	Land Acquisition	$	37,880,000
	TOTAL	**$**	**60,960,000** **(exc.GST)**

OPTION 3-G - SWH ACHIEVING SEPP F8 WITH A GRAVITY PIPELINE

1	Earthworks	$	6,960,000
2	Drainage works	$	1,260,000
3	Landscaping	$	9,310,000
4	Access Track/Footpaths	$	340,000
5	Land Acquisition	$	32,250,000
6	Gravity Pipeline	$	3,840,000
	TOTAL	**$**	**53,960,000** **(exc.GST)**

OPTION 3-P - SWH ACHIEVING SEPP F8 WITH A PRIMED PIPELINE

1	Earthworks	$	6,960,000
2	Drainage works	$	1,260,000
3	Landscaping	$	9,310,000
4	Access Track/Footpaths	$	340,000
5	Land Acquisition	$	32,250,000
6	Primed Pipeline	$	2,810,000
	TOTAL	**$**	**52,930,000** **(exc.GST)**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 1A - BAU Methods to BPEM Standards

REVISION: 3 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	20,736	cu.m	$ 8.30	$ 172,108.80
(b)	Sediment Basin 2	2,291	cu.m	$ 8.30	$ 19,013.64
(c)	Sediment Basin 3	4,651	cu.m	$ 8.30	$ 38,604.96
(d)	Flood storage (cut)	75,000	cu.m	$ 8.30	$ 622,500.00
(e)	Free board (cut)	12,800	cu.m	$ 8.30	$ 106,240.00
(f)	Battering (cut)	40,700	cu.m	$ 8.30	$ 337,810.00
(g)	Filling (fill)	5,300	cu.m	$ 15.60	$ 82,680.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 100,187.50	$ 100,187.50
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,380	sq.m	$ 12.50	$ 17,250.00
(b)	Aquatic planting	34,714	sq.m	$ 13.60	$ 472,104.96
(c)	Clay liner	34,714	sq.m	$ 10.40	$ 361,021.44
(d)	Top soiling	82,107	sq.m	$ 3.10	$ 254,531.70
(e)	Hydroseeding	46,013	sq.m	$ 2.10	$ 96,628.14
(f)	Rock beaching	2,893	sq.m	$ 94.00	$ 271,942.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	720	sq.m	$ 27.10	$ 19,512.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 3,191,013.14

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	12,288	cu.m	$ 8.30	$ 101,990.40
(b)	Sediment Basin 4 (cut)	3,108	cu.m	$ 8.30	$ 25,796.40
(c)	Sediment Basin 5 (cut)	3,108	cu.m	$ 8.30	$ 25,796.40
(d)	Flood storage (cut)	82,300	cu.m	$ 8.30	$ 683,090.00
(e)	Free board (cut)	500	cu.m	$ 8.30	$ 4,150.00
(f)	Battering (cut)	100	cu.m	$ 8.30	$ 830.00
(g)	Filling (fill)	32,400	cu.m	$ 15.60	$ 505,440.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 97,687.50	$ 97,687.50
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,250	sq.m	$ 12.50	$ 28,125.00
(b)	Aquatic planting	42,624	sq.m	$ 13.60	$ 579,686.40
(c)	Clay liner	42,624	sq.m	$ 10.40	$ 443,289.60
(d)	Top soiling	124,820	sq.m	$ 3.10	$ 386,942.00
(e)	Hydroseeding	79,946	sq.m	$ 2.10	$ 167,886.60
(f)	Rock beaching	5,180	sq.m	$ 94.00	$ 486,920.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	700	sq.m	$ 27.10	$ 18,970.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 3,816,538.30

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	15,480	cu.m	$ 8.30	$ 128,484.00
(b)	Sediment Basin 6 (cut)	5,160	cu.m	$ 8.30	$ 42,828.00
(c)	Flood storage (cut)	59,000	cu.m	$ 8.30	$ 489,700.00
(d)	Free board (cut)	10,800	cu.m	$ 8.30	$ 89,640.00
(e)	Battering (cut)	27,700	cu.m	$ 8.30	$ 229,910.00
(f)	Filling (fill)	8,500	cu.m	$ 15.60	$ 132,600.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 64,500.00	$ 64,500.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,500	sq.m	$ 12.50	$ 18,750.00
(b)	Aquatic planting	25,800	sq.m	$ 13.60	$ 350,880.00
(c)	Clay liner	25,800	sq.m	$ 10.40	$ 268,320.00
(d)	Top soiling	58,400	sq.m	$ 3.10	$ 181,040.00
(e)	Hydroseeding	31,100	sq.m	$ 2.10	$ 65,310.00
(f)	Rock beaching	1,600	sq.m	$ 94.00	$ 150,400.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,386,135.00

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	30,000	cu.m	$ 8.30	$ 249,000.00
(b)	Sediment Basin 7 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(c)	Sediment Basin 8 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(d)	Flood storage (cut)	67,500	cu.m	$ 8.30	$ 560,250.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,000	cu.m	$ 8.30	$ 49,800.00
(g)	Filling (fill)	5,200	cu.m	$ 15.60	$ 81,120.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 101,250.00	$ 101,250.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	2,724	sq.m	$ 12.50	$ 34,050.00
(b)	Aquatic planting	51,000	sq.m	$ 13.60	$ 693,600.00
(c)	Clay liner	51,000	sq.m	$ 10.40	$ 530,400.00
(d)	Top soiling	122,000	sq.m	$ 3.10	$ 378,200.00
(e)	Hydroseeding	68,276	sq.m	$ 2.10	$ 143,379.60
(f)	Rock beaching	3,000	sq.m	$ 94.00	$ 282,000.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,493,760.60

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	59,400	cu.m	$ 8.30	$ 493,020.00
5.02	Landscaping				
(a)	Terrestrial planting	15,840	sq.m	$ 12.50	$ 198,000.00
(b)	Top soiling	55,440	sq.m	$ 3.10	$ 171,864.00
(c)	Hydroseeding	39,600	sq.m	$ 2.10	$ 83,160.00
5.03	Access Track				
(a)	Crushed rock maintenace track	792	l.m	$ 27.10	$ 21,463.20
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,584	sq.m	$ 60.00	$ 95,040.00
			TOTAL ITEM 5.00		$ 1,062,547.20
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	72,000	cu.m	$ 8.30	$ 597,600.00
6.02	Landscaping				
(a)	Terrestrial planting	19,200	sq.m	$ 12.50	$ 240,000.00
(b)	Top soiling	67,200	sq.m	$ 3.10	$ 208,320.00
(c)	Hydroseeding	48,000	sq.m	$ 2.10	$ 100,800.00
6.03	Access Track				
(a)	Crushed rock maintenace track	960	l.m	$ 27.10	$ 26,016.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,920	sq.m	$ 60.00	$ 115,200.00
			TOTAL ITEM 6.00		$ 1,287,936.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	8.5	ha.	$ 750,000.00	$ 6,375,000.00
7.02	Retarding Basin/Wetland 2	13	ha.	$ 750,000.00	$ 9,750,000.00
7.03	Retarding Basin/Wetland 3	6	ha.	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	12.5	ha.	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 30,000,000.00
				TOTAL	**$ 45,237,930.24**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 2A - BAU Methods to SEPP F8 Standards (TSS and TP)

REVISION: 3 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland (cut)	36,288	cu.m	$ 8.30	$ 301,190.40
(b)	Sediment Basin 2 (cut)	4,046	cu.m	$ 8.30	$ 33,585.12
(c)	Sediment Basin 3 (cut)	8,104	cu.m	$ 8.30	$ 67,259.88
(d)	Flood storage (cut)	83,300	cu.m	$ 8.30	$ 691,390.00
(e)	Free board (cut)	19,700	cu.m	$ 8.30	$ 163,510.00
(f)	Battering (cut)	113,700	cu.m	$ 8.30	$ 943,710.00
(g)	Filling (fill)	2,000	cu.m	$ 15.60	$ 31,200.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 148,750.00	$ 148,750.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,854	sq.m	$ 12.50	$ 23,175.00
(b)	Aquatic planting	60,749	sq.m	$ 13.60	$ 826,183.68
(c)	Clay liner	60,749	sq.m	$ 10.40	$ 631,787.52
(d)	Top soiling	99,937	sq.m	$ 3.10	$ 309,804.70
(e)	Hydroseeding	37,334	sq.m	$ 2.10	$ 78,401.82
(f)	Rock beaching	5,063	sq.m	$ 94.00	$ 475,922.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	825	sq.m	$ 27.10	$ 22,357.50
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 4,967,105.62

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	21,504	cu.m	$ 8.30	$ 178,483.20
(b)	Sediment Basin 4 (cut)	5,440	cu.m	$ 8.30	$ 45,148.68
(c)	Sediment Basin 5 (cut)	5,440	cu.m	$ 8.30	$ 45,148.68
(d)	Flood storage (cut)	127,900	cu.m	$ 8.30	$ 1,061,570.00
(e)	Free board (cut)	8,200	cu.m	$ 8.30	$ 68,060.00
(f)	Battering (cut)	6,500	cu.m	$ 8.30	$ 53,950.00
(g)	Filling (fill)	7,700	cu.m	$ 15.60	$ 120,120.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 155,000.00	$ 155,000.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	3,000	sq.m	$ 12.50	$ 37,500.00
(b)	Aquatic planting	74,592	sq.m	$ 13.60	$ 1,014,451.20
(c)	Clay liner	74,592	sq.m	$ 10.40	$ 775,756.80
(d)	Top soiling	123,784	sq.m	$ 3.10	$ 383,730.40
(e)	Hydroseeding	46,192	sq.m	$ 2.10	$ 97,003.20
(f)	Rock beaching	6,216	sq.m	$ 94.00	$ 584,304.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	750	sq.m	$ 27.10	$ 20,325.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,900,489.16

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	27,864	cu.m	$ 8.30	$ 231,271.20
(b)	Sediment Basin 6 (cut)	9,288	cu.m	$ 8.30	$ 77,090.40
(c)	Flood storage (cut)	101,000	cu.m	$ 8.30	$ 838,300.00
(d)	Free board (cut)	167,700	cu.m	$ 8.30	$ 1,391,910.00
(e)	Battering (cut)	6,500	cu.m	$ 8.30	$ 53,950.00
(f)	Filling (fill)	150	cu.m	$ 15.60	$ 2,340.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 86,250.00	$ 86,250.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,920	sq.m	$ 12.50	$ 24,000.00
(b)	Aquatic planting	46,440	sq.m	$ 13.60	$ 631,584.00
(c)	Clay liner	46,440	sq.m	$ 10.40	$ 482,976.00
(d)	Top soiling	86,130	sq.m	$ 3.10	$ 267,003.00
(e)	Hydroseeding	37,770	sq.m	$ 2.10	$ 79,317.00
(f)	Rock beaching	3,870	sq.m	$ 94.00	$ 363,780.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	600	sq.m	$ 27.10	$ 16,260.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 4,702,189.60

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	55,080	cu.m	$ 8.30	$ 457,164.00
(b)	Sediment Basin 7 (cut)	9,180	cu.m	$ 8.30	$ 76,194.00
(c)	Sediment Basin 8 (cut)	9,180	cu.m	$ 8.30	$ 76,194.00
(d)	Flood storage (cut)	129,500	cu.m	$ 8.30	$ 1,074,850.00
(e)	Free board (cut)	20,300	cu.m	$ 8.30	$ 168,490.00
(f)	Battering (cut)	36,500	cu.m	$ 8.30	$ 302,950.00
(g)	Filling (fill)	3,500	cu.m	$ 15.60	$ 54,600.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 150,750.00	$ 150,750.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	3,600	sq.m	$ 12.50	$ 45,000.00
(b)	Aquatic planting	91,800	sq.m	$ 13.60	$ 1,248,480.00
(c)	Clay liner	91,800	sq.m	$ 10.40	$ 954,720.00
(d)	Top soiling	172,350	sq.m	$ 3.10	$ 534,285.00
(e)	Hydroseeding	76,950	sq.m	$ 2.10	$ 161,595.00
(f)	Rock beaching	7,650	sq.m	$ 94.00	$ 719,100.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,550	sq.m	$ 27.10	$ 42,005.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 6,279,555.00

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve				
5.01	Earthworks				
(a)	Cut	55,800	cu.m	$ 8.30	$ 463,140.00
5.02	Landscaping				
(a)	Terrestrial planting	14,880	sq.m	$ 12.50	$ 186,000.00
(b)	Top soiling	52,080	sq.m	$ 3.10	$ 161,448.00
(c)	Hydroseeding	37,200	sq.m	$ 2.10	$ 78,120.00
5.03	Access Track				
(a)	Crushed rock maintenace track	744	l.m	$ 27.10	$ 20,162.40
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,488	sq.m	$ 60.00	$ 89,280.00
			TOTAL ITEM 5.00		$ 998,150.40
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	10.5	ha.	$ 750,000.00	$ 7,875,000.00
7.02	Retarding Basin/Wetland 2	13	ha.	$ 750,000.00	$ 9,750,000.00
7.03	Retarding Basin/Wetland 3	9	ha.	$ 750,000.00	$ 6,750,000.00
7.04	Retarding Basin/Wetland 4	18	ha.	$ 750,000.00	$ 13,500,000.00
			TOTAL ITEM 7.00		$ 37,875,000.00
				TOTAL	**$ 60,929,929.78**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 3-G - Stormwater Harvesting - GRAVITY PIPELINE

REVISIO Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	34,830	cu.m	$ 8.30	$ 289,089.00
(b)	Sediment Basin 2	5,810	cu.m	$ 8.30	$ 48,223.00
(c)	Sediment Basin 3	5,810	cu.m	$ 8.30	$ 48,223.00
(d)	Flood storage (cut)	101,150	cu.m	$ 8.30	$ 839,545.00
(e)	Free board (cut)	16,100	cu.m	$ 8.30	$ 133,630.00
(f)	Battering (cut)	59,600	cu.m	$ 8.30	$ 494,680.00
(g)	Filling (fill)	5,000	cu.m	$ 15.60	$ 78,000.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, , including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 114,875.00	$ 114,875.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,818	sq.m	$ 12.50	$ 22,725.00
(b)	Aquatic planting	58,037	sq.m	$ 13.60	$ 789,300.48
(c)	Clay liner	58,037	sq.m	$ 10.40	$ 603,582.72
(d)	Top soiling	90,164	sq.m	$ 3.10	$ 279,508.40
(e)	Hydroseeding	41,800	sq.m	$ 2.10	$ 87,780.00
(f)	Rock beaching	4,836	sq.m	$ 94.00	$ 454,584.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	760	sq.m	$ 27.10	$ 20,596.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 4,523,219.60

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	21,380	cu.m	$ 8.30	$ 177,454.00
(b)	Sediment Basin 4 (cut)	5,210	cu.m	$ 8.30	$ 43,243.00
(c)	Sediment Basin 5 (cut)	5,210	cu.m	$ 8.30	$ 43,243.00
(d)	Flood storage (cut)	121,700	cu.m	$ 8.30	$ 1,010,110.00
(e)	Free board (cut)	2,300	cu.m	$ 8.30	$ 19,090.00
(f)	Battering (cut)	1,500	cu.m	$ 8.30	$ 12,450.00
(g)	Filling (fill)	21,500	cu.m	$ 15.60	$ 335,400.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 115,500.00	$ 115,500.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,226	sq.m	$ 12.50	$ 27,825.00
(b)	Aquatic planting	71,262	sq.m	$ 13.60	$ 969,163.20
(c)	Clay liner	71,262	sq.m	$ 10.40	$ 741,124.80
(d)	Top soiling	144,062	sq.m	$ 3.10	$ 446,592.20
(e)	Hydroseeding	84,677	sq.m	$ 2.10	$ 177,821.70
(f)	Rock beaching	5,938	sq.m	$ 94.00	$ 558,172.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	780	sq.m	$ 27.10	$ 21,138.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,958,264.90

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	16,570	cu.m	$ 8.30	$ 137,531.00
(b)	Sediment Basin 6 (cut)	5,530	cu.m	$ 8.30	$ 45,899.00
(c)	Flood storage (cut)	67,200	cu.m	$ 8.30	$ 557,760.00
(d)	Free board (cut)	12,100	cu.m	$ 8.30	$ 100,430.00
(e)	Battering (cut)	36,900	cu.m	$ 8.30	$ 306,270.00
(f)	Filling (fill)	500	cu.m	$ 15.60	$ 7,800.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 65,125.00	$ 65,125.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,458	sq.m	$ 12.50	$ 18,225.00
(b)	Aquatic planting	27,606	sq.m	$ 13.60	$ 375,441.60
(c)	Clay liner	2,761	sq.m	$ 10.40	$ 28,716.48
(d)	Top soiling	57,699	sq.m	$ 3.10	$ 178,866.90
(e)	Hydroseeding	34,694	sq.m	$ 2.10	$ 72,857.40
(f)	Rock beaching	2,301	sq.m	$ 94.00	$ 216,294.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,284,989.38

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	32,750	cu.m	$ 8.30	$ 271,825.00
(b)	Sediment Basin 7 (cut)	5,460	cu.m	$ 8.30	$ 45,318.00
(c)	Sediment Basin 8 (cut)	5,460	cu.m	$ 8.30	$ 45,318.00
(d)	Flood storage (cut)	74,800	cu.m	$ 8.30	$ 620,840.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,200	cu.m	$ 8.30	$ 51,460.00
(g)	Filling (fill)	6,200	cu.m	$ 15.60	$ 96,720.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits.	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 115,000.00	$ 115,000.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	3,216	sq.m	$ 12.50	$ 40,200.00
(b)	Aquatic planting	54,570	sq.m	$ 13.60	$ 742,152.00
(c)	Clay liner	54,570	sq.m	$ 10.40	$ 567,528.00
(d)	Top soiling	120,452	sq.m	$ 3.10	$ 373,401.20
(e)	Hydroseeding	74,977	sq.m	$ 2.10	$ 157,451.70
(f)	Rock beaching	4,548	sq.m	$ 94.00	$ 427,512.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,860,776.90

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	56,700	cu.m	$ 8.30	$ 470,610.00
5.02	Landscaping				
(a)	Terrestrial planting	15,120	sq.m	$ 12.50	$ 189,000.00
(b)	Top soiling	52,920	sq.m	$ 3.10	$ 164,052.00
(c)	Hydroseeding	37,800	sq.m	$ 2.10	$ 79,380.00
5.03	Access Track				
(a)	Crushed rock maintenace track	756	l.m	$ 27.10	$ 20,487.60
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,512	sq.m	$ 60.00	$ 90,720.00
			TOTAL ITEM 5.00		$ 1,014,249.60
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	9.5	sq.m	$ 750,000.00	$ 7,125,000.00
7.02	Retarding Basin/Wetland 2	15	sq.m	$ 750,000.00	$ 11,250,000.00
7.03	Retarding Basin/Wetland 3	6	sq.m	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	12.5	sq.m	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 32,250,000.00

Item	Description of Works	Quantity	Unit	Rate	Amount
8.00	**GRAVITY PIPELINE**				
8.01	Construction of Pipeline				
	Supply all materials, bends, tees and fittings, and construct pipeline including setting out, excavation, bedding, supply and construction of concrete anchorages, backfilling, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN630 PE Pipe				
(i)	Up to and including 2.5m deep trench.	1,570	l.m	$ 550.00	$ 863,500.00
(ii)	From 2.5m up to and including 6.0m deep trench.	470	l.m	$ 650.00	$ 305,500.00
(iii)	Greater than 6.0m deep trench.	1,710	l.m	$ 1,200.00	$ 2,052,000.00
(b)	DN355 PE Pipe				
(i)	Up to and including 2.5m deep trench.	5	l.m	$ 250.00	$ 1,250.00
(ii)	From 2.5m up to and including 6.0m deep trench.	120	l.m	$ 300.00	$ 36,000.00
(c)	DN600 MSCL Pipe				
(i)	Up to and including 2.5m deep trench.	75	l.m	$ 1,350.00	$ 101,250.00
(d)	DN375 MSCL Pipe				
(i)	Up to and including 2.5m deep trench.	15	l.m	$ 900.00	$ 13,500.00
8.02	Construction of Road and Railway Crossing				
	Construction of road and Railway crossing to utilise boring techniques. Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, supply and construction of concrete anchorages, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN600 MSCL Pipe (concrete encased)				
(i)	Up to and including 2.5m depth	20	l.m	$ 3,500.00	$ 70,000.00
(ii)	From 2.5m up to and including 6.0m depth	30	l.m	$ 3,800.00	$ 114,000.00
8.03	Inlet into Bald Hill Reservoir				
	Construct Inlet Structure into Bald Hill Reservoir	1	Item	$ 50,000.00	$ 50,000.00
8.04	Bald Hill Road - Deek Creek Crossing				
	Construct Bald Hill Road, Aerial Bridge Crossing. Including supply and installation of 600 MSCL PIPE and Bolt-on Support Beam for full span of culvert.	1	Item	$ 45,000.00	$ 45,000.00
8.05	Scour Discharge Assembly				
	Supply and Construct Scour Discharge assembly including scour valve, headwall and rock beaching at outlet in accordance with Standard Drawings MRWA-W-307 Details D-F	2	No.	$ 25,000.00	$ 50,000.00
8.06	Isolation Valves				
	Provide Electronically Operated Isolation Valves	2	No.	$ 10,000.00	$ 20,000.00
8.07	Wetland Outlet Structures				
(a)	Wetland W2 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
(b)	Wetland W4 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
8.08	Control Structures				
	Level Sensors and telemetry devices to be provided at inlets and outlet to pipeline	1	Item	$ 50,000.00	$ 50,000.00
			TOTAL ITEM 8.00		$ 3,832,000.00
				TOTAL	**$ 53,930,940.38**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 3-G - Stormwater Harvesting - PRIMED PIPELINE

REVISION: 3 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	34,830	cu.m	$ 8.30	$ 289,089.00
(b)	Sediment Basin 2	5,810	cu.m	$ 8.30	$ 48,223.00
(c)	Sediment Basin 3	5,810	cu.m	$ 8.30	$ 48,223.00
(d)	Flood storage (cut)	101,150	cu.m	$ 8.30	$ 839,545.00
(e)	Free board (cut)	16,100	cu.m	$ 8.30	$ 133,630.00
(f)	Battering (cut)	59,600	cu.m	$ 8.30	$ 494,680.00
(g)	Filling (fill)	5,000	cu.m	$ 15.60	$ 78,000.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 114,875.00	$ 114,875.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,818	sq.m	$ 12.50	$ 22,725.00
(b)	Aquatic planting	58,037	sq.m	$ 13.60	$ 789,300.48
(c)	Clay liner	58,037	sq.m	$ 10.40	$ 603,582.72
(d)	Top soiling	90,164	sq.m	$ 3.10	$ 279,508.40
(e)	Hydroseeding	41,800	sq.m	$ 2.10	$ 87,780.00
(f)	Rock beaching	4,836	sq.m	$ 94.00	$ 454,584.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	760	sq.m	$ 27.10	$ 20,596.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 4,523,219.60

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	21,380	cu.m	$ 8.30	$ 177,454.00
(b)	Sediment Basin 4 (cut)	5,210	cu.m	$ 8.30	$ 43,243.00
(c)	Sediment Basin 5 (cut)	5,210	cu.m	$ 8.30	$ 43,243.00
(d)	Flood storage (cut)	121,636	cu.m	$ 8.30	$ 1,009,578.80
(e)	Free board (cut)	2,300	cu.m	$ 8.30	$ 19,090.00
(f)	Battering (cut)	1,500	cu.m	$ 8.30	$ 12,450.00
(g)	Filling (fill)	21,500	cu.m	$ 15.60	$ 335,400.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 115,500.00	$ 115,500.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,226	sq.m	$ 12.50	$ 27,825.00
(b)	Aquatic planting	71,262	sq.m	$ 13.60	$ 969,163.20
(c)	Clay liner	71,262	sq.m	$ 10.40	$ 741,124.80
(d)	Top soiling	144,062	sq.m	$ 3.10	$ 446,592.20
(e)	Hydroseeding	84,677	sq.m	$ 2.10	$ 177,821.70
(f)	Rock beaching	5,938	sq.m	$ 94.00	$ 558,172.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	780	sq.m	$ 27.10	$ 21,138.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,957,733.70

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	16,570	cu.m	$ 8.30	$ 137,531.00
(b)	Sediment Basin 6 (cut)	5,530	cu.m	$ 8.30	$ 45,899.00
(c)	Flood storage (cut)	67,200	cu.m	$ 8.30	$ 557,760.00
(d)	Free board (cut)	12,100	cu.m	$ 8.30	$ 100,430.00
(e)	Battering (cut)	36,900	cu.m	$ 8.30	$ 306,270.00
(f)	Filling (fill)	500	cu.m	$ 15.60	$ 7,800.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 65,125.00	$ 65,125.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,458	sq.m	$ 12.50	$ 18,225.00
(b)	Aquatic planting	27,606	sq.m	$ 13.60	$ 375,441.60
(c)	Clay liner	2,761	sq.m	$ 10.40	$ 28,716.48
(d)	Top soiling	57,699	sq.m	$ 3.10	$ 178,866.90
(e)	Hydroseeding	34,694	sq.m	$ 2.10	$ 72,857.40
(f)	Rock beaching	2,301	sq.m	$ 94.00	$ 216,294.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,284,989.38

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	32,750	cu.m	$ 8.30	$ 271,825.00
(b)	Sediment Basin 7 (cut)	5,460	cu.m	$ 8.30	$ 45,318.00
(c)	Sediment Basin 8 (cut)	5,460	cu.m	$ 8.30	$ 45,318.00
(d)	Flood storage (cut)	74,800	cu.m	$ 8.30	$ 620,840.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,200	cu.m	$ 8.30	$ 51,460.00
(g)	Filling (fill)	6,200	cu.m	$ 15.60	$ 96,720.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits.	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 115,000.00	$ 115,000.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	3,216	sq.m	$ 12.50	$ 40,200.00
(b)	Aquatic planting	54,570	sq.m	$ 13.60	$ 742,152.00
(c)	Clay liner	54,570	sq.m	$ 10.40	$ 567,528.00
(d)	Top soiling	120,452	sq.m	$ 3.10	$ 373,401.20
(e)	Hydroseeding	74,977	sq.m	$ 2.10	$ 157,451.70
(f)	Rock beaching	4,548	sq.m	$ 94.00	$ 427,512.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,860,776.90

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	56,700	cu.m	$ 8.30	$ 470,610.00
5.02	Landscaping				
(a)	Terrestrial planting	15,120	sq.m	$ 12.50	$ 189,000.00
(b)	Top soiling	52,920	sq.m	$ 3.10	$ 164,052.00
(c)	Hydroseeding	37,800	sq.m	$ 2.10	$ 79,380.00
5.03	Access Track				
(a)	Crushed rock maintenace track	756	l.m	$ 27.10	$ 20,487.60
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,512	sq.m	$ 60.00	$ 90,720.00
			TOTAL ITEM 5.00		$ 1,014,249.60
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	9.5	ha.	$ 750,000.00	$ 7,125,000.00
7.02	Retarding Basin/Wetland 2	15	ha.	$ 750,000.00	$ 11,250,000.00
7.03	Retarding Basin/Wetland 3	6	ha.	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	12.5	ha.	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 32,250,000.00

Item	Description of Works	Quantity	Unit	Rate	Amount
8.00	**PRIMED PIPELINE**				
8.01	Construction of Pipeline Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, bedding, supply and construction of concrete anchorages, backfilling, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN630 PE Pipe	3,750	l.m	$ 550.00	$ 2,062,500.00
(b)	DN355 PE Pipe	125	l.m	$ 650.00	$ 81,250.00
(c)	DN600 MSCL Pipe	75	l.m	$ 1,350.00	$ 101,250.00
(d)	DN375 MSCL Pipe	15	l.m	$ 900.00	$ 13,500.00
8.02	Construction of Road and Railway Crossing Construction of road and Railway crossing to utilise boring techniques. Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, supply and construction of concrete anchorages, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN600 MSCL Pipe (concrete encased)				
(i)	Up to and including 2.5m depth	20	l.m	$ 3,500.00	$ 70,000.00
(ii)	From 2.5m up to and including 6.0m depth	30	l.m	$ 3,800.00	$ 114,000.00
8.03	Inlet into Bald Hill Reservoir Construct Inlet Structure into Bald Hill Reservoir	1	Item	$ 50,000.00	$ 50,000.00
8.04	Bald Hill Road - Deek Creek Crossing Construct Bald Hill Road, Aerial Bridge Crossing. Including supply and installation of 600 MSCL PIPE and Bolt-on Support Beam for full span of culvert.	1	Item	$ 45,000.00	$ 45,000.00
8.05	Scour Discharge Assembly				
(a)	Supply and Construct Scour Discharge assembly including scour valve, headwall and rock beaching at outlet in accordance with Standard Drawings MRWA-W-307 Details D-F	2	No.	$ 25,000.00	$ 50,000.00
(b)	Supply and Construct Scour Discharge assembly including scour valve, all associated fittings and concrete surrounds and concrete block.	2	No.	$ 20,000.00	$ 40,000.00
8.06	Isolation Valves Supply and Install Electronically Operated Isolation Valves	2	No.	$ 7,500.00	$ 15,000.00
8.07	Check Valve (Non-Return) Provide and install Check Valve (Non-return Valve)	2	No.	$ 5,000.00	$ 10,000.00
8.08	Connection Assembly for Pump Supply and install Connection Assembly for Portable Pump	1	Item	$ 5,000.00	$ 5,000.00
8.09	Pump Supply and install 7.5kw axial flow submersible pump (50l/s flowrate)	2	No.	$ 20,000.00	$ 40,000.00
8.10	Wetland Outlet Structures				
(a)	Wetland W2 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
(b)	Wetland W4 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
8.11	Control Structures Level Sensors and telemetry devices to be provided at inlets and outlet to pipeline	1	Item	$ 50,000.00	$ 50,000.00
			TOTAL ITEM 8.00		$ 2,807,500.00
				TOTAL	**$ 52,905,909.18**

5.3 Appendix C: Operational Costs

Maintenance Estimate v6

12221 - PAKENHAM EAST SWH

SUMMARY

OPTION 1A - BAU Treatment to BPEM Standards

1	RB/Wetland 1	$	238,000
2	RB/Wetland 2	$	235,000
3	RB/Wetland 3	$	190,000
4	RB/Wetland 4	$	325,000
5-6	Vegetated Swales	$	334,000
	TOTAL	**$**	**1,322,000 (exc.GST)**

OPTION 2A - BAU Treatment to SEPP-F8 Standards (TSS and TP only)

1	RB/Wetland 1	$	373,000
2	RB/Wetland 2	$	362,000
3	RB/Wetland 3	$	299,000
4	RB/Wetland 4	$	539,000
5-6	Vegetated Swales	$	314,000
	TOTAL	**$**	**1,887,000 (exc.GST)**

OPTION 3-G - SWH and Wetlands Treatment to SEPP-F8 with a Gravity Pipeline

1	RB/Wetland 1	$	358,000
2	RB/Wetland 2	$	351,000
3	RB/Wetland 3	$	199,000
4	RB/Wetland 4	$	343,000
5-6	Vegetated Swales	$	316,000
7	Gravity Pipeline	$	45,000
	TOTAL	**$**	**1,612,000 (exc.GST)**

OPTION 3-G - SWH and Wetlands Treatment to SEPP-F8 with a Primed Pipeline

1	RB/Wetland 1	$	358,000
2	RB/Wetland 2	$	351,000
3	RB/Wetland 3	$	199,000
4	RB/Wetland 4	$	343,000
5-6	Vegetated Swales	$	316,000
7	Primed Pipeline	$	48,000
	TOTAL	**$**	**1,615,000 (exc.GST)**

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 1A - BAU Treatment to BPEM Standards

Date: 8-Mar-16 Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	28,928	28,928	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 15,621.12	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	28,928	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	955	955	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 6,685.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	955	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	955	cu.m	n/a	n/a	$ 250.00	$ 47,725.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	1,909	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	1,938	1,938	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 13,566.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	1,938	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,938	cu.m	n/a	n/a	$ 250.00	$ 96,900.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	3,876	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	50,299	n/a	sq.m	n/a	$ 0.10	n/a	$ 5,029.90	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	2,880	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 1.00		$ 238,067.02				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	35,520	35,520	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 19,180.80	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	35,520	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	1,776	1,776	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 12,432.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	1,776	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,295	cu.m	n/a	n/a	$ 250.00	$ 64,750.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	2,590	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	1,776	1,776	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 12,432.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	1,776	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,295	cu.m	n/a	n/a	$ 250.00	$ 64,750.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	2,590	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	88,128	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,812.80	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	2,800	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 2.00		$ 234,897.60				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	21,500	21,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 11,610.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	21,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,150	2,150	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,050.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,150	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,150	cu.m	n/a	n/a	$ 250.00	$ 107,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,300	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	33,750	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,375.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 190,075.00				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	42,500	42,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 22,950.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	42,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	73,730	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,373.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 325,113.00				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	13,200	13,200	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 67,320.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	13,200	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,300	cu.m	n/a	n/a	$ 250.00	$ 16,500.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	13,200	13,200	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,346.40	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	13,200	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	13,200	cu.m	n/a	n/a	$ 250.00	$ 66,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	16,000	16,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 81,600.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	16,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	4,000	cu.m	n/a	n/a	$ 250.00	$ 20,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	16,000	16,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,632.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	16,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	16,000	cu.m	n/a	n/a	$ 250.00	$ 80,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 334,398.40				

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 2A - BAU Treatment to SEPP-F8 Standards (TSS and TP)

Date: 8-Mar-16 Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Ongoing	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	50,624	50,624	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 27,336.96	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	50,624	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	1,686	1,686	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 11,802.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	1,686	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,686	cu.m	n/a	n/a	$ 250.00	$ 84,300.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	3,372	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,377	3,377	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 23,639.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,377	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,377	cu.m	n/a	n/a	$ 250.00	$ 168,825.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	6,753	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	46,013	n/a	sq.m	n/a	$ 0.10	n/a	$ 4,601.30	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,300	Revised mowing rate from MW 23/2/2016
								TOTAL ITEM 1.00	$ 373,044.26				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	62,160	62,160	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 33,566.40	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	62,160	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,108	3,108	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 21,756.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,108	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,267	cu.m	n/a	n/a	$ 250.00	$ 113,325.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,533	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,108	3,108	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 21,756.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,108	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,267	cu.m	n/a	n/a	$ 250.00	$ 113,325.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,533	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	58,624	n/a	sq.m	n/a	$ 0.10	n/a	$ 5,862.40	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,000	Revised mowing rate from MW 23/2/2016
								TOTAL ITEM 2.00	$ 362,130.80				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	38,700	38,700	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 20,898.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	38,700	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,870	3,870	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 27,090.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,870	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,870	cu.m	n/a	n/a	$ 250.00	$ 193,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,740	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	45,030	n/a	sq.m	n/a	$ 0.10	n/a	$ 4,503.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,400	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 298,531.00				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	76,500	76,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 41,310.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	76,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,825	3,825	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 26,775.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,825	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,825	cu.m	n/a	n/a	$ 250.00	$ 191,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,650	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,825	3,825	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 26,775.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,825	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,825	cu.m	n/a	n/a	$ 250.00	$ 191,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,650	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	89,650	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,965.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	6,200	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 538,865.00				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,400	12,400	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 63,240.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,400	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,100	cu.m	n/a	n/a	$ 250.00	$ 15,500.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,400	12,400	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,264.80	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,400	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,400	cu.m	n/a	n/a	$ 250.00	$ 62,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 313,784.80				

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 3 - SWH and TREATMENT TO SEPP-F8 (GRAVITY PIPE)

Date: 8-Mar-16

Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	48,364	48,364	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 26,116.56	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	48,364	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,418	2,418	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,927.40	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,418	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,418	cu.m	n/a	n/a	$ 250.00	$ 120,910.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,836	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,418	2,418	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,927.40	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,418	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,418	cu.m	n/a	n/a	$ 250.00	$ 120,910.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,836	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	38,760	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,875.96	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,040	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 1.00		$ 358,207.32				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	59,385	59,385	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 32,067.90	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	59,385	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,969	2,969	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,784.75	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,969	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,168	cu.m	n/a	n/a	$ 250.00	$ 108,375.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,335	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,969	2,969	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,784.75	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,969	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,168	cu.m	n/a	n/a	$ 250.00	$ 108,375.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,335	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	81,557	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,155.65	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,120	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 2.00		$ 351,083.05				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	23,005	23,005	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 12,422.70	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	23,005	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,301	2,301	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,103.50	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,301	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,301	cu.m	n/a	n/a	$ 250.00	$ 115,025.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,601	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	32,095	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,209.45	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 199,300.65				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	45,475	45,475	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 24,556.50	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	45,475	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,274	2,274	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,916.25	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,274	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,274	cu.m	n/a	n/a	$ 250.00	$ 113,687.50	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,548	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,274	2,274	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,916.25	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,274	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,274	cu.m	n/a	n/a	$ 250.00	$ 113,687.50	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,548	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	70,458	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,045.75	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 343,349.75				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,600	12,600	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 64,260.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,600	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,150	cu.m	n/a	n/a	$ 250.00	$ 15,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,600	12,600	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,285.20	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,600	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,600	cu.m	n/a	n/a	$ 250.00	$ 63,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 316,075.20				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES
7.00	**Gravity Stormwater Pipeline**									
7.01	Inspections									
(a)	Annual inpsection of pipe including inlets/outlets, valves and telemetry	n/a	1	n/a	ea.	n/a	$ 1,000.00	n/a	$ 1,000.00	Assume 1 full day of inspection for entire pipeline at daily rate of $1,000/day
7.02	Telemetry maintenance									
(a)	Replace batteries / Annual major maintenance	n/a	3	n/a	ea.	n/a	$ 500.00	n/a	$ 1,500.00	
(b)	Quarterly maintenance (minor maintenance/data download)	n/a	12	n/a	ea.	n/a	$ 500.00	n/a	$ 6,000.00	
7.03	Pipeline maintenance									
(a)	Scour pipe to ensure no accumulation of sediment at low points	n/a	1	n/a	ea.	n/a	$ 500.00	n/a	$ 500.00	Assume 1/2 day of scouring and sediment assessment. All stormwater treated to SEPP-F8, so no impact on receiving system
7.04	Easement maintenance									
(a)	Mowing/slashing of easement to maintain access	n/a	12,000	n/a	sq.m	n/a	$ 3.00	n/a	$ 36,000.00	Assume 3m easement
							TOTAL ITEM 7.00		$ 45,000.00	MW WSUD Lifecycle Costing Data, October 2013

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 3 - SWH and TREATMENT TO SEPP-F8 (PRIMED PIPE)

Date: 8-Mar-16 Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	48,364	48,364	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 26,116.56	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	48,364	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,418	2,418	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,927.40	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,418	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,418	cu.m	n/a	n/a	$ 250.00	$ 120,910.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,836	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,418	2,418	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,927.40	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,418	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,418	cu.m	n/a	n/a	$ 250.00	$ 120,910.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,836	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	38,760	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,875.96	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,040	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 1.00		$ 358,207.32				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	59,385	59,385	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 32,067.90	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	59,385	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,969	2,969	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,784.75	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,969	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,168	cu.m	n/a	n/a	$ 250.00	$ 108,375.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,335	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,969	2,969	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,784.75	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,969	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,168	cu.m	n/a	n/a	$ 250.00	$ 108,375.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,335	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	81,557	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,155.65	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,120	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 2.00		$ 351,083.05				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	23,005	23,005	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 12,422.70	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	23,005	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,301	2,301	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,103.50	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,301	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,301	cu.m	n/a	n/a	$ 250.00	$ 115,025.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,601	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	32,095	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,209.45	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 199,300.65				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	45,475	45,475	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 24,556.50	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	45,475	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,274	2,274	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,916.25	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,274	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,274	cu.m	n/a	n/a	$ 250.00	$ 113,687.50	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,548	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,274	2,274	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,916.25	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,274	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,274	cu.m	n/a	n/a	$ 250.00	$ 113,687.50	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,548	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	70,458	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,045.75	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 343,349.75				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,600	12,600	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 64,260.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,600	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,150	cu.m	n/a	n/a	$ 250.00	$ 15,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,600	12,600	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,285.20	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,600	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,600	cu.m	n/a	n/a	$ 250.00	$ 63,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 316,075.20				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES
7.00	**Primed Stormwater Pipeline**									
7.01	Inspections									
(a)	Annual inpsection of pipe including inlets/outlets, valves and telemetry	n/a	1	n/a	ea.	n/a	$ 1,000.00	n/a	$ 1,000.00	Assume 1 full day of inspection for entire pipeline at daily rate of $1,000/day
7.02	Telemetry maintenance									
(a)	Replace batteries / Annual major maintenance	n/a	3	n/a	ea.	n/a	$ 500.00	n/a	$ 1,500.00	
(b)	Quarterly maintenance (minor maintenance/data download)	n/a	12	n/a	ea.	n/a	$ 500.00	n/a	$ 6,000.00	
7.03	Pipeline maintenance									
(a)	Scour pipe to ensure no accumulation of sediment at low points	n/a	1	n/a	ea.	n/a	$ 500.00	n/a	$ 500.00	Assume 1/2 day of scouring and sediment assessment. All stormwater treated to SEPP-F8, so no impact on receiving system
7.04	Easement maintenance									
(a)	Mowing/slashing of easement to maintain access	n/a	12,000	n/a	sq.m	n/a	$ 3.00	n/a	$ 36,000.00	Assume 3m easement — MW WSUD Lifecycle Costing Data, October 2013
7.05	Pump maintenance	n/a								
(a)	Annual cost of power (mains connection)	n/a	2	n/a	ea.	n/a	$ 500.00	n/a	$ 1,000.00	
(b)	Annual cost of power (usage)	n/a	2	n/a	ea.	n/a	$ 250.00	n/a	$ 500.00	
(c)	Annual inspection, service and test run	n/a	2	n/a	ea.	n/a	$ 500.00	n/a	$ 1,000.00	Assume 1 full day to inspect, service and test 2x pumps at a daily rate of 1,000/day
							TOTAL ITEM 7.00		$ 47,500.00	

5.4 Appendix D: Water and Nutrient Balances – MUSIC modelling results

Option 1A:

BAU - BPEMG (No External Catchment)

WETLAND 3 - DIVERSION TO DEEP CREEK

	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	892.383	363.33	529.05	40.7%
TSS (Kg/yr)	82059.1	70083.24	11975.86	85.4%
TP (Kg/yr)	189.051	135.59	53.46	71.7%
TN (Kg/yr)	1443.41	693.14	750.27	48.0%

WETLAND 4 - WESTERN TRIBUTARY

	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	1609.475	658.55	950.93	40.9%
TSS (Kg/yr)	147999.5	130745.26	17254.24	88.3%
TP (Kg/yr)	340.9545	253.59	87.36	74.4%
TN (Kg/yr)	2603.3	1255.68	1347.62	48.2%

WETLAND 1 & 2- HANCOCKS GULLY

	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	3218.95	1541.07	1677.89	47.9%
TSS (Kg/yr)	264665.7	214003.93	50661.77	80.9%
TP (Kg/yr)	627.796	418.06	209.74	66.6%
TN (Kg/yr)	4759.931	2018.65	2741.28	42.4%

CATCHMENT TOTAL

	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	5720.808	2562.944	3157.864	44.8%
TSS (Kg/yr)	494724.3	414832.43	79891.87	83.9%
TP (Kg/yr)	1157.8015	807.2345	350.567	69.7%
TN (Kg/yr)	8806.641	3967.468	4839.173	45.1%

Option 2A:

BAU - SEPP F8

WETLAND 3 - DIVERSION TO DEEP CREEK				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	892.383	386.12	506.27	43.3%
TSS (Kg/yr)	82059.1	77288.84	4770.26	94.2%
TP (Kg/yr)	189.051	153.65	35.40	81.3%
TN (Kg/yr)	1443.41	851.59	591.82	59.0%

WETLAND 4 - WESTERN TRIBUTARY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	1609.475	705.23	904.25	43.8%
TSS (Kg/yr)	147999.5	140944.97	7054.53	95.2%
TP (Kg/yr)	340.966	281.52	59.44	82.6%
TN (Kg/yr)	2603.3	1580.49	1022.81	60.7%

WETLAND 1 & 2- HANCOCKS GULLY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	3218.95	1605.18	1613.78	49.9%
TSS (Kg/yr)	264665.7	241947.35	22718.35	91.4%
TP (Kg/yr)	627.796	491.41	136.39	78.3%
TN (Kg/yr)	4759.931	2629.78	2130.15	55.2%

CATCHMENT TOTAL				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	5720.808	2696.52	3024.29	47.1%
TSS (Kg/yr)	494724.3	460181.16	34543.14	93.0%
TP (Kg/yr)	1157.813	926.58	231.24	80.0%
TN (Kg/yr)	8806.641	5061.86	3744.78	57.5%

Option 3:

SWH - SEPP F8 - 1

WETLAND 3 - DIVERSION TO DEEP CREEK				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	892.383	365.37	527.01	40.9%
TSS (Kg/yr)	82059.1	70415.67	11643.43	85.8%
TP (Kg/yr)	189.051	136.23	52.83	72.1%
TN (Kg/yr)	1443.41	704.13	739.28	48.8%

WETLAND 4 - WESTERN TRIBUTARY				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	1609.475	664.28	945.20	41.3%
TSS (Kg/yr)	147999.5	131408.84	16590.66	88.8%
TP (Kg/yr)	340.966	255.45	85.52	74.9%
TN (Kg/yr)	2603.3	1332.74	1270.56	51.2%

WETLAND 1 & 2- HANCOCKS GULLY & WESTERN TRIB				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	3218.95	1598.68	1620.27	49.7%
TSS (Kg/yr)	264665.7	238196.01	26469.69	90.0%
TP (Kg/yr)	627.796	482.84	144.95	76.9%
TN (Kg/yr)	4759.931	2602.51	2157.42	54.7%

STORMWATER HARVESTING SCHEME				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	240547.908	238945.96	1601.95	99.3%
TSS (Kg/yr)	233535.565	210679.23	22856.34	90.2%
TP (Kg/yr)	757.828	625.41	132.41	82.5%
TN (Kg/yr)	7301.158	5286.84	2014.32	72.4%

PAKENHAM EAST PSP CATCHMENT TOTAL				
	IN	LOSSES	OUT	% REDUCTION
FLOW (ML/yr)	5720.808	2628.32	2128.96	62.8%
TSS (Kg/yr)	494724.3	460224.53	34499.77	93.0%
TP (Kg/yr)	1157.813	874.52	185.24	84.0%
TN (Kg/yr)	8806.641	4639.38	2753.59	68.7%

8.3 Appendix C: Capital Costs

DALTON CONSULTING ENGINEERS

SUMMARY

12221 - PAKENHAM EAST SWH COSTING

REVISION: 2 DATE: 8/3/2016

OPTION 1 - BAU - BPEMG

1	Earthworks	$	6,480,000
2	Drainage works	$	1,220,000
3	Landscaping	$	9,070,000
4	Access Track/Footpaths	$	350,000
5	Land Acquisition	$	32,250,000
	TOTAL	**$**	**49,370,000** **(exc.GST)**

OPTION 1A - BAU - BPEMG (no external catchment)

1	Earthworks	$	6,020,000
2	Drainage works	$	1,210,000
3	Landscaping	$	7,670,000
4	Access Track/Footpaths	$	350,000
5	Land Acquisition	$	30,000,000
	TOTAL	**$**	**45,250,000** **(exc.GST)**

OPTION 2 - BAU - SEPP F8

1	Earthworks	$	13,230,000
2	Drainage works	$	1,420,000
3	Landscaping	$	15,340,000
4	Access Track/Footpaths	$	340,000
5	Land Acquisition	$	48,750,000
	TOTAL	**$**	**79,080,000** **(exc.GST)**

OPTION 2A - BAU - SEPP F8 (no external catchment)

1	Earthworks	$	9,640,000
2	Drainage works	$	1,390,000
3	Landscaping	$	11,700,000
4	Access Track/Footpaths	$	350,000
5	Land Acquisition	$	37,880,000
	TOTAL	**$**	**60,960,000** **(exc.GST)**

OPTION 3-G - SWH - SEPP F8 - GRAVITY PIPELINE

1	Earthworks	$	6,960,000	
2	Drainage works	$	1,260,000	
3	Landscaping	$	9,310,000	
4	Access Track/Footpaths	$	340,000	
5	Land Acquisition	$	32,250,000	
6	Gravity Pipeline	$	3,840,000	
	TOTAL	**$**	**53,960,000**	**(exc.GST)**

OPTION 3-P - SWH - SEPP F8 - PRIMED PIPELINE

1	Earthworks	$	6,960,000	
2	Drainage works	$	1,260,000	
3	Landscaping	$	9,310,000	
4	Access Track/Footpaths	$	340,000	
5	Land Acquisition	$	32,250,000	
6	Primed Pipeline	$	2,810,000	
	TOTAL	**$**	**52,930,000**	**(exc.GST)**

OPTION 4-G - SWH - SEPP F8 - GRAVITY PIPELINE (external treated to BPEM)

1	Earthworks	$	8,390,000	
2	Drainage works	$	1,260,000	
3	Landscaping	$	9,180,000	
4	Access Track/Footpaths	$	350,000	
5	Land Acquisition	$	38,250,000	
6	Gravity Pipeline	$	3,840,000	
	TOTAL	**$**	**61,270,000**	**(exc.GST)**

OPTION 4-P - SWH - SEPP F8 - PRIMED PIPELINE (external treated to BPEM)

1	Earthworks	$	8,390,000	
2	Drainage works	$	1,260,000	
3	Landscaping	$	9,180,000	
4	Access Track/Footpaths	$	350,000	
5	Land Acquisition	$	38,250,000	
6	Primed Pipeline	$	2,810,000	
	TOTAL	**$**	**60,240,000**	**(exc.GST)**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 1 - BAU - BPEMG

REVISION: 2 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	32,400	cu.m	$ 8.30	$ 268,920.00
(b)	Sediment Basin 2	3,580	cu.m	$ 8.30	$ 29,710.68
(c)	Sediment Basin 3	7,268	cu.m	$ 8.30	$ 60,327.72
(d)	Flood storage (cut)	89,000	cu.m	$ 8.30	$ 738,700.00
(e)	Free board (cut)	14,500	cu.m	$ 8.30	$ 120,350.00
(f)	Battering (cut)	47,500	cu.m	$ 8.30	$ 394,250.00
(g)	Filling (fill)	4,500	cu.m	$ 15.60	$ 70,200.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 102,375.00	$ 102,375.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,548	sq.m	$ 12.50	$ 19,350.00
(b)	Aquatic planting	54,240	sq.m	$ 13.60	$ 737,664.00
(c)	Clay liner	54,240	sq.m	$ 10.40	$ 564,096.00
(d)	Top soiling	90,480	sq.m	$ 3.10	$ 280,488.00
(e)	Hydroseeding	34,692	sq.m	$ 2.10	$ 72,853.20
(f)	Rock beaching	4,520	sq.m	$ 94.00	$ 424,880.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	760	sq.m	$ 27.10	$ 20,596.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 4,123,638.60

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	19,200	cu.m	$ 8.30	$ 159,360.00
(b)	Sediment Basin 4 (cut)	4,862	cu.m	$ 8.30	$ 40,357.92
(c)	Sediment Basin 5 (cut)	4,862	cu.m	$ 8.30	$ 40,357.92
(d)	Flood storage (cut)	110,500	cu.m	$ 8.30	$ 917,150.00
(e)	Free board (cut)	2,200	cu.m	$ 8.30	$ 18,260.00
(f)	Battering (cut)	1,600	cu.m	$ 8.30	$ 13,280.00
(g)	Filling (fill)	24,000	cu.m	$ 15.60	$ 374,400.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 107,375.00	$ 107,375.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,880	sq.m	$ 12.50	$ 36,000.00
(b)	Aquatic planting	66,600	sq.m	$ 13.60	$ 905,760.00
(c)	Clay liner	66,600	sq.m	$ 10.40	$ 692,640.00
(d)	Top soiling	144,450	sq.m	$ 3.10	$ 447,795.00
(e)	Hydroseeding	74,970	sq.m	$ 2.10	$ 157,437.00
(f)	Rock beaching	5,550	sq.m	$ 94.00	$ 521,700.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	860	sq.m	$ 27.10	$ 23,306.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,715,116.84

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	15,480	cu.m	$ 8.30	$ 128,484.00
(b)	Sediment Basin 6 (cut)	5,160	cu.m	$ 8.30	$ 42,828.00
(c)	Flood storage (cut)	59,000	cu.m	$ 8.30	$ 489,700.00
(d)	Free board (cut)	10,800	cu.m	$ 8.30	$ 89,640.00
(e)	Battering (cut)	27,700	cu.m	$ 8.30	$ 229,910.00
(f)	Filling (fill)	8,500	cu.m	$ 15.60	$ 132,600.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 64,500.00	$ 64,500.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,500	sq.m	$ 12.50	$ 18,750.00
(b)	Aquatic planting	25,800	sq.m	$ 13.60	$ 350,880.00
(c)	Clay liner	25,800	sq.m	$ 10.40	$ 268,320.00
(d)	Top soiling	57,850	sq.m	$ 3.10	$ 179,335.00
(e)	Hydroseeding	30,550	sq.m	$ 2.10	$ 64,155.00
(f)	Rock beaching	2,150	sq.m	$ 94.00	$ 202,100.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,434,975.00

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	30,000	cu.m	$ 8.30	$ 249,000.00
(b)	Sediment Basin 7 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(c)	Sediment Basin 8 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(d)	Flood storage (cut)	67,500	cu.m	$ 8.30	$ 560,250.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,000	cu.m	$ 8.30	$ 49,800.00
(g)	Filling (fill)	5,200	cu.m	$ 15.60	$ 81,120.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 101,250.00	$ 101,250.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	2,724	sq.m	$ 12.50	$ 34,050.00
(b)	Aquatic planting	51,000	sq.m	$ 13.60	$ 693,600.00
(c)	Clay liner	51,000	sq.m	$ 10.40	$ 530,400.00
(d)	Top soiling	120,750	sq.m	$ 3.10	$ 374,325.00
(e)	Hydroseeding	67,026	sq.m	$ 2.10	$ 140,754.60
(f)	Rock beaching	4,250	sq.m	$ 94.00	$ 399,500.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,604,760.60

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	56,700	cu.m	$ 8.30	$ 470,610.00
5.02	Landscaping				
(a)	Terrestrial planting	15,120	sq.m	$ 12.50	$ 189,000.00
(b)	Top soiling	52,920	sq.m	$ 3.10	$ 164,052.00
(c)	Hydroseeding	37,800	sq.m	$ 2.10	$ 79,380.00
5.03	Access Track				
(a)	Crushed rock maintenace track	756	l.m	$ 27.10	$ 20,487.60
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,512	sq.m	$ 60.00	$ 90,720.00
			TOTAL ITEM 5.00		$ 1,014,249.60
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	9.5	ha.	$ 750,000.00	$ 7,125,000.00
7.02	Retarding Basin/Wetland 2	15	ha.	$ 750,000.00	$ 11,250,000.00
7.03	Retarding Basin/Wetland 3	6	ha.	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	12.5	ha.	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 32,250,000.00
				TOTAL	**$ 49,350,180.64**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 1A - BAU - BPEMG - Northern external catchment not treated

REVISION: 2 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	20,736	cu.m	$ 8.30	$ 172,108.80
(b)	Sediment Basin 2	2,291	cu.m	$ 8.30	$ 19,013.64
(c)	Sediment Basin 3	4,651	cu.m	$ 8.30	$ 38,604.96
(d)	Flood storage (cut)	75,000	cu.m	$ 8.30	$ 622,500.00
(e)	Free board (cut)	12,800	cu.m	$ 8.30	$ 106,240.00
(f)	Battering (cut)	40,700	cu.m	$ 8.30	$ 337,810.00
(g)	Filling (fill)	5,300	cu.m	$ 15.60	$ 82,680.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 100,187.50	$ 100,187.50
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,380	sq.m	$ 12.50	$ 17,250.00
(b)	Aquatic planting	34,714	sq.m	$ 13.60	$ 472,104.96
(c)	Clay liner	34,714	sq.m	$ 10.40	$ 361,021.44
(d)	Top soiling	82,107	sq.m	$ 3.10	$ 254,531.70
(e)	Hydroseeding	46,013	sq.m	$ 2.10	$ 96,628.14
(f)	Rock beaching	2,893	sq.m	$ 94.00	$ 271,942.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	720	sq.m	$ 27.10	$ 19,512.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 3,191,013.14

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	12,288	cu.m	$ 8.30	$ 101,990.40
(b)	Sediment Basin 4 (cut)	3,108	cu.m	$ 8.30	$ 25,796.40
(c)	Sediment Basin 5 (cut)	3,108	cu.m	$ 8.30	$ 25,796.40
(d)	Flood storage (cut)	82,300	cu.m	$ 8.30	$ 683,090.00
(e)	Free board (cut)	500	cu.m	$ 8.30	$ 4,150.00
(f)	Battering (cut)	100	cu.m	$ 8.30	$ 830.00
(g)	Filling (fill)	32,400	cu.m	$ 15.60	$ 505,440.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 97,687.50	$ 97,687.50
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,250	sq.m	$ 12.50	$ 28,125.00
(b)	Aquatic planting	42,624	sq.m	$ 13.60	$ 579,686.40
(c)	Clay liner	42,624	sq.m	$ 10.40	$ 443,289.60
(d)	Top soiling	124,820	sq.m	$ 3.10	$ 386,942.00
(e)	Hydroseeding	79,946	sq.m	$ 2.10	$ 167,886.60
(f)	Rock beaching	5,180	sq.m	$ 94.00	$ 486,920.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	700	sq.m	$ 27.10	$ 18,970.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 3,816,538.30

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	15,480	cu.m	$ 8.30	$ 128,484.00
(b)	Sediment Basin 6 (cut)	5,160	cu.m	$ 8.30	$ 42,828.00
(c)	Flood storage (cut)	59,000	cu.m	$ 8.30	$ 489,700.00
(d)	Free board (cut)	10,800	cu.m	$ 8.30	$ 89,640.00
(e)	Battering (cut)	27,700	cu.m	$ 8.30	$ 229,910.00
(f)	Filling (fill)	8,500	cu.m	$ 15.60	$ 132,600.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 64,500.00	$ 64,500.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,500	sq.m	$ 12.50	$ 18,750.00
(b)	Aquatic planting	25,800	sq.m	$ 13.60	$ 350,880.00
(c)	Clay liner	25,800	sq.m	$ 10.40	$ 268,320.00
(d)	Top soiling	58,400	sq.m	$ 3.10	$ 181,040.00
(e)	Hydroseeding	31,100	sq.m	$ 2.10	$ 65,310.00
(f)	Rock beaching	1,600	sq.m	$ 94.00	$ 150,400.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,386,135.00

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	30,000	cu.m	$ 8.30	$ 249,000.00
(b)	Sediment Basin 7 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(c)	Sediment Basin 8 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(d)	Flood storage (cut)	67,500	cu.m	$ 8.30	$ 560,250.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,000	cu.m	$ 8.30	$ 49,800.00
(g)	Filling (fill)	5,200	cu.m	$ 15.60	$ 81,120.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 101,250.00	$ 101,250.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	2,724	sq.m	$ 12.50	$ 34,050.00
(b)	Aquatic planting	51,000	sq.m	$ 13.60	$ 693,600.00
(c)	Clay liner	51,000	sq.m	$ 10.40	$ 530,400.00
(d)	Top soiling	122,000	sq.m	$ 3.10	$ 378,200.00
(e)	Hydroseeding	68,276	sq.m	$ 2.10	$ 143,379.60
(f)	Rock beaching	3,000	sq.m	$ 94.00	$ 282,000.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,493,760.60

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	59,400	cu.m	$ 8.30	$ 493,020.00
5.02	Landscaping				
(a)	Terrestrial planting	15,840	sq.m	$ 12.50	$ 198,000.00
(b)	Top soiling	55,440	sq.m	$ 3.10	$ 171,864.00
(c)	Hydroseeding	39,600	sq.m	$ 2.10	$ 83,160.00
5.03	Access Track				
(a)	Crushed rock maintenace track	792	l.m	$ 27.10	$ 21,463.20
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,584	sq.m	$ 60.00	$ 95,040.00
			TOTAL ITEM 5.00		$ 1,062,547.20
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	72,000	cu.m	$ 8.30	$ 597,600.00
6.02	Landscaping				
(a)	Terrestrial planting	19,200	sq.m	$ 12.50	$ 240,000.00
(b)	Top soiling	67,200	sq.m	$ 3.10	$ 208,320.00
(c)	Hydroseeding	48,000	sq.m	$ 2.10	$ 100,800.00
6.03	Access Track				
(a)	Crushed rock maintenace track	960	l.m	$ 27.10	$ 26,016.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,920	sq.m	$ 60.00	$ 115,200.00
			TOTAL ITEM 6.00		$ 1,287,936.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	8.5	ha.	$ 750,000.00	$ 6,375,000.00
7.02	Retarding Basin/Wetland 2	13	ha.	$ 750,000.00	$ 9,750,000.00
7.03	Retarding Basin/Wetland 3	6	ha.	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	12.5	ha.	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 30,000,000.00
				TOTAL	**$ 45,237,930.24**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 2 - BAU - SEPP F8

REVISION: 2 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland (cut)	61,834	cu.m	$ 8.30	$ 513,218.88
(b)	Sediment Basin 2 (cut)	6,870	cu.m	$ 8.30	$ 57,021.00
(c)	Sediment Basin 3 (cut)	13,741	cu.m	$ 8.30	$ 114,051.96
(d)	Flood storage (cut)	168,900	cu.m	$ 8.30	$ 1,401,870.00
(e)	Free board (cut)	29,100	cu.m	$ 8.30	$ 241,530.00
(f)	Battering (cut)	173,500	cu.m	$ 8.30	$ 1,440,050.00
(g)	Filling (fill)	4,000	cu.m	$ 15.60	$ 62,400.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 164,375.00	$ 164,375.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	2,496	sq.m	$ 12.50	$ 31,200.00
(b)	Aquatic planting	103,056	sq.m	$ 13.60	$ 1,401,561.60
(c)	Clay liner	103,056	sq.m	$ 10.40	$ 1,071,782.40
(d)	Top soiling	146,412	sq.m	$ 3.10	$ 453,877.20
(e)	Hydroseeding	40,860	sq.m	$ 2.10	$ 85,806.00
(f)	Rock beaching	8,588	sq.m	$ 94.00	$ 807,272.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,000	sq.m	$ 27.10	$ 27,100.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 8,091,994.04

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	39,960	cu.m	$ 8.30	$ 331,668.00
(b)	Sediment Basin 4 (cut)	9,720	cu.m	$ 8.30	$ 80,676.00
(c)	Sediment Basin 5 (cut)	9,720	cu.m	$ 8.30	$ 80,676.00
(d)	Flood storage (cut)	279,500	cu.m	$ 8.30	$ 2,319,850.00
(e)	Free board (cut)	20,000	cu.m	$ 8.30	$ 166,000.00
(f)	Battering (cut)	50,500	cu.m	$ 8.30	$ 419,150.00
(g)	Filling (fill)	16,750	cu.m	$ 15.60	$ 261,300.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 173,750.00	$ 173,750.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	4,140	sq.m	$ 12.50	$ 51,750.00
(b)	Aquatic planting	133,200	sq.m	$ 13.60	$ 1,811,520.00
(c)	Clay liner	133,200	sq.m	$ 10.40	$ 1,385,280.00
(d)	Top soiling	213,900	sq.m	$ 3.10	$ 663,090.00
(e)	Hydroseeding	76,560	sq.m	$ 2.10	$ 160,776.00
(f)	Rock beaching	11,100	sq.m	$ 94.00	$ 1,043,400.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	780	sq.m	$ 27.10	$ 21,138.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 9,229,962.00

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	27,864	cu.m	$ 8.30	$ 231,271.20
(b)	Sediment Basin 6 (cut)	9,288	cu.m	$ 8.30	$ 77,090.40
(c)	Flood storage (cut)	101,000	cu.m	$ 8.30	$ 838,300.00
(d)	Free board (cut)	19,200	cu.m	$ 8.30	$ 159,360.00
(e)	Battering (cut)	155,000	cu.m	$ 8.30	$ 1,286,500.00
(f)	Filling (fill)	150	cu.m	$ 15.60	$ 2,340.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 86,250.00	$ 86,250.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,920	sq.m	$ 12.50	$ 24,000.00
(b)	Aquatic planting	46,440	sq.m	$ 13.60	$ 631,584.00
(c)	Clay liner	46,440	sq.m	$ 10.40	$ 482,976.00
(d)	Top soiling	86,130	sq.m	$ 3.10	$ 267,003.00
(e)	Hydroseeding	37,770	sq.m	$ 2.10	$ 79,317.00
(f)	Rock beaching	3,870	sq.m	$ 94.00	$ 363,780.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	600	sq.m	$ 27.10	$ 16,260.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 4,702,189.60

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	55,080	cu.m	$ 8.30	$ 457,164.00
(b)	Sediment Basin 7 (cut)	9,180	cu.m	$ 8.30	$ 76,194.00
(c)	Sediment Basin 8 (cut)	9,180	cu.m	$ 8.30	$ 76,194.00
(d)	Flood storage (cut)	129,500	cu.m	$ 8.30	$ 1,074,850.00
(e)	Free board (cut)	20,300	cu.m	$ 8.30	$ 168,490.00
(f)	Battering (cut)	36,500	cu.m	$ 8.30	$ 302,950.00
(g)	Filling (fill)	3,500	cu.m	$ 15.60	$ 54,600.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 150,750.00	$ 150,750.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	3,600	sq.m	$ 12.50	$ 45,000.00
(b)	Aquatic planting	91,800	sq.m	$ 13.60	$ 1,248,480.00
(c)	Clay liner	91,800	sq.m	$ 10.40	$ 954,720.00
(d)	Top soiling	172,350	sq.m	$ 3.10	$ 534,285.00
(e)	Hydroseeding	76,950	sq.m	$ 2.10	$ 161,595.00
(f)	Rock beaching	7,650	sq.m	$ 94.00	$ 719,100.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,550	sq.m	$ 27.10	$ 42,005.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 6,279,555.00

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve				
5.01	Earthworks				
(a)	Cut	52,200	cu.m	$ 8.30	$ 433,260.00
5.02	Landscaping				
(a)	Terrestrial planting	13,920	sq.m	$ 12.50	$ 174,000.00
(b)	Top soiling	48,720	sq.m	$ 3.10	$ 151,032.00
(c)	Hydroseeding	34,800	sq.m	$ 2.10	$ 73,080.00
5.03	Access Track				
(a)	Crushed rock maintenace track	696	l.m	$ 27.10	$ 18,861.60
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,392	sq.m	$ 60.00	$ 83,520.00
			TOTAL ITEM 5.00		$ 933,753.60
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	59,400	cu.m	$ 8.30	$ 493,020.00
6.02	Landscaping				
(a)	Terrestrial planting	15,840	sq.m	$ 12.50	$ 198,000.00
(b)	Top soiling	55,440	sq.m	$ 3.10	$ 171,864.00
(c)	Hydroseeding	39,600	sq.m	$ 2.10	$ 83,160.00
6.03	Access Track				
(a)	Crushed rock maintenace track	792	l.m	$ 27.10	$ 21,463.20
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,584	sq.m	$ 60.00	$ 95,040.00
			TOTAL ITEM 6.00		$ 1,062,547.20
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	15.5	ha.	$ 750,000.00	$ 11,625,000.00
7.02	Retarding Basin/Wetland 2	22.5	ha.	$ 750,000.00	$ 16,875,000.00
7.03	Retarding Basin/Wetland 3	9	ha.	$ 750,000.00	$ 6,750,000.00
7.04	Retarding Basin/Wetland 4	18	ha.	$ 750,000.00	$ 13,500,000.00
			TOTAL ITEM 7.00		$ 48,750,000.00
				TOTAL	**$ 79,050,001.44**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 2A - BAU - SEPP F8 - Northern external catchment not treated

REVISION: 2 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland (cut)	36,288	cu.m	$ 8.30	$ 301,190.40
(b)	Sediment Basin 2 (cut)	4,046	cu.m	$ 8.30	$ 33,585.12
(c)	Sediment Basin 3 (cut)	8,104	cu.m	$ 8.30	$ 67,259.88
(d)	Flood storage (cut)	83,300	cu.m	$ 8.30	$ 691,390.00
(e)	Free board (cut)	19,700	cu.m	$ 8.30	$ 163,510.00
(f)	Battering (cut)	113,700	cu.m	$ 8.30	$ 943,710.00
(g)	Filling (fill)	2,000	cu.m	$ 15.60	$ 31,200.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 148,750.00	$ 148,750.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,854	sq.m	$ 12.50	$ 23,175.00
(b)	Aquatic planting	60,749	sq.m	$ 13.60	$ 826,183.68
(c)	Clay liner	60,749	sq.m	$ 10.40	$ 631,787.52
(d)	Top soiling	99,937	sq.m	$ 3.10	$ 309,804.70
(e)	Hydroseeding	37,334	sq.m	$ 2.10	$ 78,401.82
(f)	Rock beaching	5,063	sq.m	$ 94.00	$ 475,922.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	825	sq.m	$ 27.10	$ 22,357.50
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 4,967,105.62

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	21,504	cu.m	$ 8.30	$ 178,483.20
(b)	Sediment Basin 4 (cut)	5,440	cu.m	$ 8.30	$ 45,148.68
(c)	Sediment Basin 5 (cut)	5,440	cu.m	$ 8.30	$ 45,148.68
(d)	Flood storage (cut)	127,900	cu.m	$ 8.30	$ 1,061,570.00
(e)	Free board (cut)	8,200	cu.m	$ 8.30	$ 68,060.00
(f)	Battering (cut)	6,500	cu.m	$ 8.30	$ 53,950.00
(g)	Filling (fill)	7,700	cu.m	$ 15.60	$ 120,120.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 155,000.00	$ 155,000.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	3,000	sq.m	$ 12.50	$ 37,500.00
(b)	Aquatic planting	74,592	sq.m	$ 13.60	$ 1,014,451.20
(c)	Clay liner	74,592	sq.m	$ 10.40	$ 775,756.80
(d)	Top soiling	123,784	sq.m	$ 3.10	$ 383,730.40
(e)	Hydroseeding	46,192	sq.m	$ 2.10	$ 97,003.20
(f)	Rock beaching	6,216	sq.m	$ 94.00	$ 584,304.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	750	sq.m	$ 27.10	$ 20,325.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,900,489.16

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	27,864	cu.m	$ 8.30	$ 231,271.20
(b)	Sediment Basin 6 (cut)	9,288	cu.m	$ 8.30	$ 77,090.40
(c)	Flood storage (cut)	101,000	cu.m	$ 8.30	$ 838,300.00
(d)	Free board (cut)	167,700	cu.m	$ 8.30	$ 1,391,910.00
(e)	Battering (cut)	6,500	cu.m	$ 8.30	$ 53,950.00
(f)	Filling (fill)	150	cu.m	$ 15.60	$ 2,340.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 86,250.00	$ 86,250.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,920	sq.m	$ 12.50	$ 24,000.00
(b)	Aquatic planting	46,440	sq.m	$ 13.60	$ 631,584.00
(c)	Clay liner	46,440	sq.m	$ 10.40	$ 482,976.00
(d)	Top soiling	86,130	sq.m	$ 3.10	$ 267,003.00
(e)	Hydroseeding	37,770	sq.m	$ 2.10	$ 79,317.00
(f)	Rock beaching	3,870	sq.m	$ 94.00	$ 363,780.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	600	sq.m	$ 27.10	$ 16,260.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 4,702,189.60

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	55,080	cu.m	$ 8.30	$ 457,164.00
(b)	Sediment Basin 7 (cut)	9,180	cu.m	$ 8.30	$ 76,194.00
(c)	Sediment Basin 8 (cut)	9,180	cu.m	$ 8.30	$ 76,194.00
(d)	Flood storage (cut)	129,500	cu.m	$ 8.30	$ 1,074,850.00
(e)	Free board (cut)	20,300	cu.m	$ 8.30	$ 168,490.00
(f)	Battering (cut)	36,500	cu.m	$ 8.30	$ 302,950.00
(g)	Filling (fill)	3,500	cu.m	$ 15.60	$ 54,600.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 150,750.00	$ 150,750.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	3,600	sq.m	$ 12.50	$ 45,000.00
(b)	Aquatic planting	91,800	sq.m	$ 13.60	$ 1,248,480.00
(c)	Clay liner	91,800	sq.m	$ 10.40	$ 954,720.00
(d)	Top soiling	172,350	sq.m	$ 3.10	$ 534,285.00
(e)	Hydroseeding	76,950	sq.m	$ 2.10	$ 161,595.00
(f)	Rock beaching	7,650	sq.m	$ 94.00	$ 719,100.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,550	sq.m	$ 27.10	$ 42,005.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 6,279,555.00

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve				
5.01	Earthworks				
(a)	Cut	55,800	cu.m	$ 8.30	$ 463,140.00
5.02	Landscaping				
(a)	Terrestrial planting	14,880	sq.m	$ 12.50	$ 186,000.00
(b)	Top soiling	52,080	sq.m	$ 3.10	$ 161,448.00
(c)	Hydroseeding	37,200	sq.m	$ 2.10	$ 78,120.00
5.03	Access Track				
(a)	Crushed rock maintenace track	744	l.m	$ 27.10	$ 20,162.40
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,488	sq.m	$ 60.00	$ 89,280.00
			TOTAL ITEM 5.00		$ 998,150.40
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	10.5	ha.	$ 750,000.00	$ 7,875,000.00
7.02	Retarding Basin/Wetland 2	13	ha.	$ 750,000.00	$ 9,750,000.00
7.03	Retarding Basin/Wetland 3	9	ha.	$ 750,000.00	$ 6,750,000.00
7.04	Retarding Basin/Wetland 4	18	ha.	$ 750,000.00	$ 13,500,000.00
			TOTAL ITEM 7.00		$ 37,875,000.00
				TOTAL	**$ 60,929,929.78**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 3-G - SWH - GRAVITY PIPELINE

REVISION: 2 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	34,830	cu.m	$ 8.30	$ 289,089.00
(b)	Sediment Basin 2	5,810	cu.m	$ 8.30	$ 48,223.00
(c)	Sediment Basin 3	5,810	cu.m	$ 8.30	$ 48,223.00
(d)	Flood storage (cut)	101,150	cu.m	$ 8.30	$ 839,545.00
(e)	Free board (cut)	16,100	cu.m	$ 8.30	$ 133,630.00
(f)	Battering (cut)	59,600	cu.m	$ 8.30	$ 494,680.00
(g)	Filling (fill)	5,000	cu.m	$ 15.60	$ 78,000.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, , including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 114,875.00	$ 114,875.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,818	sq.m	$ 12.50	$ 22,725.00
(b)	Aquatic planting	58,037	sq.m	$ 13.60	$ 789,300.48
(c)	Clay liner	58,037	sq.m	$ 10.40	$ 603,582.72
(d)	Top soiling	90,164	sq.m	$ 3.10	$ 279,508.40
(e)	Hydroseeding	41,800	sq.m	$ 2.10	$ 87,780.00
(f)	Rock beaching	4,836	sq.m	$ 94.00	$ 454,584.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	760	sq.m	$ 27.10	$ 20,596.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 4,523,219.60

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	21,380	cu.m	$ 8.30	$ 177,454.00
(b)	Sediment Basin 4 (cut)	5,210	cu.m	$ 8.30	$ 43,243.00
(c)	Sediment Basin 5 (cut)	5,210	cu.m	$ 8.30	$ 43,243.00
(d)	Flood storage (cut)	121,700	cu.m	$ 8.30	$ 1,010,110.00
(e)	Free board (cut)	2,300	cu.m	$ 8.30	$ 19,090.00
(f)	Battering (cut)	1,500	cu.m	$ 8.30	$ 12,450.00
(g)	Filling (fill)	21,500	cu.m	$ 15.60	$ 335,400.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 115,500.00	$ 115,500.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,226	sq.m	$ 12.50	$ 27,825.00
(b)	Aquatic planting	71,262	sq.m	$ 13.60	$ 969,163.20
(c)	Clay liner	71,262	sq.m	$ 10.40	$ 741,124.80
(d)	Top soiling	144,062	sq.m	$ 3.10	$ 446,592.20
(e)	Hydroseeding	84,677	sq.m	$ 2.10	$ 177,821.70
(f)	Rock beaching	5,938	sq.m	$ 94.00	$ 558,172.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	780	sq.m	$ 27.10	$ 21,138.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,958,264.90

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	16,570	cu.m	$ 8.30	$ 137,531.00
(b)	Sediment Basin 6 (cut)	5,530	cu.m	$ 8.30	$ 45,899.00
(c)	Flood storage (cut)	67,200	cu.m	$ 8.30	$ 557,760.00
(d)	Free board (cut)	12,100	cu.m	$ 8.30	$ 100,430.00
(e)	Battering (cut)	36,900	cu.m	$ 8.30	$ 306,270.00
(f)	Filling (fill)	500	cu.m	$ 15.60	$ 7,800.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 65,125.00	$ 65,125.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,458	sq.m	$ 12.50	$ 18,225.00
(b)	Aquatic planting	27,606	sq.m	$ 13.60	$ 375,441.60
(c)	Clay liner	2,761	sq.m	$ 10.40	$ 28,716.48
(d)	Top soiling	57,699	sq.m	$ 3.10	$ 178,866.90
(e)	Hydroseeding	34,694	sq.m	$ 2.10	$ 72,857.40
(f)	Rock beaching	2,301	sq.m	$ 94.00	$ 216,294.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,284,989.38

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	32,750	cu.m	$ 8.30	$ 271,825.00
(b)	Sediment Basin 7 (cut)	5,460	cu.m	$ 8.30	$ 45,318.00
(c)	Sediment Basin 8 (cut)	5,460	cu.m	$ 8.30	$ 45,318.00
(d)	Flood storage (cut)	74,800	cu.m	$ 8.30	$ 620,840.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,200	cu.m	$ 8.30	$ 51,460.00
(g)	Filling (fill)	6,200	cu.m	$ 15.60	$ 96,720.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits.	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 115,000.00	$ 115,000.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	3,216	sq.m	$ 12.50	$ 40,200.00
(b)	Aquatic planting	54,570	sq.m	$ 13.60	$ 742,152.00
(c)	Clay liner	54,570	sq.m	$ 10.40	$ 567,528.00
(d)	Top soiling	120,452	sq.m	$ 3.10	$ 373,401.20
(e)	Hydroseeding	74,977	sq.m	$ 2.10	$ 157,451.70
(f)	Rock beaching	4,548	sq.m	$ 94.00	$ 427,512.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,860,776.90

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	56,700	cu.m	$ 8.30	$ 470,610.00
5.02	Landscaping				
(a)	Terrestrial planting	15,120	sq.m	$ 12.50	$ 189,000.00
(b)	Top soiling	52,920	sq.m	$ 3.10	$ 164,052.00
(c)	Hydroseeding	37,800	sq.m	$ 2.10	$ 79,380.00
5.03	Access Track				
(a)	Crushed rock maintenace track	756	l.m	$ 27.10	$ 20,487.60
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,512	sq.m	$ 60.00	$ 90,720.00
			TOTAL ITEM 5.00		$ 1,014,249.60
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	9.5	sq.m	$ 750,000.00	$ 7,125,000.00
7.02	Retarding Basin/Wetland 2	15	sq.m	$ 750,000.00	$ 11,250,000.00
7.03	Retarding Basin/Wetland 3	6	sq.m	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	12.5	sq.m	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 32,250,000.00

Item	Description of Works	Quantity	Unit	Rate	Amount
8.00	**GRAVITY PIPELINE**				
8.01	Construction of Pipeline				
	Supply all materials, bends, tees and fittings, and construct pipeline including setting out, excavation, bedding, supply and construction of concrete anchorages, backfilling, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN630 PE Pipe				
(i)	Up to and including 2.5m deep trench.	1,570	l.m	$ 550.00	$ 863,500.00
(ii)	From 2.5m up to and including 6.0m deep trench.	470	l.m	$ 650.00	$ 305,500.00
(iii)	Greater than 6.0m deep trench.	1,710	l.m	$ 1,200.00	$ 2,052,000.00
(b)	DN355 PE Pipe				
(i)	Up to and including 2.5m deep trench.	5	l.m	$ 250.00	$ 1,250.00
(ii)	From 2.5m up to and including 6.0m deep trench.	120	l.m	$ 300.00	$ 36,000.00
(c)	DN600 MSCL Pipe				
(i)	Up to and including 2.5m deep trench.	75	l.m	$ 1,350.00	$ 101,250.00
(d)	DN375 MSCL Pipe				
(i)	Up to and including 2.5m deep trench.	15	l.m	$ 900.00	$ 13,500.00
8.02	Construction of Road and Railway Crossing				
	Construction of road and Railway crossing to utilise boring techniques. Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, supply and construction of concrete anchorages, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN600 MSCL Pipe (concrete encased)				
(i)	Up to and including 2.5m depth	20	l.m	$ 3,500.00	$ 70,000.00
(ii)	From 2.5m up to and including 6.0m depth	30	l.m	$ 3,800.00	$ 114,000.00
8.03	Inlet into Bald Hill Reservoir				
	Construct Inlet Structure into Bald Hill Reservoir	1	Item	$ 50,000.00	$ 50,000.00
8.04	Bald Hill Road - Deek Creek Crossing				
	Construct Bald Hill Road, Aerial Bridge Crossing. Including supply and installation of 600 MSCL PIPE and Bolt-on Support Beam for full span of culvert.	1	Item	$ 45,000.00	$ 45,000.00
8.05	Scour Discharge Assembly				
	Supply and Construct Scour Discharge assembly including scour valve, headwall and rock beaching at outlet in accordance with Standard Drawings MRWA-W-307 Details D-F	2	No.	$ 25,000.00	$ 50,000.00
8.06	Isolation Valves				
	Provide Electronically Operated Isolation Valves	2	No.	$ 10,000.00	$ 20,000.00
8.07	Wetland Outlet Structures				
(a)	Wetland W2 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
(b)	Wetland W4 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
8.08	Control Structures				
	Level Sensors and telemetry devices to be provided at inlets and outlet to pipeline	1	Item	$ 50,000.00	$ 50,000.00
			TOTAL ITEM 8.00		$ 3,832,000.00
				TOTAL	**$ 53,930,940.38**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 3-P - SWH - PRIMED PIPELINE

REVISION: 2 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	34,830	cu.m	$ 8.30	$ 289,089.00
(b)	Sediment Basin 2	5,810	cu.m	$ 8.30	$ 48,223.00
(c)	Sediment Basin 3	5,810	cu.m	$ 8.30	$ 48,223.00
(d)	Flood storage (cut)	101,150	cu.m	$ 8.30	$ 839,545.00
(e)	Free board (cut)	16,100	cu.m	$ 8.30	$ 133,630.00
(f)	Battering (cut)	59,600	cu.m	$ 8.30	$ 494,680.00
(g)	Filling (fill)	5,000	cu.m	$ 15.60	$ 78,000.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 114,875.00	$ 114,875.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,818	sq.m	$ 12.50	$ 22,725.00
(b)	Aquatic planting	58,037	sq.m	$ 13.60	$ 789,300.48
(c)	Clay liner	58,037	sq.m	$ 10.40	$ 603,582.72
(d)	Top soiling	90,164	sq.m	$ 3.10	$ 279,508.40
(e)	Hydroseeding	41,800	sq.m	$ 2.10	$ 87,780.00
(f)	Rock beaching	4,836	sq.m	$ 94.00	$ 454,584.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	760	sq.m	$ 27.10	$ 20,596.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 4,523,219.60

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	21,380	cu.m	$ 8.30	$ 177,454.00
(b)	Sediment Basin 4 (cut)	5,210	cu.m	$ 8.30	$ 43,243.00
(c)	Sediment Basin 5 (cut)	5,210	cu.m	$ 8.30	$ 43,243.00
(d)	Flood storage (cut)	121,636	cu.m	$ 8.30	$ 1,009,578.80
(e)	Free board (cut)	2,300	cu.m	$ 8.30	$ 19,090.00
(f)	Battering (cut)	1,500	cu.m	$ 8.30	$ 12,450.00
(g)	Filling (fill)	21,500	cu.m	$ 15.60	$ 335,400.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 115,500.00	$ 115,500.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,226	sq.m	$ 12.50	$ 27,825.00
(b)	Aquatic planting	71,262	sq.m	$ 13.60	$ 969,163.20
(c)	Clay liner	71,262	sq.m	$ 10.40	$ 741,124.80
(d)	Top soiling	144,062	sq.m	$ 3.10	$ 446,592.20
(e)	Hydroseeding	84,677	sq.m	$ 2.10	$ 177,821.70
(f)	Rock beaching	5,938	sq.m	$ 94.00	$ 558,172.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	780	sq.m	$ 27.10	$ 21,138.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,957,733.70

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	16,570	cu.m	$ 8.30	$ 137,531.00
(b)	Sediment Basin 6 (cut)	5,530	cu.m	$ 8.30	$ 45,899.00
(c)	Flood storage (cut)	67,200	cu.m	$ 8.30	$ 557,760.00
(d)	Free board (cut)	12,100	cu.m	$ 8.30	$ 100,430.00
(e)	Battering (cut)	36,900	cu.m	$ 8.30	$ 306,270.00
(f)	Filling (fill)	500	cu.m	$ 15.60	$ 7,800.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 65,125.00	$ 65,125.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,458	sq.m	$ 12.50	$ 18,225.00
(b)	Aquatic planting	27,606	sq.m	$ 13.60	$ 375,441.60
(c)	Clay liner	2,761	sq.m	$ 10.40	$ 28,716.48
(d)	Top soiling	57,699	sq.m	$ 3.10	$ 178,866.90
(e)	Hydroseeding	34,694	sq.m	$ 2.10	$ 72,857.40
(f)	Rock beaching	2,301	sq.m	$ 94.00	$ 216,294.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,284,989.38

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	32,750	cu.m	$ 8.30	$ 271,825.00
(b)	Sediment Basin 7 (cut)	5,460	cu.m	$ 8.30	$ 45,318.00
(c)	Sediment Basin 8 (cut)	5,460	cu.m	$ 8.30	$ 45,318.00
(d)	Flood storage (cut)	74,800	cu.m	$ 8.30	$ 620,840.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,200	cu.m	$ 8.30	$ 51,460.00
(g)	Filling (fill)	6,200	cu.m	$ 15.60	$ 96,720.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits.	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 115,000.00	$ 115,000.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	3,216	sq.m	$ 12.50	$ 40,200.00
(b)	Aquatic planting	54,570	sq.m	$ 13.60	$ 742,152.00
(c)	Clay liner	54,570	sq.m	$ 10.40	$ 567,528.00
(d)	Top soiling	120,452	sq.m	$ 3.10	$ 373,401.20
(e)	Hydroseeding	74,977	sq.m	$ 2.10	$ 157,451.70
(f)	Rock beaching	4,548	sq.m	$ 94.00	$ 427,512.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,860,776.90

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	56,700	cu.m	$ 8.30	$ 470,610.00
5.02	Landscaping				
(a)	Terrestrial planting	15,120	sq.m	$ 12.50	$ 189,000.00
(b)	Top soiling	52,920	sq.m	$ 3.10	$ 164,052.00
(c)	Hydroseeding	37,800	sq.m	$ 2.10	$ 79,380.00
5.03	Access Track				
(a)	Crushed rock maintenace track	756	l.m	$ 27.10	$ 20,487.60
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,512	sq.m	$ 60.00	$ 90,720.00
			TOTAL ITEM 5.00		$ 1,014,249.60
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	9.5	ha.	$ 750,000.00	$ 7,125,000.00
7.02	Retarding Basin/Wetland 2	15	ha.	$ 750,000.00	$ 11,250,000.00
7.03	Retarding Basin/Wetland 3	6	ha.	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	12.5	ha.	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 32,250,000.00

Item	Description of Works	Quantity	Unit	Rate	Amount
8.00	**PRIMED PIPELINE**				
8.01	Construction of Pipeline Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, bedding, supply and construction of concrete anchorages, backfilling, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN630 PE Pipe	3,750	l.m	$ 550.00	$ 2,062,500.00
(b)	DN355 PE Pipe	125	l.m	$ 650.00	$ 81,250.00
(c)	DN600 MSCL Pipe	75	l.m	$ 1,350.00	$ 101,250.00
(d)	DN375 MSCL Pipe	15	l.m	$ 900.00	$ 13,500.00
8.02	Construction of Road and Railway Crossing Construction of road and Railway crossing to utilise boring techniques. Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, supply and construction of concrete anchorages, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN600 MSCL Pipe (concrete encased)				
(i)	Up to and including 2.5m depth	20	l.m	$ 3,500.00	$ 70,000.00
(ii)	From 2.5m up to and including 6.0m depth	30	l.m	$ 3,800.00	$ 114,000.00
8.03	Inlet into Bald Hill Reservoir Construct Inlet Structure into Bald Hill Reservoir	1	Item	$ 50,000.00	$ 50,000.00
8.04	Bald Hill Road - Deek Creek Crossing Construct Bald Hill Road, Aerial Bridge Crossing. Including supply and installation of 600 MSCL PIPE and Bolt-on Support Beam for full span of culvert.	1	Item	$ 45,000.00	$ 45,000.00
8.05	Scour Discharge Assembly				
(a)	Supply and Construct Scour Discharge assembly including scour valve, headwall and rock beaching at outlet in accordance with Standard Drawings MRWA-W-307 Details D-F	2	No.	$ 25,000.00	$ 50,000.00
(b)	Supply and Construct Scour Discharge assembly including scour valve, all associated fittings and concrete surrounds and concrete block.	2	No.	$ 20,000.00	$ 40,000.00
8.06	Isolation Valves Supply and Install Electronically Operated Isolation Valves	2	No.	$ 7,500.00	$ 15,000.00
8.07	Check Valve (Non-Return) Provide and install Check Valve (Non-return Valve)	2	No.	$ 5,000.00	$ 10,000.00
8.08	Connection Assembly for Pump Supply and install Connection Assembly for Portable Pump	1	Item	$ 5,000.00	$ 5,000.00
8.09	Pump Supply and install 7.5kw axial flow submersible pump (50l/s flowrate)	2	No.	$ 20,000.00	$ 40,000.00
8.10	Wetland Outlet Structures				
(a)	Wetland W2 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
(b)	Wetland W4 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
8.11	Control Structures Level Sensors and telemetry devices to be provided at inlets and outlet to pipeline	1	Item	$ 50,000.00	$ 50,000.00
			TOTAL ITEM 8.00		$ 2,807,500.00
				TOTAL	**$ 52,905,909.18**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 4-G - SWH - GRAVITY PIPELINE - Northern external catchment treated to BPEMG

REVISION: 2 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	57,280	cu.m	$ 8.30	$ 475,424.00
(b)	Sediment Basin 2	6,370	cu.m	$ 8.30	$ 52,871.00
(c)	Sediment Basin 3	6,370	cu.m	$ 8.30	$ 52,871.00
(d)	Flood storage (cut)	164,200	cu.m	$ 8.30	$ 1,362,860.00
(e)	Free board (cut)	28,500	cu.m	$ 8.30	$ 236,550.00
(f)	Battering (cut)	165,300	cu.m	$ 8.30	$ 1,371,990.00
(g)	Filling (fill)	4,500	cu.m	$ 15.60	$ 70,200.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 136,375.00	$ 136,375.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,818	sq.m	$ 12.50	$ 22,725.00
(b)	Aquatic planting	58,037	sq.m	$ 13.60	$ 789,300.48
(c)	Clay liner	58,037	sq.m	$ 10.40	$ 603,582.72
(d)	Top soiling	90,164	sq.m	$ 3.10	$ 279,508.40
(e)	Hydroseeding	41,800	sq.m	$ 2.10	$ 87,780.00
(f)	Rock beaching	4,836	sq.m	$ 94.00	$ 454,584.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,180	sq.m	$ 27.10	$ 31,978.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 6,247,477.60

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	19,200	cu.m	$ 8.30	$ 159,360.00
(b)	Sediment Basin 4 (cut)	4,862	cu.m	$ 8.30	$ 40,357.92
(c)	Sediment Basin 5 (cut)	4,862	cu.m	$ 8.30	$ 40,357.92
(d)	Flood storage (cut)	110,500	cu.m	$ 8.30	$ 917,150.00
(e)	Free board (cut)	2,200	cu.m	$ 8.30	$ 18,260.00
(f)	Battering (cut)	1,600	cu.m	$ 8.30	$ 13,280.00
(g)	Filling (fill)	24,000	cu.m	$ 15.60	$ 374,400.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 107,375.00	$ 107,375.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,880	sq.m	$ 12.50	$ 36,000.00
(b)	Aquatic planting	66,600	sq.m	$ 13.60	$ 905,760.00
(c)	Clay liner	66,600	sq.m	$ 10.40	$ 692,640.00
(d)	Top soiling	144,450	sq.m	$ 3.10	$ 447,795.00
(e)	Hydroseeding	74,970	sq.m	$ 2.10	$ 157,437.00
(f)	Rock beaching	5,550	sq.m	$ 94.00	$ 521,700.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	860	sq.m	$ 27.10	$ 23,306.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,715,116.84

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	15,480	cu.m	$ 8.30	$ 128,484.00
(b)	Sediment Basin 6 (cut)	5,160	cu.m	$ 8.30	$ 42,828.00
(c)	Flood storage (cut)	59,000	cu.m	$ 8.30	$ 489,700.00
(d)	Free board (cut)	10,800	cu.m	$ 8.30	$ 89,640.00
(e)	Battering (cut)	27,700	cu.m	$ 8.30	$ 229,910.00
(f)	Filling (fill)	8,500	cu.m	$ 15.60	$ 132,600.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 64,500.00	$ 64,500.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,500	sq.m	$ 12.50	$ 18,750.00
(b)	Aquatic planting	25,800	sq.m	$ 13.60	$ 350,880.00
(c)	Clay liner	25,800	sq.m	$ 10.40	$ 268,320.00
(d)	Top soiling	57,850	sq.m	$ 3.10	$ 179,335.00
(e)	Hydroseeding	30,550	sq.m	$ 2.10	$ 64,155.00
(f)	Rock beaching	2,150	sq.m	$ 94.00	$ 202,100.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,434,975.00

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	30,000	cu.m	$ 8.30	$ 249,000.00
(b)	Sediment Basin 7 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(c)	Sediment Basin 8 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(d)	Flood storage (cut)	67,500	cu.m	$ 8.30	$ 560,250.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,000	cu.m	$ 8.30	$ 49,800.00
(g)	Filling (fill)	5,200	cu.m	$ 15.60	$ 81,120.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits.	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 101,250.00	$ 101,250.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	2,724	sq.m	$ 12.50	$ 34,050.00
(b)	Aquatic planting	51,000	sq.m	$ 13.60	$ 693,600.00
(c)	Clay liner	51,000	sq.m	$ 10.40	$ 530,400.00
(d)	Top soiling	120,750	sq.m	$ 3.10	$ 374,325.00
(e)	Hydroseeding	67,026	sq.m	$ 2.10	$ 140,754.60
(f)	Rock beaching	4,250	sq.m	$ 94.00	$ 399,500.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,604,760.60

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	53,100	cu.m	$ 8.30	$ 440,730.00
5.02	Landscaping				
(a)	Terrestrial planting	14,160	sq.m	$ 12.50	$ 177,000.00
(b)	Top soiling	49,560	sq.m	$ 3.10	$ 153,636.00
(c)	Hydroseeding	35,400	sq.m	$ 2.10	$ 74,340.00
5.03	Access Track				
(a)	Crushed rock maintenace track	708	l.m	$ 27.10	$ 19,186.80
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,416	sq.m	$ 60.00	$ 84,960.00
			TOTAL ITEM 5.00		$ 949,852.80
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	18	ha.	$ 750,000.00	$ 13,125,000.00
7.02	Retarding Basin/Wetland 2	15	ha.	$ 750,000.00	$ 11,250,000.00
7.03	Retarding Basin/Wetland 3	6	ha.	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	13	ha.	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 38,250,000.00

Item	Description of Works	Quantity	Unit	Rate	Amount
8.00	**GRAVITY PIPELINE**				
8.01	Construction of Pipeline				
	Supply all materials, bends, tees and fittings, and construct				
(a)	DN630 PE Pipe				
(i)	Up to and including 2.5m deep trench.	1,570	l.m	$ 550.00	$ 863,500.00
(ii)	From 2.5m up to and including 6.0m deep trench.	470	l.m	$ 650.00	$ 305,500.00
(iii)	Greater than 6.0m deep trench.	1,710	l.m	$ 1,200.00	$ 2,052,000.00
(b)	DN355 PE Pipe				
(i)	Up to and including 2.5m deep trench.	5	l.m	$ 250.00	$ 1,250.00
(ii)	From 2.5m up to and including 6.0m deep trench.	120	l.m	$ 300.00	$ 36,000.00
(c)	DN600 MSCL Pipe				
(i)	Up to and including 2.5m deep trench.	75	l.m	$ 1,350.00	$ 101,250.00
(d)	DN375 MSCL Pipe				
(i)	Up to and including 2.5m deep trench.	15	l.m	$ 900.00	$ 13,500.00
8.02	Construction of Road and Railway Crossing				
	Construction of road and Railway crossing to utilise boring techniques. Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, supply and construction of concrete anchorages, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN600 MSCL Pipe (concrete encased)				
(i)	Up to and including 2.5m depth	20	l.m	$ 3,500.00	$ 70,000.00
(ii)	From 2.5m up to and including 6.0m depth	30	l.m	$ 3,800.00	$ 114,000.00
8.03	Inlet into Bald Hill Reservoir				
	Construct Inlet Structure into Bald Hill Reservoir	1	Item	$ 50,000.00	$ 50,000.00
8.04	Bald Hill Road - Deek Creek Crossing				
	Construct Bald Hill Road, Aerial Bridge Crossing. Including supply and installation of 600 MSCL PIPE and Bolt-on Support Beam for full span of culvert.	1	Item	$ 45,000.00	$ 45,000.00
8.05	Scour Discharge Assembly				
	Supply and Construct Scour Discharge assembly including scour valve, headwall and rock beaching at outlet in accordance with Standard Drawings MRWA-W-307 Details D-F	2	No.	$ 25,000.00	$ 50,000.00
8.06	Isolation Valves				
	Provide Electronically Operated Isolation Valves	2	No.	$ 10,000.00	$ 20,000.00
8.07	Wetland Outlet Structures				
(a)	Wetland W2 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
(b)	Wetland W4 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
8.08	Control Structures				
	Level Sensors and telemetry devices to be provided at inlets and outlet to pipeline	1	Item	$ 50,000.00	$ 50,000.00
			TOTAL ITEM 8.00		$ 3,832,000.00
				TOTAL	**$ 61,241,622.84**

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
COST ESTIMATE
OPTION 4-P - SWH - PRIMED PIPELINE - Northern external catchment treated to BPEMG

REVISION: 2 Date: 8/3/2016

Item	Description of Works	Quantity	Unit	Rate	Amount
1.00	**RETARDING BASIN/WETLAND 1**				
1.01	Earthworks				
(a)	Wetland	57,280	cu.m	$ 8.30	$ 475,424.00
(b)	Sediment Basin 2	6,370	cu.m	$ 8.30	$ 52,871.00
(c)	Sediment Basin 3	6,370	cu.m	$ 8.30	$ 52,871.00
(d)	Flood storage (cut)	164,200	cu.m	$ 8.30	$ 1,362,860.00
(e)	Free board (cut)	28,500	cu.m	$ 8.30	$ 236,550.00
(f)	Battering (cut)	165,300	cu.m	$ 8.30	$ 1,371,990.00
(g)	Filling (fill)	4,500	cu.m	$ 15.60	$ 70,200.00
1.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1350mm dia pipe	1	Item	$ 10,000.00	$ 10,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
1.03	Outlet from wetland				
(a)	Riser pit (6.0m x 1.2m)	1	Item	$ 30,000.00	$ 30,000.00
1.04	Outlet from Retarding Basin				
(a)	4 x 1050mm dia RRJ drainage pipes	20	l.m	$ 3,256.00	$ 65,120.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 1050mm dia pipe	1	Item	$ 40,000.00	$ 40,000.00
1.05	Balance Pipes				
(a)	750mm dia RRJ balance pipe from sediment basin 2 to wetland, including inlet and outlet pit	1	Item	$ 8,290.00	$ 8,290.00
(b)	825mm dia RRJ balance pipe from sediment basin 3 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits	1	Item	$ 136,375.00	$ 136,375.00
1.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, including rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
1.07	Landscaping				
(a)	Terrestrial planting	1,818	sq.m	$ 12.50	$ 22,725.00
(b)	Aquatic planting	58,037	sq.m	$ 13.60	$ 789,300.48
(c)	Clay liner	58,037	sq.m	$ 10.40	$ 603,582.72
(d)	Top soiling	90,164	sq.m	$ 3.10	$ 279,508.40
(e)	Hydroseeding	41,800	sq.m	$ 2.10	$ 87,780.00
(f)	Rock beaching	4,836	sq.m	$ 94.00	$ 454,584.00
1.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,180	sq.m	$ 27.10	$ 31,978.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 1.00		$ 6,247,477.60

Item	Description of Works	Quantity	Unit	Rate	Amount
2.00	**RETARDING BASIN/WETLAND 2**				
2.01	Earthworks				
(a)	Wetland (cut)	19,200	cu.m	$ 8.30	$ 159,360.00
(b)	Sediment Basin 4 (cut)	4,862	cu.m	$ 8.30	$ 40,357.92
(c)	Sediment Basin 5 (cut)	4,862	cu.m	$ 8.30	$ 40,357.92
(d)	Flood storage (cut)	110,500	cu.m	$ 8.30	$ 917,150.00
(e)	Free board (cut)	2,200	cu.m	$ 8.30	$ 18,260.00
(f)	Battering (cut)	1,600	cu.m	$ 8.30	$ 13,280.00
(g)	Filling (fill)	24,000	cu.m	$ 15.60	$ 374,400.00
2.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1650mm dia pipe	1	Item	$ 18,000.00	$ 18,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
2.03	Outlet from wetland				
(a)	Riser pit (7.5m x 1.2m)	1	Item	$ 35,000.00	$ 35,000.00
2.04	Outlet from Retarding Basin				
(a)	5 x 1050mm dia RRJ drainage pipes	20	l.m	$ 4,070.00	$ 81,400.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 5 x 1050mm dia pipe	1	Item	$ 50,000.00	$ 50,000.00
2.05	Balance Pipes				
(a)	900mm dia RRJ balance pipe from sediment basin 4 to wetland, including inlet and outlet pit	1	Item	$ 10,070.00	$ 10,070.00
(b)	825mm dia RRJ balance pipe from sediment basin 5 to wetland, including inlet and outlet pit	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 107,375.00	$ 107,375.00
2.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
2.07	Landscaping				
(a)	Terrestrial planting	2,880	sq.m	$ 12.50	$ 36,000.00
(b)	Aquatic planting	66,600	sq.m	$ 13.60	$ 905,760.00
(c)	Clay liner	66,600	sq.m	$ 10.40	$ 692,640.00
(d)	Top soiling	144,450	sq.m	$ 3.10	$ 447,795.00
(e)	Hydroseeding	74,970	sq.m	$ 2.10	$ 157,437.00
(f)	Rock beaching	5,550	sq.m	$ 94.00	$ 521,700.00
2.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	860	sq.m	$ 27.10	$ 23,306.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 2.00		$ 4,715,116.84

Item	Description of Works	Quantity	Unit	Rate	Amount
3.00	**RETARDING BASIN/WETLAND 3**				
3.01	Earthworks				
(a)	Wetland (cut)	15,480	cu.m	$ 8.30	$ 128,484.00
(b)	Sediment Basin 6 (cut)	5,160	cu.m	$ 8.30	$ 42,828.00
(c)	Flood storage (cut)	59,000	cu.m	$ 8.30	$ 489,700.00
(d)	Free board (cut)	10,800	cu.m	$ 8.30	$ 89,640.00
(e)	Battering (cut)	27,700	cu.m	$ 8.30	$ 229,910.00
(f)	Filling (fill)	8,500	cu.m	$ 15.60	$ 132,600.00
3.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
3.03	Outlet for wetland				
(a)	Riser pit (4.0m x 1.5m)	1	Item	$ 25,000.00	$ 25,000.00
3.04	Outlet from Retarding Basin				
(a)	3 x 900mm dia RRJ drainage pipes	20	l.m	$ 1,911.00	$ 38,220.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 3 x 900mm dia pipe	1	Item	$ 30,000.00	$ 30,000.00
3.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 64,500.00	$ 64,500.00
3.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	1	Item	$ 10,000.00	$ 10,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
3.07	Landscaping				
(a)	Terrestrial planting	1,500	sq.m	$ 12.50	$ 18,750.00
(b)	Aquatic planting	25,800	sq.m	$ 13.60	$ 350,880.00
(c)	Clay liner	25,800	sq.m	$ 10.40	$ 268,320.00
(d)	Top soiling	57,850	sq.m	$ 3.10	$ 179,335.00
(e)	Hydroseeding	30,550	sq.m	$ 2.10	$ 64,155.00
(f)	Rock beaching	2,150	sq.m	$ 94.00	$ 202,100.00
3.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	650	sq.m	$ 27.10	$ 17,615.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 3.00		$ 2,434,975.00

Item	Description of Works	Quantity	Unit	Rate	Amount
4.00	**RETARDING BASIN/WETLAND 4**				
4.01	Earthworks				
(a)	Wetland (cut)	30,000	cu.m	$ 8.30	$ 249,000.00
(b)	Sediment Basin 7 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(c)	Sediment Basin 8 (cut)	5,100	cu.m	$ 8.30	$ 42,330.00
(d)	Flood storage (cut)	67,500	cu.m	$ 8.30	$ 560,250.00
(e)	Free board (cut)	7,500	cu.m	$ 8.30	$ 62,250.00
(f)	Battering (cut)	6,000	cu.m	$ 8.30	$ 49,800.00
(g)	Filling (fill)	5,200	cu.m	$ 15.60	$ 81,120.00
4.02	Pipe Outlet into Sediment Pond				
(a)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit:				
(i)	1800mm dia pipe	1	Item	$ 20,000.00	$ 20,000.00
(ii)	1500mm dia pipe	1	Item	$ 15,000.00	$ 15,000.00
4.03	Outlet				
(a)	Riser pit (6.0m x 1.5m)	1	Item	$ 30,000.00	$ 30,000.00
4.04	Outlet from Retarding Basin				
(a)	4 x 900mm dia RRJ drainage pipes	20	l.m	$ 2,548.00	$ 50,960.00
(b)	Supply & install rock endwalls & energy dissipation rocks in accordance with Melbourne Water's requirements. Including excavation, rock beaching & post & rail fences to suit 4 x 900mm dia pipe	1	Item	$ 35,000.00	$ 35,000.00
4.05	Balance Pipes				
(a)	1050mm dia RRJ balance pipe from sediment basin 7 to wetland, including inlet and outlet pits.	1	Item	$ 11,750.00	$ 11,750.00
(b)	825mm dia RRJ balance pipe from sediment basin 8 to wetland, including inlet and outlet pits.	1	Item	$ 9,280.00	$ 9,280.00
(c)	300mm dia RRJ balance pipe inside wetland, including inlet and outlet pits.	1	Item	$ 101,250.00	$ 101,250.00
4.06	Concrete Weir				
(a)	Supply & install 2m long concrete weir for sediment basin, inlcuding rock beaching.	2	Item	$ 10,000.00	$ 20,000.00
(b)	Supply & install Q100 concrete weir for retarding basin, including rock beaching.	1	Item	$ 20,000.00	$ 20,000.00
4.07	Landscaping				
(a)	Terrestrial planting	2,724	sq.m	$ 12.50	$ 34,050.00
(b)	Aquatic planting	51,000	sq.m	$ 13.60	$ 693,600.00
(c)	Clay liner	51,000	sq.m	$ 10.40	$ 530,400.00
(d)	Top soiling	120,750	sq.m	$ 3.10	$ 374,325.00
(e)	Hydroseeding	67,026	sq.m	$ 2.10	$ 140,754.60
(f)	Rock beaching	4,250	sq.m	$ 94.00	$ 399,500.00
4.08	Access Track				
(a)	4m wide, 250mm deep, Crushed rock maintenace track	1,130	sq.m	$ 27.10	$ 30,623.00
(b)	4m wide, 250mm deep, Concrete maintenace track	20	sq.m	$ 59.40	$ 1,188.00
			TOTAL ITEM 4.00		$ 3,604,760.60

Item	Description of Works	Quantity	Unit	Rate	Amount
5.00	**VEGETATED CHANNEL V1** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
5.01	Earthworks				
(a)	Cut	53,100	cu.m	$ 8.30	$ 440,730.00
5.02	Landscaping				
(a)	Terrestrial planting	14,160	sq.m	$ 12.50	$ 177,000.00
(b)	Top soiling	49,560	sq.m	$ 3.10	$ 153,636.00
(c)	Hydroseeding	35,400	sq.m	$ 2.10	$ 74,340.00
5.03	Access Track				
(a)	Crushed rock maintenace track	708	l.m	$ 27.10	$ 19,186.80
5.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,416	sq.m	$ 60.00	$ 84,960.00
			TOTAL ITEM 5.00		$ 949,852.80
6.00	**VEGETATED CHANNEL V2** Remodelled Hancocks Gully to 40m wide vegetated channel, meandering in 65m drainage reserve.				
6.01	Earthworks				
(a)	Cut	67,500	cu.m	$ 8.30	$ 560,250.00
6.02	Landscaping				
(a)	Terrestrial planting	18,000	sq.m	$ 12.50	$ 225,000.00
(b)	Top soiling	63,000	sq.m	$ 3.10	$ 195,300.00
(c)	Hydroseeding	45,000	sq.m	$ 2.10	$ 94,500.00
6.03	Access Track				
(a)	Crushed rock maintenace track	900	l.m	$ 27.10	$ 24,390.00
6.04	Concrete Footpath				
(a)	2m wide conrete footpath	1,800	sq.m	$ 60.00	$ 108,000.00
			TOTAL ITEM 6.00		$ 1,207,440.00
7.00	**LAND ACQUISITION**				
7.01	Retarding Basin/Wetland 1	18	ha.	$ 750,000.00	$ 13,125,000.00
7.02	Retarding Basin/Wetland 2	15	ha.	$ 750,000.00	$ 11,250,000.00
7.03	Retarding Basin/Wetland 3	6	ha.	$ 750,000.00	$ 4,500,000.00
7.04	Retarding Basin/Wetland 4	13	ha.	$ 750,000.00	$ 9,375,000.00
			TOTAL ITEM 7.00		$ 38,250,000.00

Item	Description of Works	Quantity	Unit	Rate	Amount
8.00	**PRIMED PIPELINE**				
8.01	Construction of Pipeline Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, bedding, supply and construction of concrete anchorages, backfilling, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN630 PE Pipe	3,750	l.m	$ 550.00	$ 2,062,500.00
(b)	DN355 PE Pipe	125	l.m	$ 650.00	$ 81,250.00
(c)	DN600 MSCL Pipe	75	l.m	$ 1,350.00	$ 101,250.00
(d)	DN375 MSCL Pipe	15	l.m	$ 900.00	$ 13,500.00
8.02	Construction of Road and Railway Crossing Construction of road and Railway crossing to utilise boring techniques. Supply all materials bends, tees and fittings, and construct pipeline including setting out, excavation, supply and construction of concrete anchorages, reinstatement to original surface conditions and the disposal of surplus spoil all as specified for:				
(a)	DN600 MSCL Pipe (concrete encased)				
(i)	Up to and including 2.5m depth	20	l.m	$ 3,500.00	$ 70,000.00
(ii)	From 2.5m up to and including 6.0m depth	30	l.m	$ 3,800.00	$ 114,000.00
8.03	Inlet into Bald Hill Reservoir Construct Inlet Structure into Bald Hill Reservoir	1	Item	$ 50,000.00	$ 50,000.00
8.04	Bald Hill Road - Deek Creek Crossing Construct Bald Hill Road, Aerial Bridge Crossing. Including supply and installation of 600 MSCL PIPE and Bolt-on Support Beam for full span of culvert.	1	Item	$ 45,000.00	$ 45,000.00
8.05	Scour Discharge Assembly				
(a)	Supply and Construct Scour Discharge assembly including scour valve, headwall and rock beaching at outlet in accordance with Standard Drawings MRWA-W-307 Details D-F	2	No.	$ 25,000.00	$ 50,000.00
(b)	Supply and Construct Scour Discharge assembly including scour valve, all associated fittings and concrete surrounds and concrete block.	2	No.	$ 20,000.00	$ 40,000.00
8.06	Isolation Valves Supply and Install Electronically Operated Isolation Valves	2	No.	$ 7,500.00	$ 15,000.00
8.07	Check Valve (Non-Return) Provide and install Check Valve (Non-return Valve)	2	No.	$ 5,000.00	$ 10,000.00
8.08	Connection Assembly for Pump Supply and install Connection Assembly for Portable Pump	1	Item	$ 5,000.00	$ 5,000.00
8.09	Pump Supply and install 7.5kw axial flow submersible pump	2	No.	$ 20,000.00	$ 40,000.00
8.10	Wetland Outlet Structures				
(a)	Wetland W2 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
(b)	Wetland W4 Outlet Pit Structure as specified	1	Item	$ 30,000.00	$ 30,000.00
8.11	Control Structures Level Sensors and telemetry devices to be provided at	1	Item	$ 50,000.00	$ 50,000.00
			TOTAL ITEM 8.00		$ 2,807,500.00
				TOTAL	**$ 60,217,122.84**

8.4 Appendix D: Operational Costs

Maintenance Estimate v6

12221 - PAKENHAM EAST SWH

SUMMARY

BAU - BPEMG (Option 1)

1	RB/Wetland 1	$	339,000
2	RB/Wetland 2	$	333,000
3	RB/Wetland 3	$	190,000
4	RB/Wetland 4	$	325,000
5-6	Vegetated Swales	$	316,000
	TOTAL	**$**	**1,503,000 (exc.GST)**

BAU - BPEMG (Option 1A - Northern external untreated)

1	RB/Wetland 1	$	238,000
2	RB/Wetland 2	$	235,000
3	RB/Wetland 3	$	190,000
4	RB/Wetland 4	$	325,000
5-6	Vegetated Swales	$	334,000
	TOTAL	**$**	**1,322,000 (exc.GST)**

BAU - SEPP F8 (Option 2)

1	RB/Wetland 1	$	594,000
2	RB/Wetland 2	$	605,000
3	RB/Wetland 3	$	299,000
4	RB/Wetland 4	$	539,000
5-6	Vegetated Swales	$	284,000
	TOTAL	**$**	**2,321,000 (exc.GST)**

BAU - SEPP F8 (Option 2A - Northern external untreated)

1	RB/Wetland 1	$	373,000
2	RB/Wetland 2	$	362,000
3	RB/Wetland 3	$	299,000
4	RB/Wetland 4	$	539,000
5-6	Vegetated Swales	$	314,000
	TOTAL	**$**	**1,887,000 (exc.GST)**

SWH (Option 3-G - Northern external untreated) - Gravity Pipeline

1	RB/Wetland 1	$	358,000
2	RB/Wetland 2	$	351,000
3	RB/Wetland 3	$	199,000
4	RB/Wetland 4	$	343,000
5-6	Vegetated Swales	$	316,000
7	Gravity Pipeline	$	45,000
	TOTAL	**$**	**1,612,000 (exc.GST)**

SWH (Option 3-P - Northern external untreated) - Primed Pipeline

1	RB/Wetland 1	$	358,000
2	RB/Wetland 2	$	351,000
3	RB/Wetland 3	$	199,000
4	RB/Wetland 4	$	343,000
5-6	Vegetated Swales	$	316,000
7	Primed Pipeline	$	48,000
	TOTAL	**$**	**1,615,000 (exc.GST)**

SWH (Option 4-G - Northern external treated to BPEM) - Gravity Pipeline

1	RB/Wetland 1	$	550,000
2	RB/Wetland 2	$	333,000
3	RB/Wetland 3	$	190,000
4	RB/Wetland 4	$	325,000
5-6	Vegetated Swales	$	316,000
7	Gravity Pipeline	$	45,000
	TOTAL	**$**	**1,759,000 (exc.GST)**

SWH (Option 4-P - Northern external treated to BPEM) - Primed Pipeline

1	RB/Wetland 1	$	550,000
2	RB/Wetland 2	$	333,000
3	RB/Wetland 3	$	190,000
4	RB/Wetland 4	$	325,000
5-6	Vegetated Swales	$	316,000
7	Primed Pipeline	$	48,000
	TOTAL	**$**	**1,762,000 (exc.GST)**

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 1 - BAU - BPEMG

Date: 8-Mar-16

Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	45,200	45,200	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 24,408.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	45,200	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	1,492	1,492	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 10,444.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	1,492	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,492	cu.m	n/a	n/a	$ 250.00	$ 74,575.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	2,983	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,028	3,028	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 21,196.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,028	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,029	cu.m	n/a	n/a	$ 250.00	$ 151,425.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	6,057	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	42,240	n/a	sq.m	n/a	$ 0.10	n/a	$ 4,224.00	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,040	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 1.00		$ 338,812.00				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	55,500	55,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 29,970.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	55,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,775	2,775	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 19,425.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,775	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,026	cu.m	n/a	n/a	$ 250.00	$ 101,300.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,052	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,775	2,775	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 19,425.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,775	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,026	cu.m	n/a	n/a	$ 250.00	$ 101,300.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,052	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	85,510	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,551.00	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,440	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 2.00		$ 332,511.00				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	21,500	21,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 11,610.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	21,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,150	2,150	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,050.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,150	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,150	cu.m	n/a	n/a	$ 250.00	$ 107,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,300	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	33,750	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,375.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 190,075.00				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	42,500	42,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 22,950.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	42,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	73,730	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,373.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 325,113.00				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,600	12,600	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 64,260.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,600	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,150	cu.m	n/a	n/a	$ 250.00	$ 15,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,600	12,600	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,285.20	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,600	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,600	cu.m	n/a	n/a	$ 250.00	$ 63,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 316,075.20				

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 1A - BAU - BPEMG 1A (Northern external catchment untreated)

Date: 8-Mar-16 Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES
1.00	**RETARDING BASIN/WETLAND 1**									
1.01	Inspections									
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day
1.02	Wetland Maintenance									
(a)	Planting, litter control, and debris management	28,928	28,928	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 15,621.12	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr — Wetland Area (sq. m) 28,928 — MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00	MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance									
(a)	Vegetation (in establishment phase), litter control and debris management	955	955	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 6,685.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr — Sed Basin Area (sq. m) 955 — MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	955	cu.m	n/a	n/a	$ 250.00	$ 47,725.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3 — SB Perm. Pool Vol. (cu. m) 1,909 — MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance									
(a)	Vegetation (in establishment phase), litter control and debris management	1,938	1,938	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 13,566.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr — Sed Basin Area (sq. m) 1,938 — MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,938	cu.m	n/a	n/a	$ 250.00	$ 96,900.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3 — SB Perm. Pool Vol. (cu. m) 3,876 — MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance									
(a)	Weeding and Mowing (annually)	n/a	50,299	n/a	sq.m	n/a	$ 0.10	n/a	$ 5,029.90	Reserve area - Access track - Sed basins - Wetland — Access Track (sq. m) 2,880 — Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 1.00		$ 238,067.02	
2.00	**RETARDING BASIN/WETLAND 2**									
2.01	Inspections									
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day
2.02	Wetland Maintenance									
(a)	Planting, litter control, and debris management	35,520	35,520	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 19,180.80	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr — Wetland Area (sq. m) 35,520 — MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00	MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance									
(a)	Vegetation (in establishment phase), litter control and debris management	1,776	1,776	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 12,432.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr — Sed Basin Area (sq. m) 1,776 — MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,295	cu.m	n/a	n/a	$ 250.00	$ 64,750.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3 — SB Perm. Pool Vol. (cu. m) 2,590 — MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance									
(a)	Vegetation (in establishment phase), litter control and debris management	1,776	1,776	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 12,432.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr — Sed Basin Area (sq. m) 1,776 — MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,295	cu.m	n/a	n/a	$ 250.00	$ 64,750.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3 — SB Perm. Pool Vol. (cu. m) 2,590 — MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance									
(a)	Weeding and Mowing (annually)	n/a	88,128	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,812.80	Reserve area - Access track - Sed basins - Wetland — Access Track (sq. m) 2,800 — Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 2.00		$ 234,897.60	

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	21,500	21,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 11,610.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	21,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,150	2,150	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,050.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,150	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,150	cu.m	n/a	n/a	$ 250.00	$ 107,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,300	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	33,750	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,375.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 190,075.00				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	42,500	42,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 22,950.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	42,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	73,730	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,373.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 325,113.00				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	13,200	13,200	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 67,320.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	13,200	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,300	cu.m	n/a	n/a	$ 250.00	$ 16,500.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	13,200	13,200	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,346.40	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	13,200	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	13,200	cu.m	n/a	n/a	$ 250.00	$ 66,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	16,000	16,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 81,600.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	16,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	4,000	cu.m	n/a	n/a	$ 250.00	$ 20,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	16,000	16,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,632.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	16,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	16,000	cu.m	n/a	n/a	$ 250.00	$ 80,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 334,398.40				

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 2 - BAU - SEPP-F8

Date: 8-Mar-16

Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Ongoing	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	85,880	85,880	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 46,375.20	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	85,880	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,863	2,863	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,041.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,863	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,863	cu.m	n/a	n/a	$ 250.00	$ 143,125.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	5,725	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	5,725	5,725	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 40,075.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	5,725	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	5,726	cu.m	n/a	n/a	$ 250.00	$ 286,275.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	11,451	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	56,532	n/a	sq.m	n/a	$ 0.10	n/a	$ 5,653.20	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	4,000	Revised mowing rate from MW 23/2/2016
								TOTAL ITEM 1.00	$ 594,084.40				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	111,000	111,000	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 59,940.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	111,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	5,550	5,550	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 38,850.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	5,550	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	4,050	cu.m	n/a	n/a	$ 250.00	$ 202,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	8,100	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	5,550	5,550	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 38,850.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	5,550	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	4,050	cu.m	n/a	n/a	$ 250.00	$ 202,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	8,100	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	99,780	n/a	sq.m	n/a	$ 0.10	n/a	$ 9,978.00	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,120	Revised mowing rate from MW 23/2/2016
								TOTAL ITEM 2.00	$ 605,158.00				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	38,700	38,700	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 20,898.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	38,700	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,870	3,870	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 27,090.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,870	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,870	cu.m	n/a	n/a	$ 250.00	$ 193,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,740	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	45,030	n/a	sq.m	n/a	$ 0.10	n/a	$ 4,503.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,400	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 298,531.00				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	76,500	76,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 41,310.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	76,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,825	3,825	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 26,775.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,825	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,825	cu.m	n/a	n/a	$ 250.00	$ 191,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,650	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,825	3,825	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 26,775.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,825	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,825	cu.m	n/a	n/a	$ 250.00	$ 191,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,650	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	89,650	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,965.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	6,200	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 538,865.00				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	11,600	11,600	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 59,160.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	11,600	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	2,900	cu.m	n/a	n/a	$ 250.00	$ 14,500.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	11,600	11,600	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,183.20	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	11,600	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	11,600	cu.m	n/a	n/a	$ 250.00	$ 58,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	13,200	13,200	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 67,320.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	13,200	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,300	cu.m	n/a	n/a	$ 250.00	$ 16,500.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	13,200	13,200	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,346.40	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	13,200	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	13,200	cu.m	n/a	n/a	$ 250.00	$ 66,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 284,009.60				

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 2A - BAU - SEPP-F8 (Northern external catchment untreated)

Date: 8-Mar-16 Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Ongoing	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	50,624	50,624	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 27,336.96	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	50,624	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	1,686	1,686	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 11,802.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	1,686	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	1,686	cu.m	n/a	n/a	$ 250.00	$ 84,300.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	3,372	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,377	3,377	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 23,639.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,377	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,377	cu.m	n/a	n/a	$ 250.00	$ 168,825.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	6,753	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	46,013	n/a	sq.m	n/a	$ 0.10	n/a	$ 4,601.30	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,300	Revised mowing rate from MW 23/2/2016
								TOTAL ITEM 1.00	$ 373,044.26				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	62,160	62,160	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 33,566.40	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	62,160	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,108	3,108	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 21,756.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,108	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,267	cu.m	n/a	n/a	$ 250.00	$ 113,325.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,533	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,108	3,108	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 21,756.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,108	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,267	cu.m	n/a	n/a	$ 250.00	$ 113,325.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,533	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	58,624	n/a	sq.m	n/a	$ 0.10	n/a	$ 5,862.40	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,000	Revised mowing rate from MW 23/2/2016
								TOTAL ITEM 2.00	$ 362,130.80				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	38,700	38,700	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 20,898.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	38,700	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,870	3,870	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 27,090.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,870	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,870	cu.m	n/a	n/a	$ 250.00	$ 193,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,740	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	45,030	n/a	sq.m	n/a	$ 0.10	n/a	$ 4,503.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,400	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 298,531.00				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	76,500	76,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 41,310.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	76,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,825	3,825	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 26,775.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,825	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,825	cu.m	n/a	n/a	$ 250.00	$ 191,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,650	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	3,825	3,825	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 26,775.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	3,825	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	3,825	cu.m	n/a	n/a	$ 250.00	$ 191,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	7,650	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	89,650	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,965.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	6,200	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 538,865.00				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,400	12,400	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 63,240.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,400	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,100	cu.m	n/a	n/a	$ 250.00	$ 15,500.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,400	12,400	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,264.80	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,400	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,400	cu.m	n/a	n/a	$ 250.00	$ 62,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 313,784.80				

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 3-G (Northern external catchment untreated) - SWH AND GRAVITY PIPE

Date: 8-Mar-16

Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	48,364	48,364	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 26,116.56	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	48,364	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,418	2,418	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,927.40	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,418	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,418	cu.m	n/a	n/a	$ 250.00	$ 120,910.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,836	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,418	2,418	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,927.40	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,418	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,418	cu.m	n/a	n/a	$ 250.00	$ 120,910.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,836	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	38,760	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,875.96	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,040	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 1.00		$ 358,207.32				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	59,385	59,385	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 32,067.90	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	59,385	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,969	2,969	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,784.75	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,969	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,168	cu.m	n/a	n/a	$ 250.00	$ 108,375.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,335	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,969	2,969	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,784.75	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,969	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,168	cu.m	n/a	n/a	$ 250.00	$ 108,375.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,335	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	81,557	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,155.65	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,120	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 2.00		$ 351,083.05				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	23,005	23,005	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 12,422.70	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	23,005	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,301	2,301	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,103.50	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,301	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,301	cu.m	n/a	n/a	$ 250.00	$ 115,025.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,601	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	32,095	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,209.45	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 199,300.65				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	45,475	45,475	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 24,556.50	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	45,475	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,274	2,274	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,916.25	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,274	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,274	cu.m	n/a	n/a	$ 250.00	$ 113,687.50	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,548	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,274	2,274	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,916.25	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,274	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,274	cu.m	n/a	n/a	$ 250.00	$ 113,687.50	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,548	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	70,458	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,045.75	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 343,349.75				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,600	12,600	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 64,260.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,600	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,150	cu.m	n/a	n/a	$ 250.00	$ 15,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,600	12,600	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,285.20	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,600	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,600	cu.m	n/a	n/a	$ 250.00	$ 63,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 316,075.20				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES
7.00	**Gravity Stormwater Pipeline**									
7.01	Inspections									
(a)	Annual inpsection of pipe including inlets/outlets, valves and telemetry	n/a	1	n/a	ea.	n/a	$ 1,000.00	n/a	$ 1,000.00	Assume 1 full day of inspection for entire pipeline at daily rate of $1,000/day
7.02	Telemetry maintenance									
(a)	Replace batteries / Annual major maintenance	n/a	3	n/a	ea.	n/a	$ 500.00	n/a	$ 1,500.00	
(b)	Quarterly maintenance (minor maintenance/data download)	n/a	12	n/a	ea.	n/a	$ 500.00	n/a	$ 6,000.00	
7.03	Pipeline maintenance									
(a)	Scour pipe to ensure no accumulation of sediment at low points	n/a	1	n/a	ea.	n/a	$ 500.00	n/a	$ 500.00	Assume 1/2 day of scouring and sediment assessment. All stormwater treated to SEPP-F8, so no impact on receiving system
7.04	Easement maintenance									
(a)	Mowing/slashing of easement to maintain access	n/a	12,000	n/a	sq.m	n/a	$ 3.00	n/a	$ 36,000.00	Assume 3m easement
							TOTAL ITEM 7.00		$ 45,000.00	MW WSUD Lifecycle Costing Data, October 2013

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 3-P (Northern external catchment untreated) - SWH AND PRIMED PIPE

Date: 8-Mar-16 Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	48,364	48,364	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 26,116.56	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	48,364	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,418	2,418	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,927.40	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,418	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,418	cu.m	n/a	n/a	$ 250.00	$ 120,910.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,836	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,418	2,418	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,927.40	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,418	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,418	cu.m	n/a	n/a	$ 250.00	$ 120,910.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,836	MW WSUD Lifecycle Costing Data, October 2013
1.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	38,760	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,875.96	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,040	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 1.00		$ 358,207.32				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	59,385	59,385	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 32,067.90	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	59,385	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,969	2,969	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,784.75	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,969	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,168	cu.m	n/a	n/a	$ 250.00	$ 108,375.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,335	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,969	2,969	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 20,784.75	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,969	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,168	cu.m	n/a	n/a	$ 250.00	$ 108,375.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,335	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	81,557	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,155.65	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,120	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 2.00		$ 351,083.05				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	23,005	23,005	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 12,422.70	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	23,005	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,301	2,301	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 16,103.50	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,301	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,301	cu.m	n/a	n/a	$ 250.00	$ 115,025.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,601	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	32,095	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,209.45	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 199,300.65				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	45,475	45,475	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 24,556.50	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	45,475	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,274	2,274	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,916.25	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,274	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,274	cu.m	n/a	n/a	$ 250.00	$ 113,687.50	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,548	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,274	2,274	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,916.25	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,274	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,274	cu.m	n/a	n/a	$ 250.00	$ 113,687.50	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,548	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	70,458	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,045.75	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 343,349.75				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,600	12,600	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 64,260.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,600	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,150	cu.m	n/a	n/a	$ 250.00	$ 15,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,600	12,600	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,285.20	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,600	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,600	cu.m	n/a	n/a	$ 250.00	$ 63,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 316,075.20				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES
7.00	**Primed Stormwater Pipeline**									
7.01	Inspections									
(a)	Annual inpsection of pipe including inlets/outlets, valves and telemetry	n/a	1	n/a	ea.	n/a	$ 1,000.00	n/a	$ 1,000.00	Assume 1 full day of inspection for entire pipeline at daily rate of $1,000/day
7.02	Telemetry maintenance									
(a)	Replace batteries / Annual major maintenance	n/a	3	n/a	ea.	n/a	$ 500.00	n/a	$ 1,500.00	
(b)	Quarterly maintenance (minor maintenance/data download)	n/a	12	n/a	ea.	n/a	$ 500.00	n/a	$ 6,000.00	
7.03	Pipeline maintenance									
(a)	Scour pipe to ensure no accumulation of sediment at low points	n/a	1	n/a	ea.	n/a	$ 500.00	n/a	$ 500.00	Assume 1/2 day of scouring and sediment assessment. All stormwater treated to SEPP-F8, so no impact on receiving system
7.04	Easement maintenance									
(a)	Mowing/slashing of easement to maintain access	n/a	12,000	n/a	sq.m	n/a	$ 3.00	n/a	$ 36,000.00	Assume 3m easement — MW WSUD Lifecycle Costing Data, October 2013
7.05	Pump maintenance	n/a								
(a)	Annual cost of power (mains connection)	n/a	2	n/a	ea.	n/a	$ 500.00	n/a	$ 1,000.00	
(b)	Annual cost of power (usage)	n/a	2	n/a	ea.	n/a	$ 250.00	n/a	$ 500.00	
(c)	Annual inspection, service and test run	n/a	2	n/a	ea.	n/a	$ 500.00	n/a	$ 1,000.00	Assume 1 full day to inspect, service and test 2x pumps at a daily rate of 1,000/day
							TOTAL ITEM 7.00		$ 47,500.00	

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 4-G (Northern external catchment treated to BPEM) - SWH AND GRAVITY PIPE

Date: 8-Mar-16 Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	79,552	79,552	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 42,958.08	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	79,552	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 0 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,652	2,652	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 18,564.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,652	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,652	cu.m	n/a	n/a	$ 250.00	$ 132,575.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	5,303	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,652	2,652	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 18,564.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,652	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,652	cu.m	n/a	n/a	$ 250.00	$ 132,575.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	5,303	MW WSUD Lifecycle Costing Data, October 2013
1.05	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,652	2,652	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 18,564.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,652	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,652	cu.m	n/a	n/a	$ 250.00	$ 132,575.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	5,303	MW WSUD Lifecycle Costing Data, October 2013
1.06	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	7,104	n/a	sq.m	n/a	$ 0.10	n/a	$ 710.40	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,040	Revised mowing rate from MW 23/2/2016
								TOTAL ITEM 1.00	$ 549,625.48				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	55,500	55,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 29,970.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	55,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,775	2,775	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 19,425.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,775	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,026	cu.m	n/a	n/a	$ 250.00	$ 101,300.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,052	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,775	2,775	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 19,425.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,775	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,026	cu.m	n/a	n/a	$ 250.00	$ 101,300.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,052	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	85,830	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,583.00	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,120	Revised mowing rate from MW 23/2/2016
								TOTAL ITEM 2.00	$ 332,543.00				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	21,500	21,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 11,610.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	21,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,150	2,150	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,050.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,150	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,150	cu.m	n/a	n/a	$ 250.00	$ 107,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,300	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	33,750	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,375.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 190,075.00				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	42,500	42,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 22,950.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	42,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	73,730	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,373.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 325,113.00				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,600	12,600	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 64,260.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,600	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,150	cu.m	n/a	n/a	$ 250.00	$ 15,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,600	12,600	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,285.20	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,600	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,600	cu.m	n/a	n/a	$ 250.00	$ 63,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 316,075.20				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES
7.00	**Gravity Stormwater Pipeline**									
7.01	Inspections									
(a)	Annual inpsection of pipe including inlets/outlets, valves and telemetry	n/a	1	n/a	ea.	n/a	$ 1,000.00	n/a	$ 1,000.00	Assume 1 full day of inspection for entire pipeline at daily rate of $1,000/day
7.02	Telemetry maintenance									
(a)	Replace batteries / Annual major maintenance	n/a	3	n/a	ea.	n/a	$ 500.00	n/a	$ 1,500.00	
(b)	Quarterly maintenance (minor maintenance/data download)	n/a	12	n/a	ea.	n/a	$ 500.00	n/a	$ 6,000.00	
7.03	Pipeline maintenance									
(a)	Scour pipe to ensure no accumulation of sediment at low points	n/a	1	n/a	ea.	n/a	$ 500.00	n/a	$ 500.00	Assume 1/2 day of scouring and sediment assessment. All stormwater treated to SEPP-F8, so no impact on receiving system
7.04	Easement maintenance									
(a)	Mowing/slashing of easement to maintain access	n/a	12,000	n/a	sq.m	n/a	$ 3.00	n/a	$ 36,000.00	Assume 3m easement MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEM 7.00		$ 45,000.00	

DALTON CONSULTING ENGINEERS

12221 -PAKENHAM EAST SWH
MAINTENACE COSTS PER YEAR
OPTION 4-P (Northern external catchment treated to BPEM) - SWH AND PRIMED PIPE

Date: 8-Mar-16 Contract No: 12221

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
1.00	**RETARDING BASIN/WETLAND 1**												
1.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
1.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	79,552	79,552	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 42,958.08	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	79,552	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
1.03	Sediment Basin 0 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,652	2,652	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 18,564.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,652	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,652	cu.m	n/a	n/a	$ 250.00	$ 132,575.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	5,303	MW WSUD Lifecycle Costing Data, October 2013
1.04	Sediment Basin 2 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,652	2,652	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 18,564.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,652	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,652	cu.m	n/a	n/a	$ 250.00	$ 132,575.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	5,303	MW WSUD Lifecycle Costing Data, October 2013
1.05	Sediment Basin 3 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,652	2,652	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 18,564.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,652	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,652	cu.m	n/a	n/a	$ 250.00	$ 132,575.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	5,303	MW WSUD Lifecycle Costing Data, October 2013
1.06	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	7,104	n/a	sq.m	n/a	$ 0.10	n/a	$ 710.40	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,040	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 1.00		$ 549,625.48				
2.00	**RETARDING BASIN/WETLAND 2**												
2.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
2.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	55,500	55,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 29,970.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	55,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
2.03	Sediment Basin 4 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,775	2,775	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 19,425.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,775	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,026	cu.m	n/a	n/a	$ 250.00	$ 101,300.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,052	MW WSUD Lifecycle Costing Data, October 2013
2.04	Sediment Basin 5 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,775	2,775	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 19,425.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,775	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,026	cu.m	n/a	n/a	$ 250.00	$ 101,300.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,052	MW WSUD Lifecycle Costing Data, October 2013
2.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	85,830	n/a	sq.m	n/a	$ 0.10	n/a	$ 8,583.00	Reserve area - Access track - Sed basins - Wetland	Access Track (sq. m)	3,120	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 2.00		$ 332,543.00				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES			
3.00	**RETARDING BASIN/WETLAND 3**												
3.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
3.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	21,500	21,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 11,610.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	21,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
3.03	Sediment Basin 6 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,150	2,150	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 15,050.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,150	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,150	cu.m	n/a	n/a	$ 250.00	$ 107,500.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,300	MW WSUD Lifecycle Costing Data, October 2013
3.04	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	33,750	n/a	sq.m	n/a	$ 0.10	n/a	$ 3,375.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	2,600	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 3.00		$ 190,075.00				
4.00	**RETARDING BASIN/WETLAND 4**												
4.01	Inspections												
	Inspect wetland, sediment basins and retarding basin and for sediment accumulation, terrestrial and aquatic vegetation condition, structural integrity, erosion, damage/vandalism ect. Every 3 months for the first year, then every 6 months there after.	4	2	n/a	ea.	$ 250.00	$ 250.00	n/a	$ 540.00	Assume 1 day of inspection for entire PSP Area at daily rate of $1,000/day			
4.02	Wetland Maintenance												
(a)	Planting, litter control, and debris management	42,500	42,500	n/a	sq.m	$ 1.00	$ 0.50	n/a	$ 22,950.00	2 times ongoing cost in establishment phase; ongoing is $0.5/m2/yr	Wetland Area (sq. m)	42,500	MW WSUD Lifecycle Costing Data, October 2013
(b)	Wetland renewal (replanting)	n/a	n/a	1	ea.	n/a	n/a	$ 1,300,000	$ 52,000.00				MW Costing Information provided February 2016
4.03	Sediment Basin 7 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.04	Sediment Basin 8 Maintenance												
(a)	Vegetation (in establishment phase), litter control and debris management	2,125	2,125	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 14,875.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Sed Basin Area (sq. m)	2,125	MW WSUD Lifecycle Costing Data, October 2013
(b)	Sediment Removal and Disposal during renewal	n/a	n/a	2,125	cu.m	n/a	n/a	$ 250.00	$ 106,250.00	Removal and dispose of Dry waste = $250/m3 , liquid waste $1,300/m3	SB Perm. Pool Vol. (cu. m)	4,250	MW WSUD Lifecycle Costing Data, October 2013
4.05	Retarding Basin Maintenance												
(a)	Weeding and Mowing (annually)	n/a	73,730	n/a	sq.m	n/a	$ 0.10	n/a	$ 7,373.00	Reserve area - Access track - Sed basin - Wetland	Access Track (sq. m)	4,520	Revised mowing rate from MW 23/2/2016
							TOTAL ITEM 4.00		$ 325,113.00				
5.00	**VEGETATED CHANNEL V1**												
5.01	Vegetated												
(a)	Planting, litter control, debris management	12,600	12,600	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 64,260.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	12,600	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,150	cu.m	n/a	n/a	$ 250.00	$ 15,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
5.02	Grassed												
(a)	Mowing, litter control and debris management	12,600	12,600	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,285.20	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	12,600	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	12,600	cu.m	n/a	n/a	$ 250.00	$ 63,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.00	**VEGETATED CHANNEL V2**												
6.01	Vegetated												
(a)	Planting, litter control, debris management	15,000	15,000	n/a	sq.m	$ 10.00	$ 5.00	n/a	$ 76,500.00	2 times ongoing cost in establishment phase; ongoing is $5/m2/yr	Swale Area (sq. m)	15,000	MW WSUD Lifecycle Costing Data, October 2013
(b)	Removal and disposal of sediment during renewal	n/a	n/a	3,750	cu.m	n/a	n/a	$ 250.00	$ 18,750.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
6.02	Grassed												
(a)	Mowing, litter control and debris management	15,000	15,000	n/a	sq.m	$ 0.20	$ 0.10	n/a	$ 1,530.00	2 times ongoing cost in establishment phase; ongoing is $3/m2/yr	Swale Area (sq. m)	15,000	Revised mowing rate from MW 23/2/2016
(b)	Removal and disposal of sediment during renewal	n/a	n/a	15,000	cu.m	n/a	n/a	$ 250.00	$ 75,000.00	Assume 0.25 m sediment accumulates in swales over 50 years			MW WSUD Lifecycle Costing Data, October 2013
							TOTAL ITEMS 5.00 and 6.00		$ 316,075.20				

Item	Description of Works	Quantity Establishment	Quantity Ongoing	Quantity Renewal	Unit	Rate Establishment	Rate Typical	Rate Renewal	Amount	NOTES
7.00	**Primed Stormwater Pipeline**									
7.01	Inspections									
(a)	Annual inpsection of pipe including inlets/outlets, valves and telemetry	n/a	1	n/a	ea.	n/a	$ 1,000.00	n/a	$ 1,000.00	Assume 1 full day of inspection for entire pipeline at daily rate of $1,000/day
7.02	Telemetry maintenance									
(a)	Replace batteries / Annual major maintenance	n/a	3	n/a	ea.	n/a	$ 500.00	n/a	$ 1,500.00	
(b)	Quarterly maintenance (minor maintenance/data download)	n/a	12	n/a	ea.	n/a	$ 500.00	n/a	$ 6,000.00	
7.03	Pipeline maintenance									
(a)	Scour pipe to ensure no accumulation of sediment at low points	n/a	1	n/a	ea.	n/a	$ 500.00	n/a	$ 500.00	Assume 1/2 day of scouring and sediment assessment. All stormwater treated to SEPP-F8, so no impact on receiving system
7.04	Easement maintenance									
(a)	Mowing/slashing of easement to maintain access	n/a	12,000	n/a	sq.m	n/a	$ 3.00	n/a	$ 36,000.00	Assume 3m easement MW WSUD Lifecycle Costing Data, October 2013
7.05	Pump maintenance	n/a								
(a)	Annual cost of power (mains connection)	n/a	2	n/a	ea.	n/a	$ 500.00	n/a	$ 1,000.00	
(b)	Annual cost of power (usage)	n/a	2	n/a	ea.	n/a	$ 250.00	n/a	$ 500.00	
(c)	Annual inspection, service and test run	n/a	2	n/a	ea.	n/a	$ 500.00	n/a	$ 1,000.00	Assume 1 full day to inspect, service and test 2x pumps at a daily rate of 1,000/day
							TOTAL ITEM 7.00		$ 47,500.00	

8.5 Appendix E: Melbourne Water NPC Summary

NPV Summary

Option	NPC ($M)
Option 1 - BAU (BPEMG with external catchment)	$ 28.4
Option 1A - BAU (BPEMG with NO external catchment)	$ 25.4
Option 2 Option 2 - BAU (SEPP-F8 with external catchment)	$ 45.6
Option 2 Option 2A - BAU (SEPP-F8 with no external catchment)	$ 37.6
Option 3 Stormwater Harvesting with Gravity Pipeline (SEPP-F8) Option 1	$ 35.4
Option 3 Stormwater Harvesting with Primed Pipeline (SEPP-F8) Option 1	$ 35.2
Option 4 Stormwater Harvesting with Gravity Pipeline (SEPP F8) Option 2	$ 41.6
Option 4 Stormwater Harvesting with Primed Pipeline (SEPP F8) Option 2	$ 40.3

Notes:
Land Acquisition not included as developers gift this encumbered land
Options that don't include the external catchment would likely require MW to build an additional asset to treat runoff from the upstream catchment

Distributional Analysis

Option	Total	Developer	MW	SEW
Option 1 - BAU (BPEMG with external catchment)	$ 28.4	$ 11.4	$ 14.5	$ 2.6
Option 1A - BAU (BPEMG with NO external catchment)	$ 25.4	$ 9.8	$ 13.0	$ 2.6
Option 2 Option 2 - BAU (SEPP-F8 with external catchment)	$ 45.5	$ 20.3	$ 22.7	$ 2.6
Option 2 Option 2A - BAU (SEPP-F8 with no external catchment)	$ 37.8	$ 14.0	$ 21.1	$ 2.6
Option 3 Stormwater Harvesting with Gravity Pipeline (SEPP-F8) Option 1	$ 35.4	$ 11.8	$ 18.0	$ 5.7
Option 3 Stormwater Harvesting with Gravity Pipeline (Developer contribute to pipeline to meet SEPP-F8)	$ 35.4	$ 14.8	$ 14.9	$ 5.7

Notes:
The NPC total doesn't add to the sum of the distrbution due to rounding throughout the NPV calculation
Small differences have occurred in the total NPV between the initial analysis and distributional analysis. This is due to some settings within the spreadsheet and not the inputs. The inputs have been checked. The differences are not significant and can be ignored.
The distributional analysis has not been completed for the other pipeline options. The primed pipeline would give similar results, so there is minimal benefit to completing it. Option 4 pipeline is not preferred to be taken forward as per council comments at the workshop, so hasn't been completed here.

Comments:
SEW cost associated with harvesting is the fee charged by MW to discharge to ETP. A larger volume is discharged to ETP in Option 3 due to stormwater displacing the effluent in the recycled water. This cost is greater than the cost of the proposed RO plant.
If SEPP-F8 is the required standard at the development site, the pipeline is the lowest cost solution

8.6 Appendix F: Functional design plans for stormwater transfer pipelines

PAKENHAM EAST SWH

TRANSFER PIPELINE OPTION 1 - GRAVITY

PAKENHAM EAST P.S.P TO BALD HILL RESERVOIR

CARDINIA SHIRE COUNCIL

FOR

MELBOURNE WATER

CIVIL DRAWINGS

DCE REF : 12221.01

NOT TO BE USED FOR CONSTRUCTION

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1. GENERAL

1.1. ALL LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM (AHD) AND COORDINATES FOR SETTING OUT ARE TO MAP GRID AUSTRALIA (MGA).

1.2. ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH THE SPECIFICATIONS AND STANDARD DRAWINGS OF MELBOURNE WATER.

1.3. ALL CHAINAGES REFER TO THE DESIGN LINE AND/OR STRUCTURE CENTRELINE AS SHOWN ON THE DRAWINGS.

1.4. THE CONTRACTOR SHALL GIVE MINIMUM 5 WORKING DAYS NOTICE OF THE COMMENCEMENT OF WORKS TO:
(a) MW DEVELOPER WORKS
(b) COUNCIL SURVEILLANCE COORDINATOR
(c) DALTON CONSULTING ENGINEERS
(d) SERVICE AUTHORITIES AFFECTED BY THE WORKS

1.5. THE CONTRACTOR IS CAUTIONED THAT EXISTING UNDERGROUND AND OVERHEAD UTILITY SERVICES ARE ADJACENT TO OR WITHIN THE CONSTRUCTION AREA AND THE RELEVANT "NO GO ZONE" SAFETY PROCEDURES MUST BE PREPARED AND APPROVED BY THE UTILITY COMPANY. ALL WORKS MUST COMPLY WITH THESE PROCEDURES.

1.6. THE LOCATION OF THE EXISTING SERVICES SHOWN ON THESE DRAWINGS ARE NOT GUARANTEED FOR THEIR ACCURACY OR COMPLETENESS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL SERVICES AFFECTED BY THE WORKS TO HIS OWN SATISFACTION.

1.7. THE CONTRACTOR WILL BE RESPONSIBLE FOR ALL DAMAGE TO ANY SERVICE, STRUCTURE OR EXISTING CONSTRUCTION RESULTING FROM HIS CONSTRUCTION WORKS AND SHALL COMPLY WITH THE MW CONSTRUCTION SPECIFICATION CLAUSE 1.4.2.

1.8. WHERE HEAVILY LADEN TRUCKS (EG T44 OR W7 WHEEL LOADS) ARE REQUIRED TO TRAFFIC OVER INSTALLED PIPELINES, A MINIMUM COVER OF 1.00m ABOVE THE CROWN OF PIPE IS REQUIRED. WHERE THE CONTRACTOR REQUIRES TO CROSS ANY PIPELINE WITH CONSTRUCTION EQUIPMENT HAVING IN EXCESS OF THE ABOVE LOADS, THE SUPERINTENDENT MUST BE REFERRED TO.

1.9. TBM'S AND CONTROL POINTS ARE TO BE RE-ESTABLISHED BY THE LICENSED SURVEYOR IF FOUND TO BE MISSING AT THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR WILL BE RESPONSIBLE FOR CARE AND MAINTENANCE OF ALL T.B.M.'S AND CONTROL POINTS THEREAFTER.

1.10. AT LEAST 3 DAYS BEFORE COMMENCING EXCAVATION OF TRENCHES IN EXCESS OF 1.5m DEEP, A COMPLETED 'NOTICE OF INTENTION TO COMMENCE TRENCHING OPERATIONS' FORM SHALL BE SENT TO WORKSAFE VICTORIA. THE NOMINATED SUPERVISOR SHALL BE SUITABLY QUALIFIED IN ACCORDANCE WITH THE VICTORIAN OHS ACT 1985 & COMMONWEALTH OHS CODES OF PRACTICE 2008

1.11. ALL SERVICE AUTHORITIES SHALL BE NOTIFIED IN WRITING SEVEN DAYS PRIOR TO COMMENCEMENT OF THE WORKS.

1.12. ALL EXISTING SURFACE LEVELS SHOWN ON THE ENGINEERING DRAWINGS HAVE BEEN INTERPOLATED FROM A DIGITAL TERRAIN MODEL. THESE LEVELS HAVE BEEN USED AS THE BASIS FOR ALL ENGINEERING DESIGN AND DETERMINATION OF QUANTITIES.

1.13. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH COUNCIL SPECIFICATIONS, STANDARD DRAWINGS AND TO THE SATISFACTION OF THE SURVEILLANCE CO-ORDINATOR OR HIS REPRESENTATIVE.

1.14. ALL TREES AND SHRUBS TO BE RETAINED UNLESS PRIOR APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT AUTHORITY BECAUSE CONSTRUCTION NECESSITATES THEIR REMOVAL, OR REMOVAL IS DIRECTED BY THE AUTHORISED ENGINEER. TREES TO BE REMOVED ARE TO BE SUITABLY LABELLED. WHEN IT IS PROPOSED TO REMOVE EXISTING TREES IN ROAD RESERVES OR COUNCIL RESERVES, CONSULTATION IS TO OCCUR WITH COUNCILS PARKS AND GARDENS DEPARTMENT.

1.16. ALL SERVICE TRENCHES UNDER ROAD CARRIAGEWAYS, FOOTPATHS, VEHICLE CROSSINGS AND OTHER ROAD STRUCTURES ARE TO BE BACKFILLED WITH 20mm CLASS 3 CRUSHED ROCK IN ACCORDANCE WITH COUNCIL'S STANDARD SPECIFICATION FOR ROADS AND DRAINAGE WORKS IN LAND DEVELOPMENTS.

1.17. SURFACE RESTORATION TO ROAD SURFACES TO COUNCILS REQUIREMENTS

1.18. CONTRACTOR SHALL IMMEDIATELY ADVISE THE CONSULTANT OF ANY SERIOUS OR REPORTABLE INCIDENT:
a) THAT HAS TO BE NOTIFIED TO THE WORKCOVER AUTHORITY UNDER PART 5 OF THE OHS ACT 2004.
b) THAT HAS DETRIMENTALLY, OR THREATENS TO, AFFECT THE EXISTING ASSETS OF ANY AUTHORITY OR PROPERTY.
c) THE CONTRACTOR MUST ALSO ADVISE THE RELEVANT AUTHORITIES AND/OR OWNERS AFFECTED.
d) THE CONSULTANT SHALL CONFIRM WITH THE RELEVANT AUTHORITIES AND/OR OWNERS THAT THEY HAVE BEEN ADVISED OF THE INCIDENT.

1.19. THE CONTENTS OF ALL CONSTRUCTION ISSUE PLANS SHALL TAKE PRECEDENCE OVER ALL DIGITAL FILES ISSUED BY DCE TO THE CONTRACTOR AND IN PARTICULAR 3D ALIGNMENT STRINGS EXPORTED DIRECTLY FROM 3D CIVIL SOFTWARE. SHOULD ANY DISCREPANCIES BETWEEN CONSTRUCTION ISSUE PLANS AND DIGITAL FILES BE FOUND THE CONTRACTOR SHALL NOTIFY THE SUPERINTENDENT IMMEDIATELY.

2. SITE SAFETY & ACCESS

2.1. THE WORKS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH MELBOURNE WATER'S OCCUPATIONAL HEALTH POLICY AND THE CONTRACTOR WILL BE REQUIRED TO SUBMIT A PROJECT RISK ASSESSMENT, SITE SAFETY MANAGEMENT AND OTHER REQUIRED INFORMATION BEFORE COMMENCEMENT.

2.2. BEFORE COMMENCING CONSTRUCTION THE CONTRACTOR SHALL ERECT ACCEPTABLE TEMPORARY SAFETY FENCES WHERE REQUIRED TO ISOLATE THE WORKS SITE FROM THE PUBLIC.

2.3. THE CONTRACTOR IS TO PREPARE A TRAFFIC MANAGEMENT PLAN TO THE SATISFACTION OF COUNCIL BEFORE COMMENCING WORKS.

2.4. THE CONTRACTOR IS REQUIRED TO CONFINE CONSTRUCTION VEHICLES TO THE DRAINAGE RESERVE UNLESS APPROVED OTHERWISE BY THE SUPERINTENDENT. ANY DAMAGE CAUSED TO ADJACENT PROPERTIES MUST BE MADE GOOD.

3. EARTHWORKS & SEDIMENTATION CONTROL

3.1. NO POLLUTED OR SEDIMENT LADEN RUNOFF IS TO BE DISCHARGED DIRECTLY OR INDIRECTLY INTO EXISTING DRAINAGE SYSTEM DURING OR AFTER THE WORKS.

3.2. CONTRACTOR TO PREPARE A SITE MANAGEMENT PLAN (SMP) AND FORWARD TO THE CONSULTANT 3 WEEKS PRIOR TO COMMENCING OF ANY WORKS. SMP IS TO BE PREPARED IN ACCORDANCE WITH THE MELBOURNE WATER SMP KIT PLAN SUBJECT TO COUNCIL AND MELBOURNE WATER APPROVAL.

3.3. CONTRACTOR MUST ENSURE THAT COMPACTION TESTING OF FILLED AREAS COMPLIES WITH LEVEL 1 GEOTECHNICAL SUPERVISION PER CLAUSE 8.2 OF AS 3798-2007 AND SHALL BE ARRANGED BY THE CONTRACTOR WITH CERTIFYING CONSULTANT AT CONTRACTORS EXPENSE.

3.4. FILLING DEPTHS IN EXCESS OF 200mm ARE TO BE STRIPPED OF TOPSOIL, FILLED AND TOPSOIL REPLACED TO OBTAIN FINAL SURFACE LEVELS SHOWN ON THE DRAWINGS.

3.5. STOCKPILING OF MATERIAL IS TO BE PLACED AS DIRECTED BY THE SUPERINTENDENT. NO TOPSOIL IS TO BE REMOVED FROM SITE.

3.6. DISTURBED AREAS WITHIN DESIGNATED GRASSED FLOODWAY ZONES MUST BE TOPSOILED AND HYDROMULCH SEEDED WITH APPROVED GRASSES AND FERTILIZER. TEMPORARY FENCING MUST BE ERECTED TO PREVENT ACCESS TO TREATED AREAS.

3.7 SURPLUS EXCAVATED SPOIL IS TO BE USED AS FILL ON THE ESTATE WHERE PRACTICAL AND IF NOT IS TO BE TAKEN OFF SITE TO A LOCATION SPECIFIED BY THE SUPERINTENDANT.

4. MELBOURNE WATER

4.1. ONLY MW REGISTERED CONTRACTORS ARE PERMITTED TO WORK ON OR ENTER MELBOURNE WATER CORPORATION LIVE ASSETS.

4.2. IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE THAT ONLY SUCH REGISTERED CONTRACTORS ARE USED AND APPROPRIATE NOTIFICATION IS GIVEN TO MELBOURNE WATER.

5. REINFORCEMENT & CONCRETE

5.1. ALL CONCRETE SHALL BE IN ACCORDANCE WITH AS3600 & AS3610 AND PRE-MIXED CONCRETE IN ACCORDANCE WITH AS1379.

5.2. UNLESS SHOWN OTHERWISE, CONCRETE GRADES SHALL BE:
(a) 32 MPa - CULVERT BASE SLABS, APRONS & WINGWALLS
(b) N25 - PITS & OTHER ENCLOSED, STRUCTURES & GENERAL WORKS.

5.3. UNLESS SHOWN OTHERWISE, CLEAR COVER TO REINFORCEMENT SHALL BE
(a) 40mm - NEXT TO FORMED FACES.
(b) 40mm - NEXT TO UNFORMED FACES EG:GROUND

5.4. STEEL REINFORCEMENT SHALL COMPLY WITH AS4671 AND FOLLOWING GRADES:

5.5. MINIMUM FABRIC OVERLAPS SHALL BE
(a) END LAP - 2 SPACES + 30mm
(b) SIDE LAP - 1 SPACE + 30mm

5.6. STEEL WORKS TO COMPLY WITH AS4100 AND SHALL HAVE MINIMUM YIELD STRESS (Fy) OF GRADE 250 AND SECTIONS CONFORM TO AS3678 & AS3679.

5.7. WELDS SHALL COMPLY WITH AS1554, ELECTRODES AS1553 (E48XX) AND TO CLASS SP.

5.8. CONTINUOUS 6mm FILLET WELDS SHALL BE USED, BUTT WELDS TO BE FULL PENETRATION.

5.9. STEEL COMPONENTS TO BE HOT DIP GALVANIZED IN ACCORDANCE WITH AS1650-1989 AFTER FABRICATION, DAMAGE TO COATING TO BE REPAIRED WITH ZINC RICH PAINT.

5.10. CONCRETE SURFACES MUST BE ADEQUATELY CURED FOR MINIMUM SEVEN DAYS (7) PRIOR TO APPLYING OF CONSTRUCTION OR EARTHWORKS LOADS.

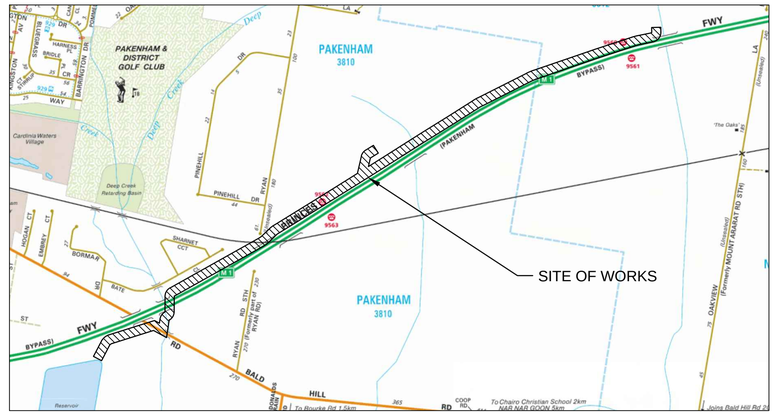
5.11. FIELD WELDING OF REINFORCEMENT IS ONLY PERMITTED WITH THE ENGINEER'S WRITTEN APPROVAL.

5.12. ALL REINFORCEMENT IS TO BE ACCURATELY PLACED, TIED AND SUPPORTED IN POSITION BY BAR CHAIRS AT 750mm CENTRES WHERE APPROPRIATE AND ADEQUATELY IN OTHER MEMBERS.

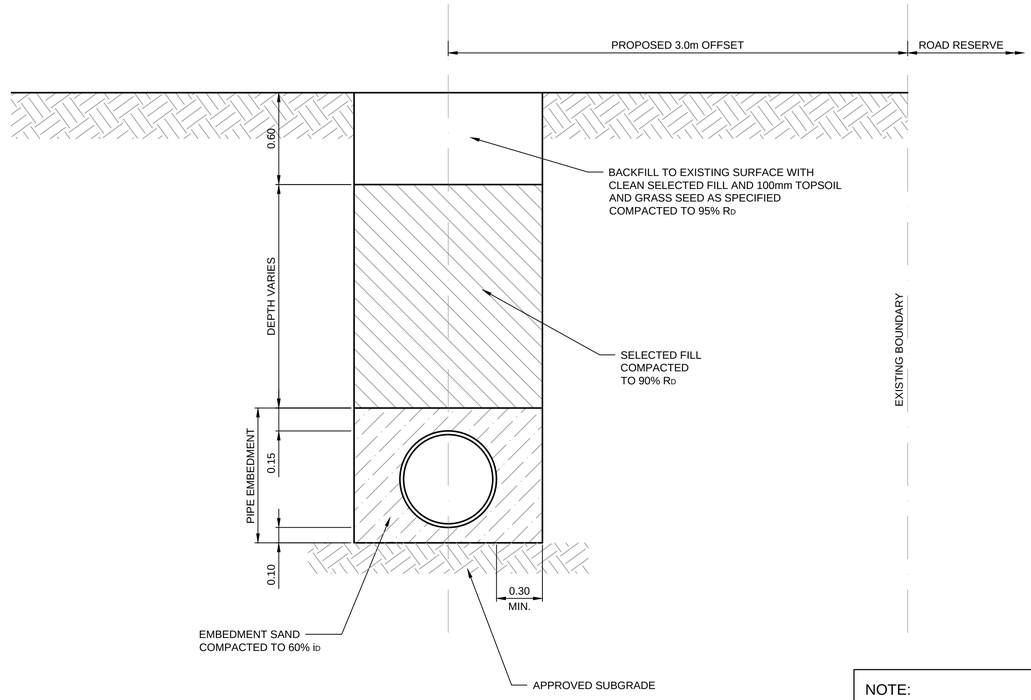
5.13. ALL FORMWORK SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH AS1509.

DRAWING INDEX

SHEET NO.	DRAWING NO.	DESCRIPTION
01	12221.01FTD01	LOCALITY PLAN, DRAWING INDEX & NOTES
02	12221.01FLP01	LAYOUT PLAN
03-08	12221.01FDP01-06	DETAIL PLANS - SHEET 01 TO 06
09	12221.01FPD01	DRAINAGE PIT DETAILS



LOCALITY PLAN
MELWAY REF MAP: 317 J12
NTS



TYPICAL TRENCH SECTION
SCALE 1:20

NOTE:
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NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

Written dimensions to take precedence over scale. Contractor shall check and verify all dimensions on site, Discrepancies to be brought to the attention of the Superintendent.

Drawn J.BURNS
Date 22/01/16
AN 1631266
Designed J.BURNS
Date 22/01/16
AN 1631267
Verified S.LEA
Date 22/02/16
AN 1062569
Audited -
Date -
AN
Approved -
Date -
AN

Coords: MGA
Levels: AHD
Hor 1:20 0m 0.2m 0.4m 0.8m 1.2m
Scale @ A1/A3

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
LOCALITY PLAN, DRAWING INDEX & NOTES

Drawing No. 12221.01FTD01 Rev B
Sheet No. 01 FUNCTIONAL

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Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\functional\12221.01 option 1\12221.01FTD01.dwg - 12221.01FTD01
Date/Time: Thu, Jun 09, 2016 - 4:02pm --- byron.shade ---

PROPOSED WETLAND 'W2'

PROPOSED WETLAND 'W4'

PAKENHAM BYPASS

REFER 12221.01FDP06

REFER 12221.01FDP05

REFER 12221.01FDP04

REFER 12221.01FDP03

REFER 12221.01FDP02

REFER 12221.01FDP01

DN630 PE

RYAN ROAD

RAILWAY CORRIDOR

RAILWAY CORRIDOR

RYAN ROAD

PAKENHAM BYPASS

BALD HILL ROAD

Ex.W

Ex.W

Ex.W

BALD HILL RESERVOIR

INLET TO BALD HILL RESERVOIR

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\functional\12221.01 option 1\12221.01FLP01.dwg - 12221.01FLP01
Date/Time: Thu Jun 09, 2016 - 4:02pm --byron.shode--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

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Drawn J.BURNS
Date 22/01/16
AN 1631266
Designed J.BURNS
Date 22/01/16
AN 1631288
Verified S.LEA
Date 22/02/16
AN 1062570
Audited -
Date -
AN
Approved -
Date -
AN

NOTE:
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Coords: MGA
Levels: AHD

Hor 1:5000 0m 50m 100m 200m 300m

Scale @ A1/A3 1:5000 / 1:10000

MELBOURNE WATER

PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
LAYOUT PLAN

Drawing No. 12221.01FLP01 Rev B
Sheet No. 02 FUNCTIONAL

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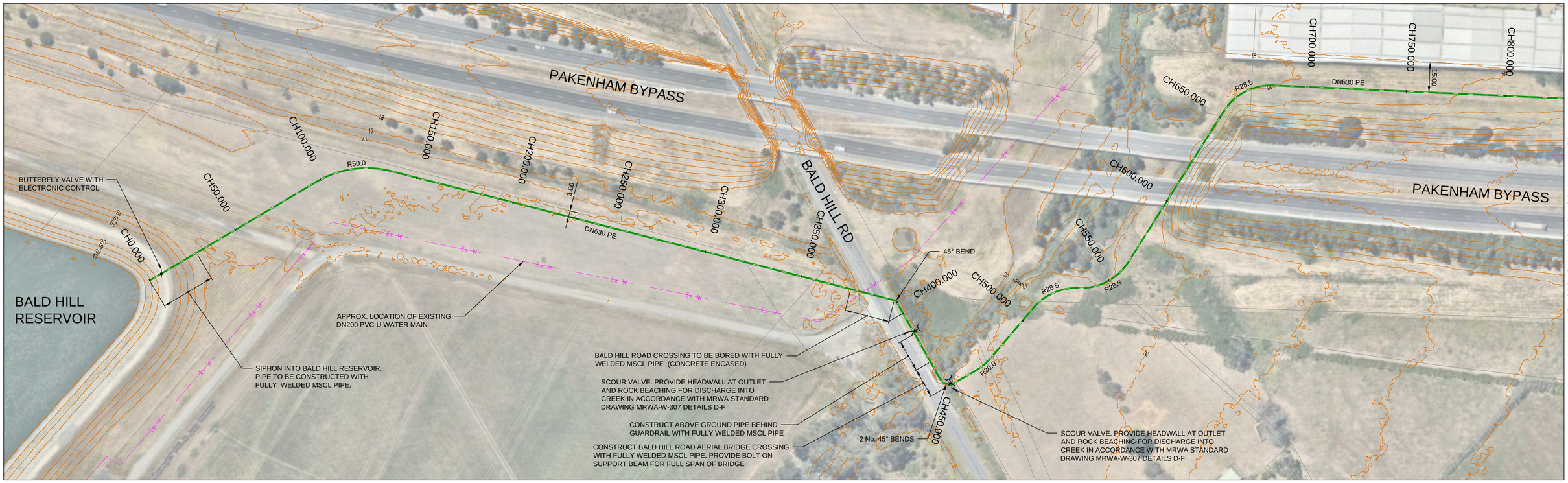
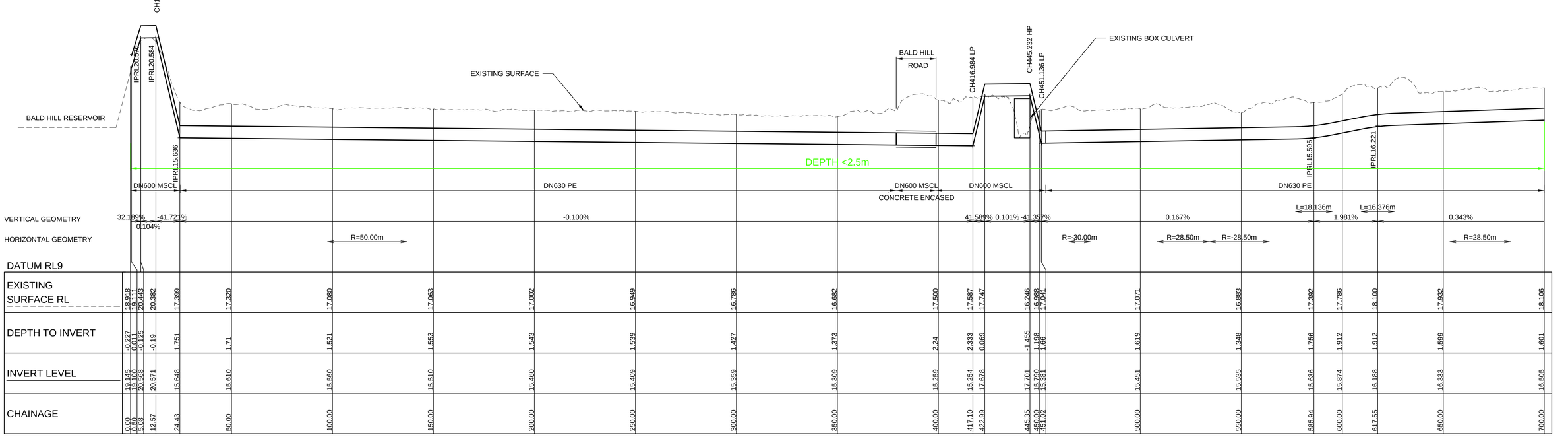


REFER DWG 12221.01FDP02 FOR CONTINUATION



EXISTING SURFACE RL	18.918	19.111	20.443	20.382	17.399	17.320	17.080	17.063	17.002	16.949	16.786	16.682	17.500	17.587	17.747	16.246	16.988	17.041	17.071	16.883	17.392	17.786	18.100	17.932	18.106
DEPTH TO INVERT	-0.227	0.011	-0.125	-0.19	1.751	1.71	1.521	1.553	1.543	1.539	1.427	1.373	2.24	2.333	0.069	-1.455	1.198	1.66	1.619	1.348	1.756	1.912	1.912	1.599	1.601
INVERT LEVEL	19.145	19.100	20.568	20.571	15.648	15.610	15.560	15.510	15.460	15.409	15.359	15.309	15.259	15.254	17.678	17.701	15.790	15.381	15.451	15.535	15.636	15.874	16.188	16.333	16.505
CHAINAGE	0.00	0.50	5.08	12.57	24.43	50.00	100.00	150.00	200.00	250.00	300.00	350.00	400.00	417.10	422.99	445.35	450.00	451.02	500.00	550.00	585.94	600.00	617.55	650.00	700.00

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

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Drawn J.BURNS
Date 22/01/16
AN 1631266
Designed J.BURNS
Date 22/01/16
AN 1631269
Verified S.LEA
Date 22/02/16
AN 1062571
Audited -
Date -
AN
Approved -
Date -
AN

NOTE:
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Coords: MGA
Levels: AHD

Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER

PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
DETAIL PLAN
SHEET 01 OF 06
Drawing No. 12221.01FDP01 Rev B
Sheet No. 03 FUNCTIONAL

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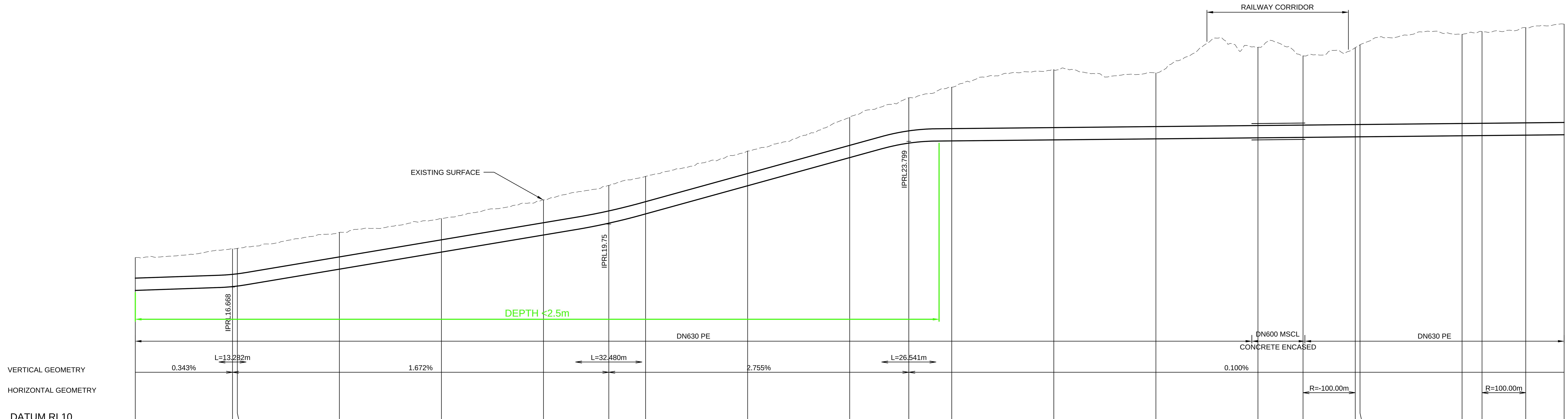

DATUM RL10

EXISTING SURFACE RL	18.106	18.531	18.561	19.342	20.018	20.937	21.641	22.085	23.323	24.974	25.928
DEPTH TO INVERT	1.601	1.841	1.844	1.798	1.638	1.722	1.847	1.839	1.7	1.973	2.218
INVERT LEVEL	16.505	16.690	16.717	17.543	18.379	19.215	19.794	20.246	21.623	23.001	23.711
CHAINAGE	700.00	747.64	750.00	800.00	850.00	900.00	931.98	950.00	1000.00	1050.00	1078.96

EXISTING SURFACE RL	26.445	27.301	27.144	28.398	27.984	28.382	28.521	29.033	29.169	29.356	29.531
DEPTH TO INVERT	2.625	3.431	3.224	4.429	3.992	4.364	4.501	4.963	5.089	5.255	5.41
INVERT LEVEL	23.820	23.870	23.920	23.970	23.992	24.018	24.020	24.070	24.080	24.101	24.120
CHAINAGE	1100.00	1150.00	1200.00	1250.00	1272.07	1297.66	1300.00	1350.00	1359.78	1381.20	1400.00

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\functional\12221.01 option 1\12221.01FDP01.dwg - 12221.01FDP02
Date/Time: Thu Jun 09, 2016 - 4:03pm --byron.shade--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

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Drawn J.BURNS
Date 22/01/16
AN 1631266
Designed J.BURNS
Date 22/01/16
AN 1631270
Verified S.LEA
Date 22/02/16
AN 1062572
Audited -
Date -
AN
Approved -
Date -
AN

NOTE:
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Coords: MGA
Levels: AHD
Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
DETAIL PLAN
SHEET 02 OF 06
Drawing No. 12221.01FDP02 Rev B
Sheet No. 04 FUNCTIONAL

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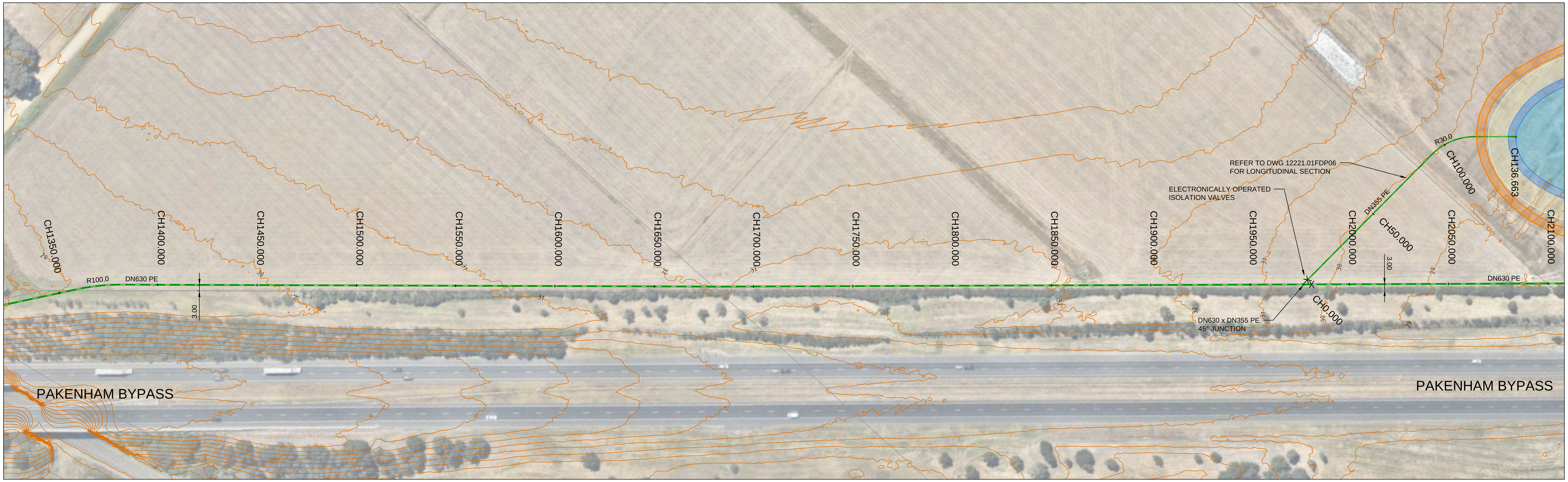

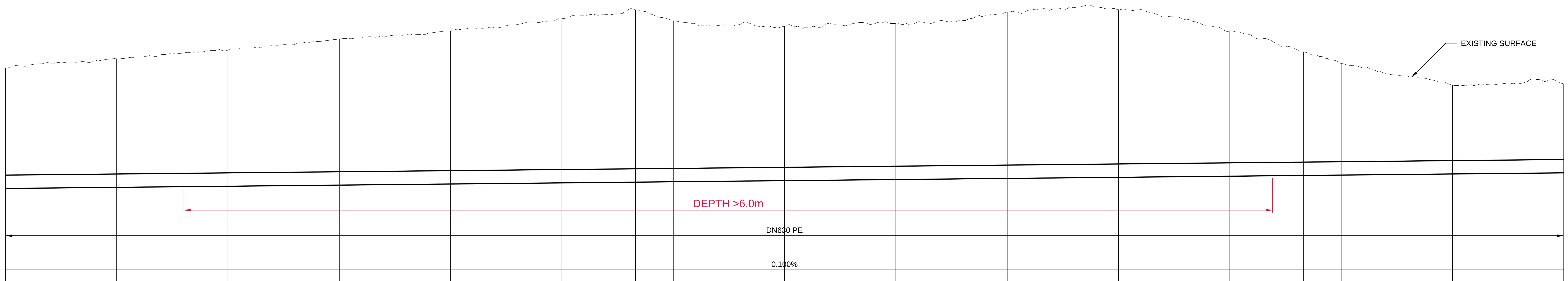

VERTICAL GEOMETRY

HORIZONTAL GEOMETRY

DATUM RL18

EXISTING SURFACE RL	29.531	29.938	30.331	30.838	31.171	31.745	32.132	31.650	31.410
DEPTH TO INVERT	5.41	5.768	6.11	6.568	6.851	7.375	7.729	7.23	6.94
INVERT LEVEL	24.120	24.170	24.220	24.270	24.320	24.370	24.403	24.420	24.470
CHAINAGE	1400.00	1450.00	1500.00	1550.00	1600.00	1650.00	1683.05	1700.00	1750.00

EXISTING SURFACE RL	31.519	32.046	32.142	31.167	30.254	29.730	28.757	28.812
DEPTH TO INVERT	6.998	7.475	7.521	6.496	5.55	5.01	3.986	3.992
INVERT LEVEL	24.521	24.571	24.621	24.671	24.704	24.721	24.771	24.821
CHAINAGE	1800.00	1850.00	1900.00	1950.00	1983.02	2000.00	2050.00	2100.00

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\functional\12221.01 option 1\12221.01FDP01.dwg - 12221.01FDP03
Date/Time: Thu Jun 09, 2016 - 4:03pm --byron.shade--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

Written dimensions to take precedence over scale. Contractor shall check and verify all dimensions on site, Discrepancies to be brought to the attention of the Superintendent.

Drawn J.BURNS
Date 22/01/16
AN 1631266
Designed J.BURNS
Date 22/01/16
AN 1631271
Verified S.LEA
Date 22/02/16
AN 1062573
Audited -
Date -
AN
Approved -
Date -
AN

NOTE:
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Coords: MGA
Levels: AHD
Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
DETAIL PLAN
SHEET 03 OF 06
Drawing No. 12221.01FDP03 Rev B
Sheet No. 05 FUNCTIONAL

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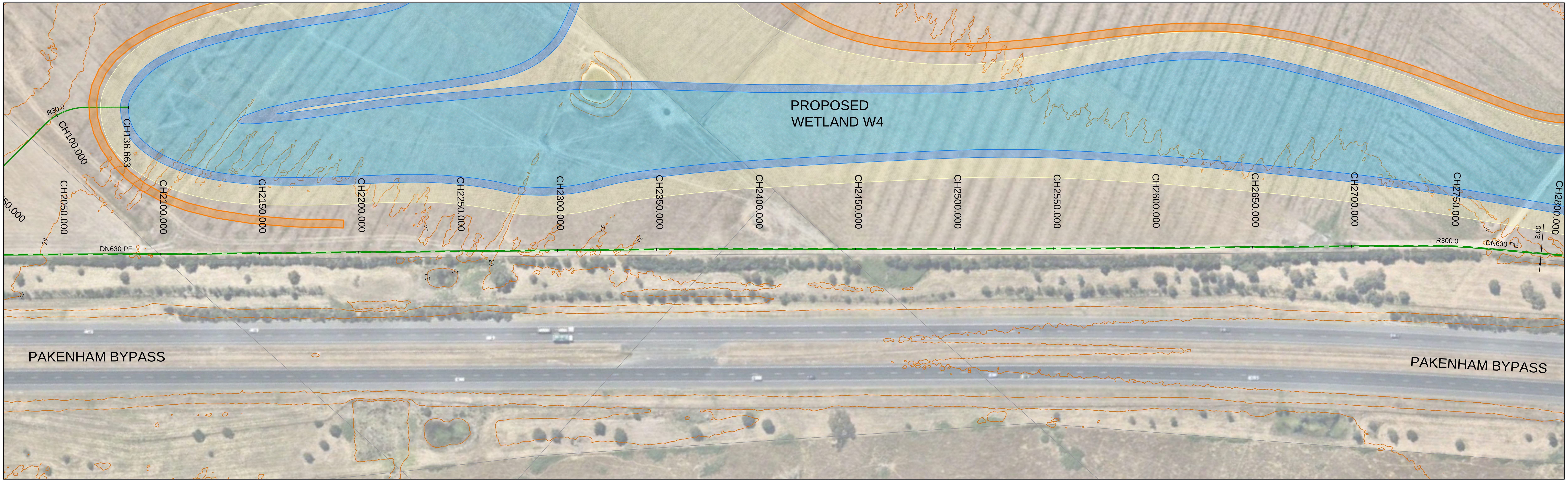

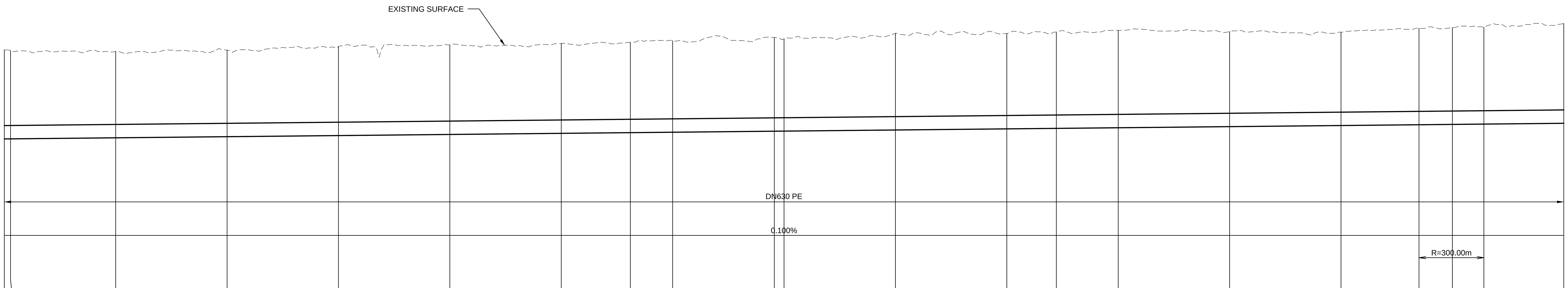

VERTICAL GEOMETRY

HORIZONTAL GEOMETRY

DATUM RL18

EXISTING SURFACE RL	28.812	28.777	28.746	28.801	28.962	29.034	29.101	29.147	29.225	29.370	29.306	29.558	29.551	29.616	29.684	29.632	29.605	29.790	29.809	29.822	29.994
DEPTH TO INVERT	3.992	3.954	3.875	3.88	3.991	4.013	4.03	4.045	4.103	4.204	4.135	4.336	4.28	4.322	4.363	4.26	4.183	4.333	4.337	4.337	4.473
INVERT LEVEL	24.821	24.824	24.871	24.921	24.971	25.021	25.071	25.102	25.121	25.167	25.171	25.221	25.271	25.294	25.321	25.371	25.421	25.457	25.472	25.486	25.522
CHAINAGE	2100.00	2102.80	2150.00	2200.00	2250.00	2300.00	2350.00	2381.02	2400.00	2445.63	2450.00	2500.00	2550.00	2572.24	2600.00	2650.00	2700.00	2735.01	2750.00	2764.15	2800.00

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\functional\12221.01 option 1\12221.01FDP01.dwg - 12221.01FDP04
Date/Time: Thu Jun 09, 2016 - 4:03pm --byron.shade--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

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Drawn J.BURNS
Date 22/01/16
AN 1631266
Designed J.BURNS
Date 22/01/16
AN 1631272
Verified S.LEA
Date 22/02/16
AN 1062574
Audited -
Date -
AN
Approved -
Date -
AN

NOTE:
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Coords: MGA
Levels: AHD
Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
DETAIL PLAN
SHEET 04 OF 06
Drawing No. 12221.01FDP04 Rev B
Sheet No. 06 FUNCTIONAL

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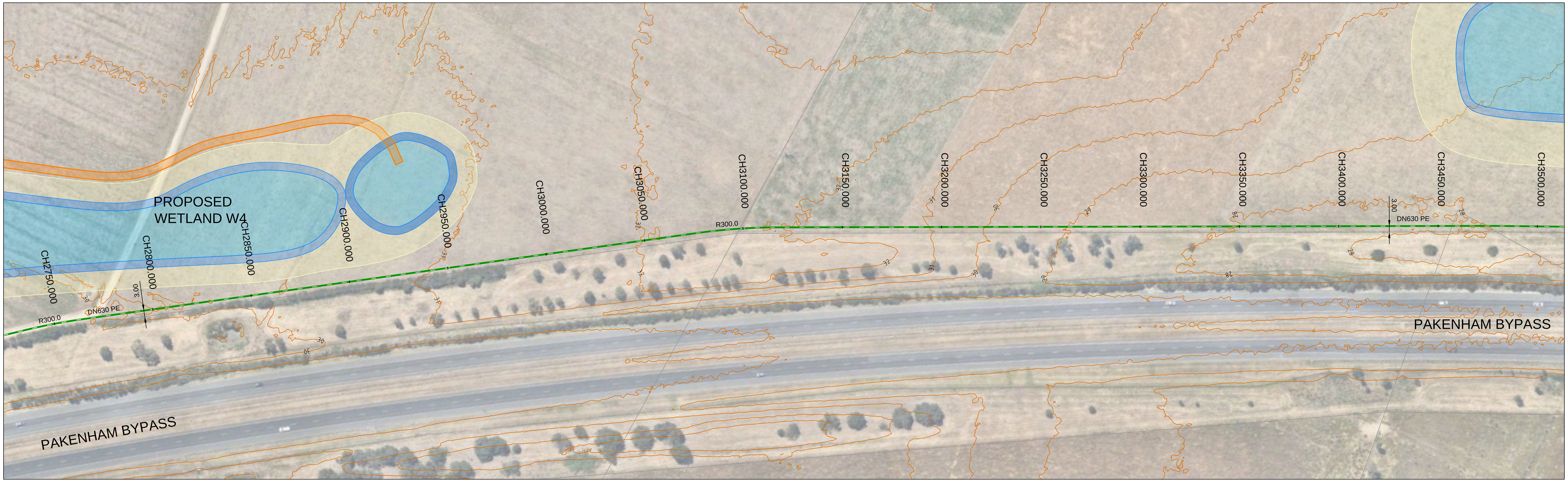
REFER DWG 12221.01FDP04 FOR CONTINUATION



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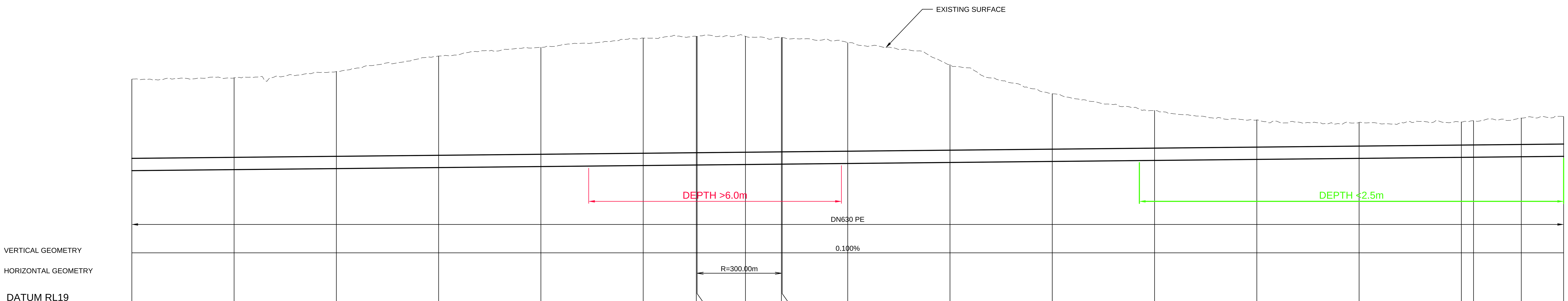

DATUM RL19

EXISTING SURFACE RL	29.994	30.063	30.369	31.127	31.556	32.009	32.094	32.088	32.095	32.035	32.035
DEPTH TO INVERT	4.473	4.492	4.748	5.455	5.834	6.237	6.296	6.29	6.273	6.196	6.195
INVERT LEVEL	25.522	25.572	25.622	25.672	25.722	25.772	25.798	25.798	25.822	25.839	25.840
CHAINAGE	2800.00	2850.00	2900.00	2950.00	3000.00	3050.00	3075.98	3076.39	3100.00	3117.57	3117.98

EXISTING SURFACE RL	31.779	30.707	29.282	28.463	28.001	27.879	27.900	27.963	28.093	28.164
DEPTH TO INVERT	5.907	4.785	3.31	2.441	1.929	1.757	1.728	1.784	1.892	1.941
INVERT LEVEL	25.872	25.922	25.972	26.022	26.072	26.122	26.172	26.178	26.202	26.222
CHAINAGE	3150.00	3200.00	3250.00	3300.00	3350.00	3400.00	3450.00	3455.94	3479.29	3500.00

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\functional\12221.01 option 1\12221.01FDP01.dwg - 12221.01FDP05
Date/Time: Thu Jun 09, 2016 - 4:03pm --byron.shade--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

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Drawn J.BURNS
Date 22/01/16
AN 1631266
Designed J.BURNS
Date 22/01/16
AN 1631273
Verified S.LEA
Date 22/02/16
AN 1062575
Audited -
Date -
AN
Approved -
Date -
AN

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Levels: AHD
Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
DETAIL PLAN
SHEET 05 OF 06
Drawing No. 12221.01FDP05 Rev B
Sheet No. 07 FUNCTIONAL

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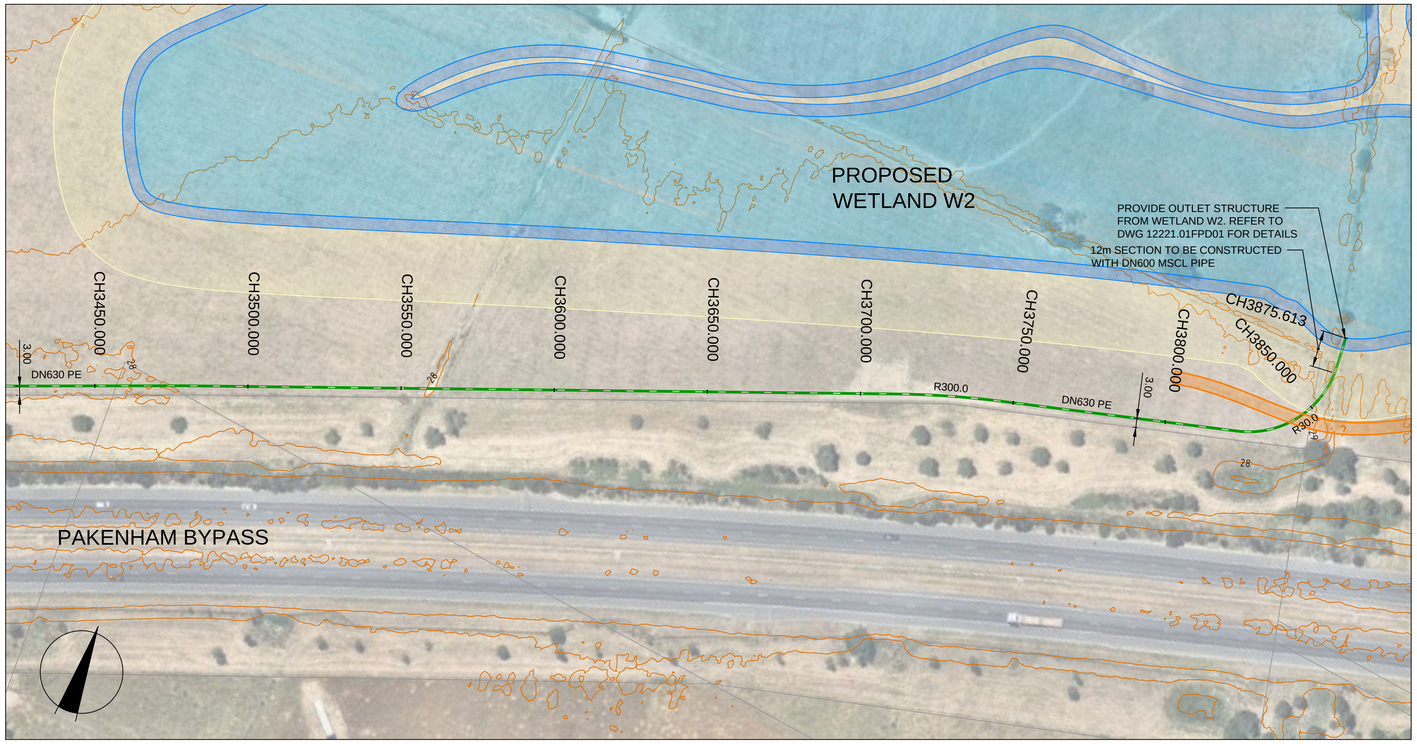
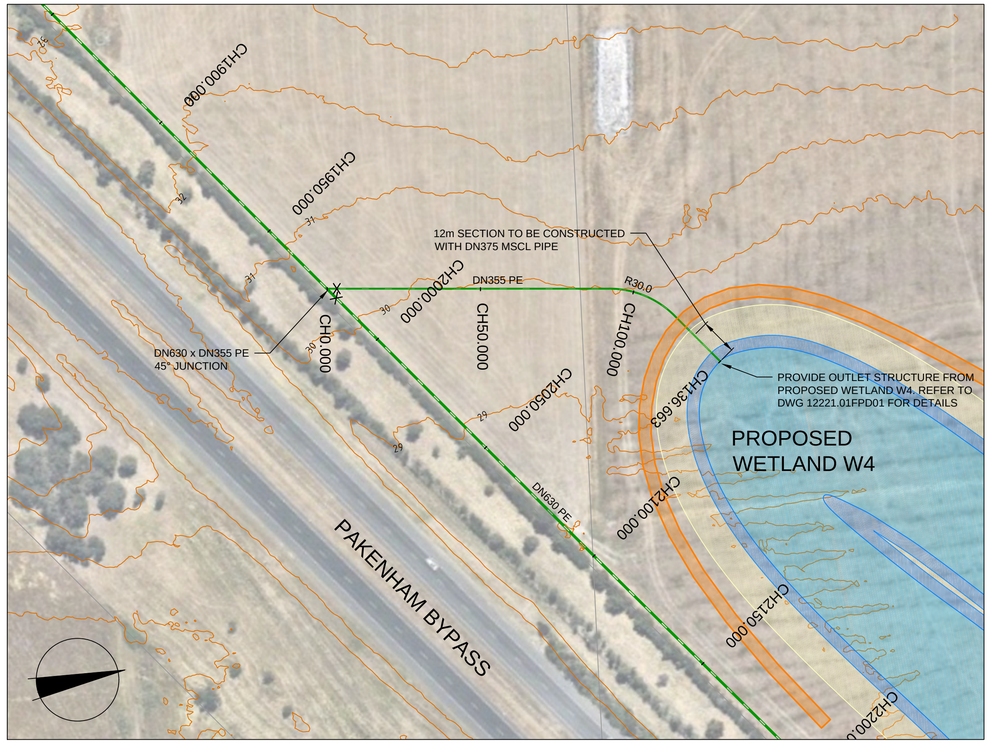
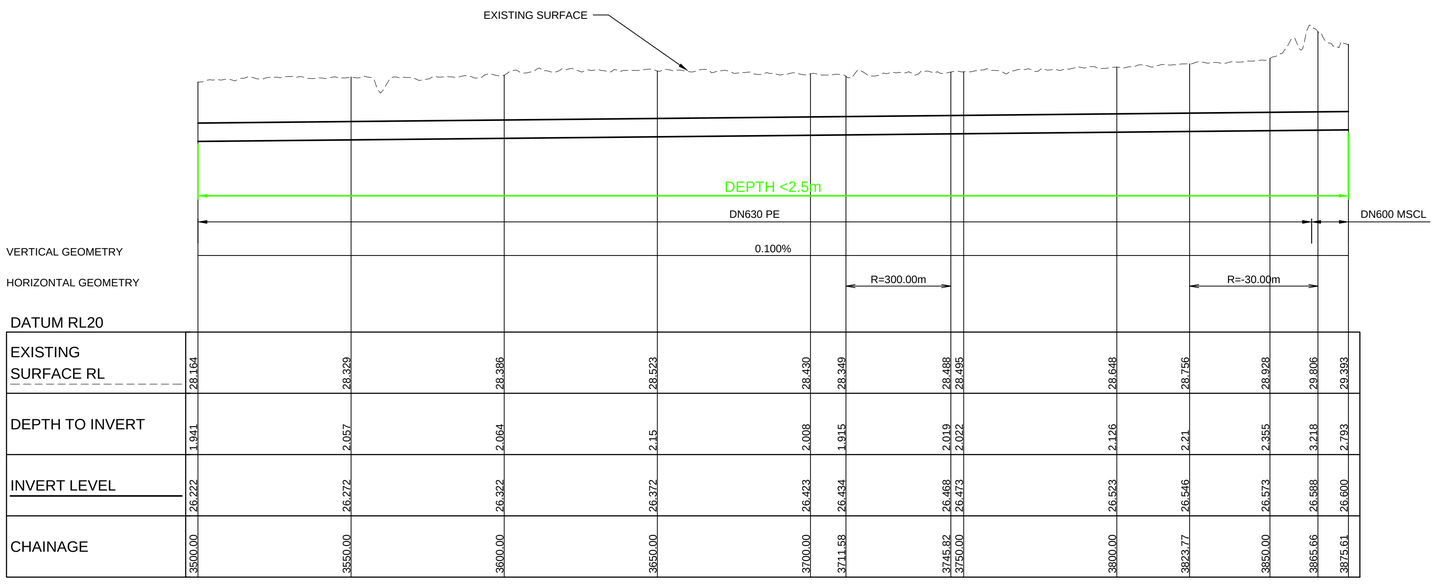
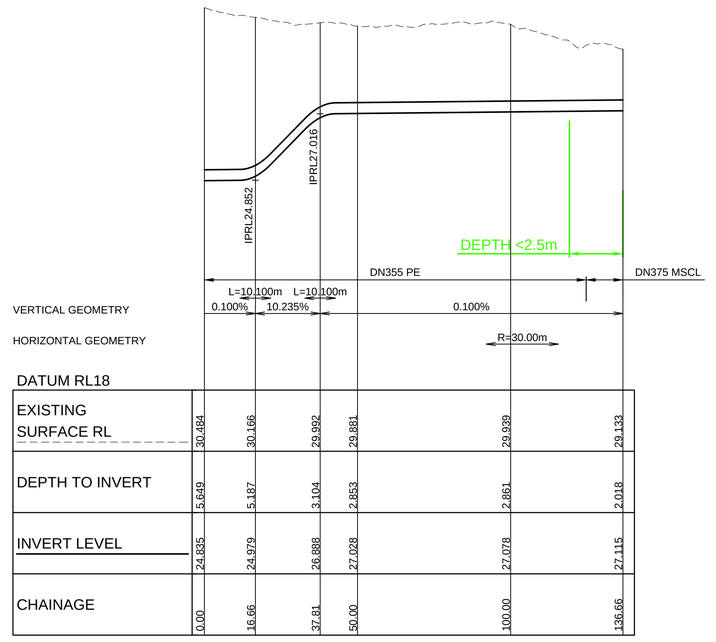
REFER DWG 12221.01FDP05 FOR CONTINUATION









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Date/Time: Thu Jun 09, 2016 - 4:04pm --byron.shode--

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MELBOURNE WATER

PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
DETAIL PLAN
SHEET 06 OF 06
Drawing No. 12221.01FDP06 Rev B
Sheet No. 08 FUNCTIONAL

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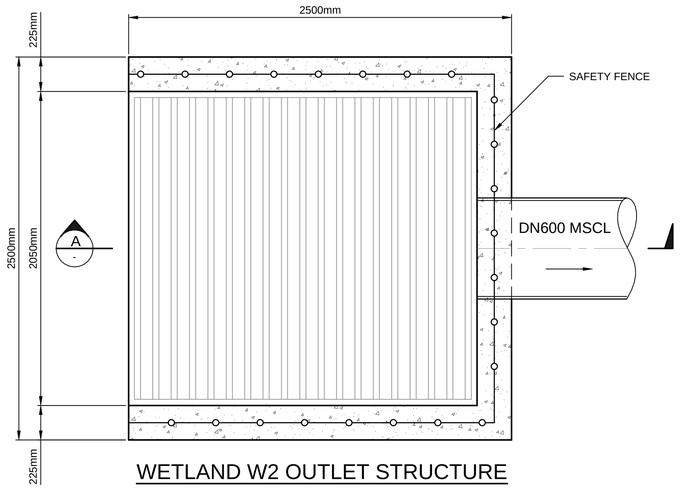
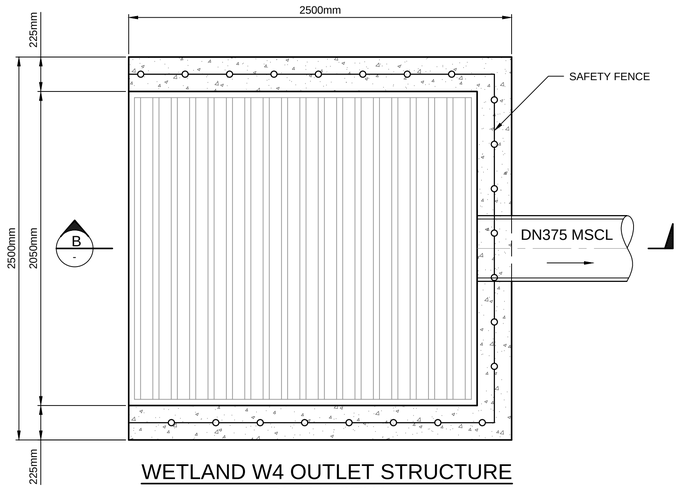
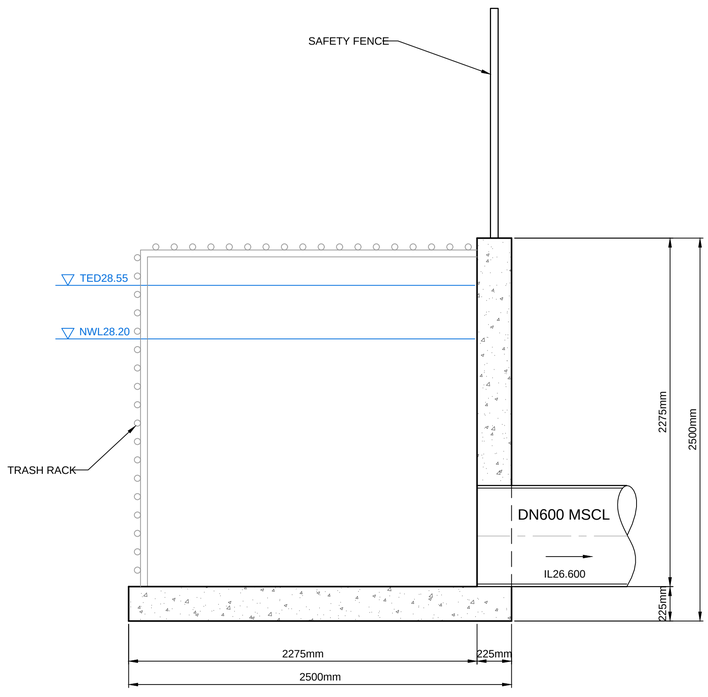


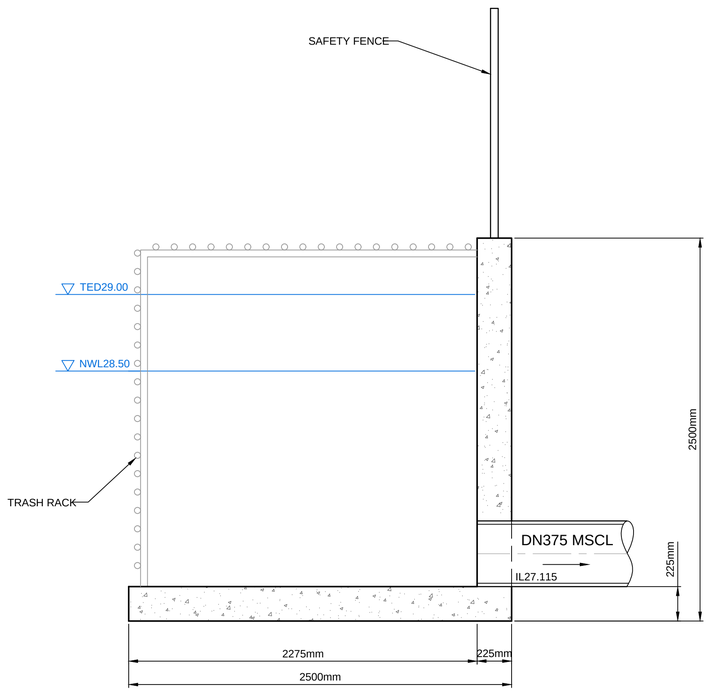
WETLAND W2 OUTLET STRUCTURE
PLAN VIEW
SCALE 1:20



WETLAND W4 OUTLET STRUCTURE
PLAN VIEW
SCALE 1:20



SECTION A
SCALE 1:20



SECTION B
SCALE 1:20

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Scale @ A1/A3 1:20 / 1:40

MELBOURNE WATER

PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 1 - GRAVITY
DRAINAGE PIT DETAILS

Drawing No. 12221.01FPD01 Rev B
Sheet No. 09 FUNCTIONAL

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PAKENHAM EAST SWH

TRANSFER PIPELINE OPTION 2 - PRIMED

PAKENHAM EAST P.S.P TO BALD HILL RESERVOIR

CARDINIA SHIRE COUNCIL

FOR

MELBOURNE WATER

CIVIL DRAWINGS

DCE REF : 12221.02

NOT TO BE USED FOR CONSTRUCTION

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1. GENERAL

1.1. ALL LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM (AHD) AND COORDINATES FOR SETTING OUT ARE TO MAP GRID AUSTRALIA (MGA).

1.2. ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH THE SPECIFICATIONS AND STANDARD DRAWINGS OF MELBOURNE WATER.

1.3. ALL CHAINAGES REFER TO THE DESIGN LINE AND/OR STRUCTURE CENTRELINE AS SHOWN ON THE DRAWINGS.

1.4. THE CONTRACTOR SHALL GIVE MINIMUM 5 WORKING DAYS NOTICE OF THE COMMENCEMENT OF WORKS TO:
(a) MW DEVELOPER WORKS
(b) COUNCIL SURVEILLANCE COORDINATOR
(c) DALTON CONSULTING ENGINEERS
(d) SERVICE AUTHORITIES AFFECTED BY THE WORKS

1.5. THE CONTRACTOR IS CAUTIONED THAT EXISTING UNDERGROUND AND OVERHEAD UTILITY SERVICES ARE ADJACENT TO OR WITHIN THE CONSTRUCTION AREA AND THE RELEVANT "NO GO ZONE" SAFETY PROCEDURES MUST BE PREPARED AND APPROVED BY THE UTILITY COMPANY. ALL WORKS MUST COMPLY WITH THESE PROCEDURES.

1.6. THE LOCATION OF THE EXISTING SERVICES SHOWN ON THESE DRAWINGS ARE NOT GUARANTEED FOR THEIR ACCURACY OR COMPLETENESS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL SERVICES AFFECTED BY THE WORKS TO HIS OWN SATISFACTION.

1.7. THE CONTRACTOR WILL BE RESPONSIBLE FOR ALL DAMAGE TO ANY SERVICE, STRUCTURE OR EXISTING CONSTRUCTION RESULTING FROM HIS CONSTRUCTION WORKS AND SHALL COMPLY WITH THE MW CONSTRUCTION SPECIFICATION CLAUSE 1.4.2.

1.8. WHERE HEAVILY LADEN TRUCKS (EG T44 OR W7 WHEEL LOADS) ARE REQUIRED TO TRAFFIC OVER INSTALLED PIPELINES, A MINIMUM COVER OF 1.00m ABOVE THE CROWN OF PIPE IS REQUIRED. WHERE THE CONTRACTOR REQUIRES TO CROSS ANY PIPELINE WITH CONSTRUCTION EQUIPMENT HAVING IN EXCESS OF THE ABOVE LOADS, THE SUPERINTENDENT MUST BE REFERRED TO.

1.9. TBM'S AND CONTROL POINTS ARE TO BE RE-ESTABLISHED BY THE LICENSED SURVEYOR IF FOUND TO BE MISSING AT THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR WILL BE RESPONSIBLE FOR CARE AND MAINTENANCE OF ALL T.B.M.'S AND CONTROL POINTS THEREAFTER.

1.10. AT LEAST 3 DAYS BEFORE COMMENCING EXCAVATION OF TRENCHES IN EXCESS OF 1.5m DEEP, A COMPLETED 'NOTICE OF INTENTION TO COMMENCE TRENCHING OPERATIONS' FORM SHALL BE SENT TO WORKSAFE VICTORIA. THE NOMINATED SUPERVISOR SHALL BE SUITABLY QUALIFIED IN ACCORDANCE WITH THE VICTORIAN OHS ACT 1985 & COMMONWEALTH OHS CODES OF PRACTICE 2008

1.11. ALL SERVICE AUTHORITIES SHALL BE NOTIFIED IN WRITING SEVEN DAYS PRIOR TO COMMENCEMENT OF THE WORKS.

1.12. ALL EXISTING SURFACE LEVELS SHOWN ON THE ENGINEERING DRAWINGS HAVE BEEN INTERPOLATED FROM A DIGITAL TERRAIN MODEL. THESE LEVELS HAVE BEEN USED AS THE BASIS FOR ALL ENGINEERING DESIGN AND DETERMINATION OF QUANTITIES.

1.13. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH COUNCIL SPECIFICATIONS, STANDARD DRAWINGS AND TO THE SATISFACTION OF THE SURVEILLANCE CO-ORDINATOR OR HIS REPRESENTATIVE.

1.14. ALL TREES AND SHRUBS TO BE RETAINED UNLESS PRIOR APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT AUTHORITY BECAUSE CONSTRUCTION NECESSITATES THEIR REMOVAL, OR REMOVAL IS DIRECTED BY THE AUTHORISED ENGINEER. TREES TO BE REMOVED ARE TO BE SUITABLY LABELLED. WHEN IT IS PROPOSED TO REMOVE EXISTING TREES IN ROAD RESERVES OR COUNCIL RESERVES, CONSULTATION IS TO OCCUR WITH COUNCILS PARKS AND GARDENS DEPARTMENT.

1.16. ALL SERVICE TRENCHES UNDER ROAD CARRIAGEWAYS, FOOTPATHS, VEHICLE CROSSINGS AND OTHER ROAD STRUCTURES ARE TO BE BACKFILLED WITH 20mm CLASS 3 CRUSHED ROCK IN ACCORDANCE WITH COUNCIL'S STANDARD SPECIFICATION FOR ROADS AND DRAINAGE WORKS IN LAND DEVELOPMENTS.

1.17. SURFACE RESTORATION TO ROAD SURFACES TO COUNCILS REQUIREMENTS

1.18. CONTRACTOR SHALL IMMEDIATELY ADVISE THE CONSULTANT OF ANY SERIOUS OR REPORTABLE INCIDENT:
a) THAT HAS TO BE NOTIFIED TO THE WORKCOVER AUTHORITY UNDER PART 5 OF THE OHS ACT 2004.
b) THAT HAS DETRIMENTALLY, OR THREATENS TO, AFFECT THE EXISTING ASSETS OF ANY AUTHORITY OR PROPERTY.
c) THE CONTRACTOR MUST ALSO ADVISE THE RELEVANT AUTHORITIES AND/OR OWNERS AFFECTED.
d) THE CONSULTANT SHALL CONFIRM WITH THE RELEVANT AUTHORITIES AND/OR OWNERS THAT THEY HAVE BEEN ADVISED OF THE INCIDENT.

1.19. THE CONTENTS OF ALL CONSTRUCTION ISSUE PLANS SHALL TAKE PRECEDENCE OVER ALL DIGITAL FILES ISSUED BY DCE TO THE CONTRACTOR AND IN PARTICULAR 3D ALIGNMENT STRINGS EXPORTED DIRECTLY FROM 3D CIVIL SOFTWARE. SHOULD ANY DISCREPANCIES BETWEEN CONSTRUCTION ISSUE PLANS AND DIGITAL FILES BE FOUND THE CONTRACTOR SHALL NOTIFY THE SUPERINTENDENT IMMEDIATELY.

2. SITE SAFETY & ACCESS

2.1. THE WORKS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH MELBOURNE WATER'S OCCUPATIONAL HEALTH POLICY AND THE CONTRACTOR WILL BE REQUIRED TO SUBMIT A PROJECT RISK ASSESSMENT, SITE SAFETY MANAGEMENT AND OTHER REQUIRED INFORMATION BEFORE COMMENCEMENT.

2.2. BEFORE COMMENCING CONSTRUCTION THE CONTRACTOR SHALL ERECT ACCEPTABLE TEMPORARY SAFETY FENCES WHERE REQUIRED TO ISOLATE THE WORKS SITE FROM THE PUBLIC.

2.3. THE CONTRACTOR IS TO PREPARE A TRAFFIC MANAGEMENT PLAN TO THE SATISFACTION OF COUNCIL BEFORE COMMENCING WORKS.

2.4. THE CONTRACTOR IS REQUIRED TO CONFINE CONSTRUCTION VEHICLES TO THE DRAINAGE RESERVE UNLESS APPROVED OTHERWISE BY THE SUPERINTENDENT. ANY DAMAGE CAUSED TO ADJACENT PROPERTIES MUST BE MADE GOOD.

3. EARTHWORKS & SEDIMENTATION CONTROL

3.1. NO POLLUTED OR SEDIMENT LADEN RUNOFF IS TO BE DISCHARGED DIRECTLY OR INDIRECTLY INTO EXISTING DRAINAGE SYSTEM DURING OR AFTER THE WORKS.

3.2. CONTRACTOR TO PREPARE A SITE MANAGEMENT PLAN (SMP) AND FORWARD TO THE CONSULTANT 3 WEEKS PRIOR TO COMMENCING OF ANY WORKS. SMP IS TO BE PREPARED IN ACCORDANCE WITH THE MELBOURNE WATER SMP KIT PLAN SUBJECT TO COUNCIL AND MELBOURNE WATER APPROVAL.

3.3. CONTRACTOR MUST ENSURE THAT COMPACTION TESTING OF FILLED AREAS COMPLIES WITH LEVEL 1 GEOTECHNICAL SUPERVISION PER CLAUSE 8.2 OF AS 3798-2007 AND SHALL BE ARRANGED BY THE CONTRACTOR WITH CERTIFYING CONSULTANT AT CONTRACTORS EXPENSE.

3.4. FILLING DEPTHS IN EXCESS OF 200mm ARE TO BE STRIPPED OF TOPSOIL, FILLED AND TOPSOIL REPLACED TO OBTAIN FINAL SURFACE LEVELS SHOWN ON THE DRAWINGS.

3.5. STOCKPILING OF MATERIAL IS TO BE PLACED AS DIRECTED BY THE SUPERINTENDENT. NO TOPSOIL IS TO BE REMOVED FROM SITE.

3.6. DISTURBED AREAS WITHIN DESIGNATED GRASSED FLOODWAY ZONES MUST BE TOPSOILED AND HYDROMULCH SEEDED WITH APPROVED GRASSES AND FERTILIZER. TEMPORARY FENCING MUST BE ERECTED TO PREVENT ACCESS TO TREATED AREAS.

3.7 SURPLUS EXCAVATED SPOIL IS TO BE USED AS FILL ON THE ESTATE WHERE PRACTICAL AND IF NOT IS TO BE TAKEN OFF SITE TO A LOCATION SPECIFIED BY THE SUPERINTENDANT.

4. MELBOURNE WATER

4.1. ONLY MW REGISTERED CONTRACTORS ARE PERMITTED TO WORK ON OR ENTER MELBOURNE WATER CORPORATION LIVE ASSETS.

4.2. IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE THAT ONLY SUCH REGISTERED CONTRACTORS ARE USED AND APPROPRIATE NOTIFICATION IS GIVEN TO MELBOURNE WATER.

5. REINFORCEMENT & CONCRETE

5.1. ALL CONCRETE SHALL BE IN ACCORDANCE WITH AS3600 & AS3610 AND PRE-MIXED CONCRETE IN ACCORDANCE WITH AS1379.

5.2. UNLESS SHOWN OTHERWISE, CONCRETE GRADES SHALL BE:
(a) 32 MPa - CULVERT BASE SLABS, APRONS & WINGWALLS
(b) N25 - PITS & OTHER ENCLOSED, STRUCTURES & GENERAL WORKS.

5.3. UNLESS SHOWN OTHERWISE, CLEAR COVER TO REINFORCEMENT SHALL BE
(a) 40mm - NEXT TO FORMED FACES.
(b) 40mm - NEXT TO UNFORMED FACES EG:GROUND

5.4. STEEL REINFORCEMENT SHALL COMPLY WITH AS4671 AND FOLLOWING GRADES:

5.5. MINIMUM FABRIC OVERLAPS SHALL BE
(a) END LAP - 2 SPACES + 30mm
(b) SIDE LAP - 1 SPACE + 30mm

5.6. STEEL WORKS TO COMPLY WITH AS4100 AND SHALL HAVE MINIMUM YIELD STRESS (Fy) OF GRADE 250 AND SECTIONS CONFORM TO AS3678 & AS3679.

5.7. WELDS SHALL COMPLY WITH AS1554, ELECTRODES AS1553 (E48XX) AND TO CLASS SP.

5.8. CONTINUOUS 6mm FILLET WELDS SHALL BE USED, BUTT WELDS TO BE FULL PENETRATION.

5.9. STEEL COMPONENTS TO BE HOT DIP GALVANIZED IN ACCORDANCE WITH AS1650-1989 AFTER FABRICATION, DAMAGE TO COATING TO BE REPAIRED WITH ZINC RICH PAINT.

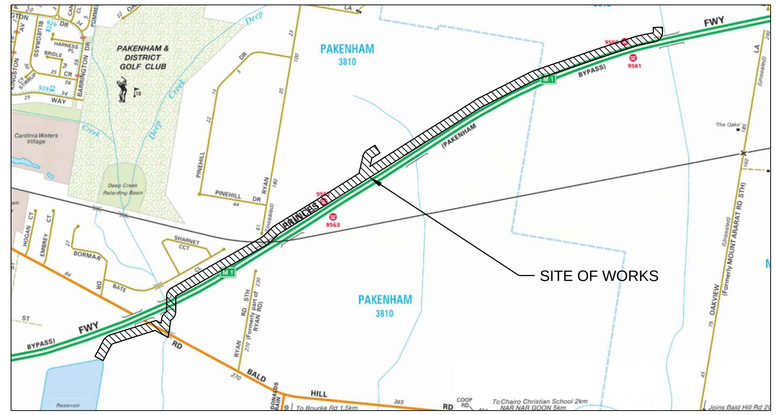
5.10. CONCRETE SURFACES MUST BE ADEQUATELY CURED FOR MINIMUM SEVEN DAYS (7) PRIOR TO APPLYING OF CONSTRUCTION OR EARTHWORKS LOADS.

5.11. FIELD WELDING OF REINFORCEMENT IS ONLY PERMITTED WITH THE ENGINEER'S WRITTEN APPROVAL.

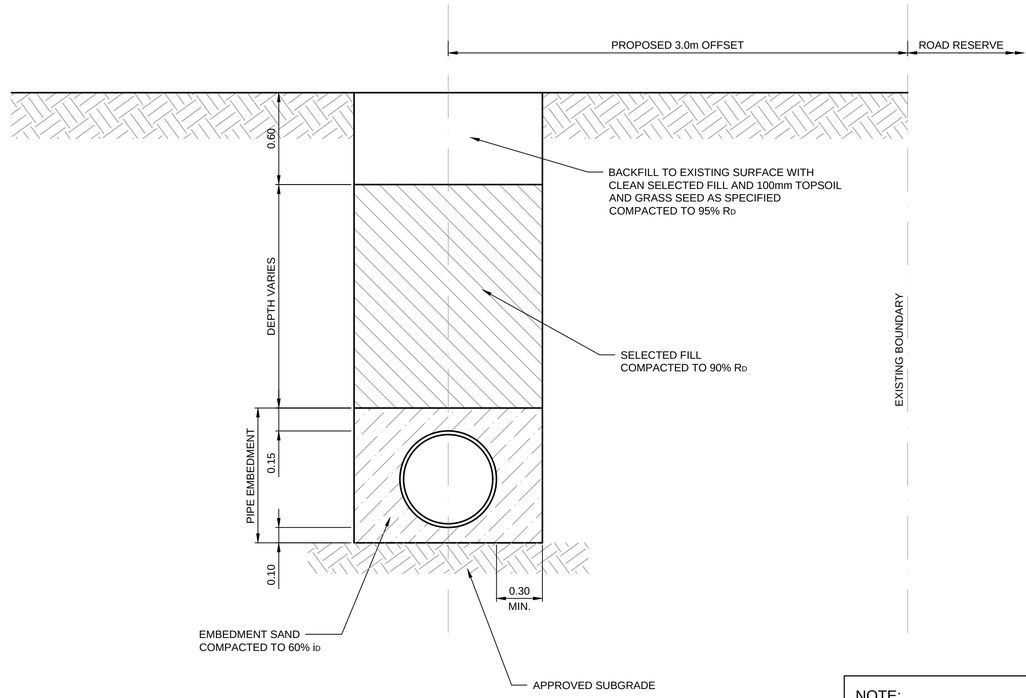
5.12. ALL REINFORCEMENT IS TO BE ACCURATELY PLACED, TIED AND SUPPORTED IN POSITION BY BAR CHAIRS AT 750mm CENTRES WHERE APPROPRIATE AND ADEQUATELY IN OTHER MEMBERS.

5.13. ALL FORMWORK SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH AS1509.

DRAWING INDEX



LOCALITY PLAN
MELWAY REF MAP: 317 J12
NTS



TYPICAL TRENCH SECTION
SCALE 1:20

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Date/Time: Thu Jun 09, 2016 - 4:17pm - --byron.shade--

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Date 23/02/16
AN 1062578
Audited -
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Coords: MGA
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Hor 1:20 0m 0.2m 0.4m 0.8m 1.2m
Scale @ A1/A3

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 2 - PRIMED
LOCALITY PLAN, DRAWING INDEX & NOTES

Drawing No. 12221.02FTD01 Rev B
Sheet No. 01 FUNCTIONAL

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PROPOSED WETLAND 'W2'

PROPOSED WETLAND 'W4'

PAKENHAM BYPASS

REFER 12221.02FDP06

REFER 12221.02FDP05

REFER 12221.02FDP04

REFER 12221.02FDP03

REFER 12221.02FDP02

REFER 12221.02FDP01

DN630 PE

RYAN ROAD

RAILWAY CORRIDOR

RAILWAY CORRIDOR

RYAN ROAD

PAKENHAM BYPASS

BALD HILL ROAD

Ex.W

Ex.W

Ex.W

BALD HILL RESERVOIR

INLET TO BALD HILL RESERVOIR

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MELBOURNE WATER

PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 2 - PRIMED
LAYOUT PLAN

Drawing No. 12221.02FLP01 Rev B
Sheet No. 02 FUNCTIONAL

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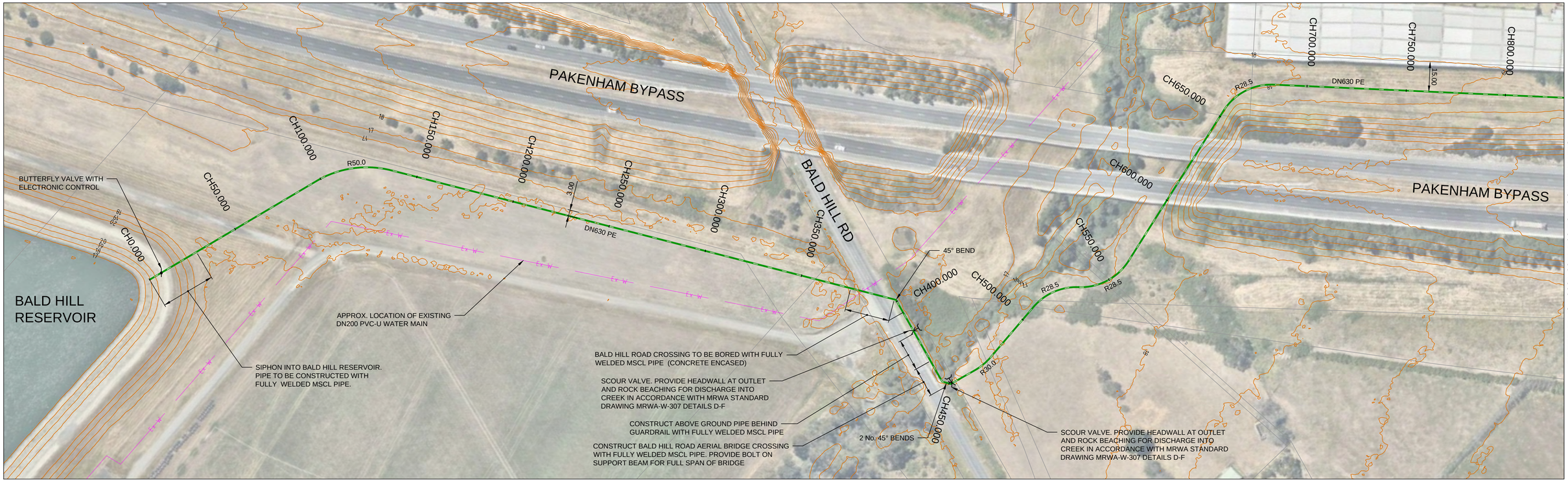

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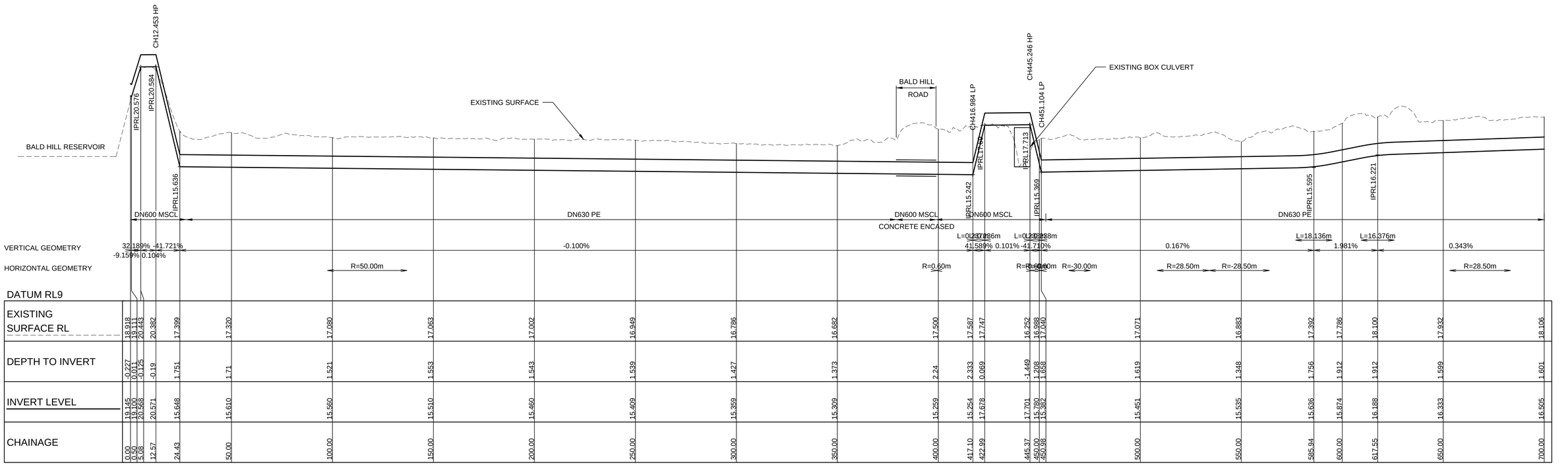

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MELBOURNE WATER

PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 2 - PRIMED
DETAIL PLAN
SHEET 01 OF 06
Drawing No. 12221.02FDP01 Rev B
Sheet No. 03 FUNCTIONAL

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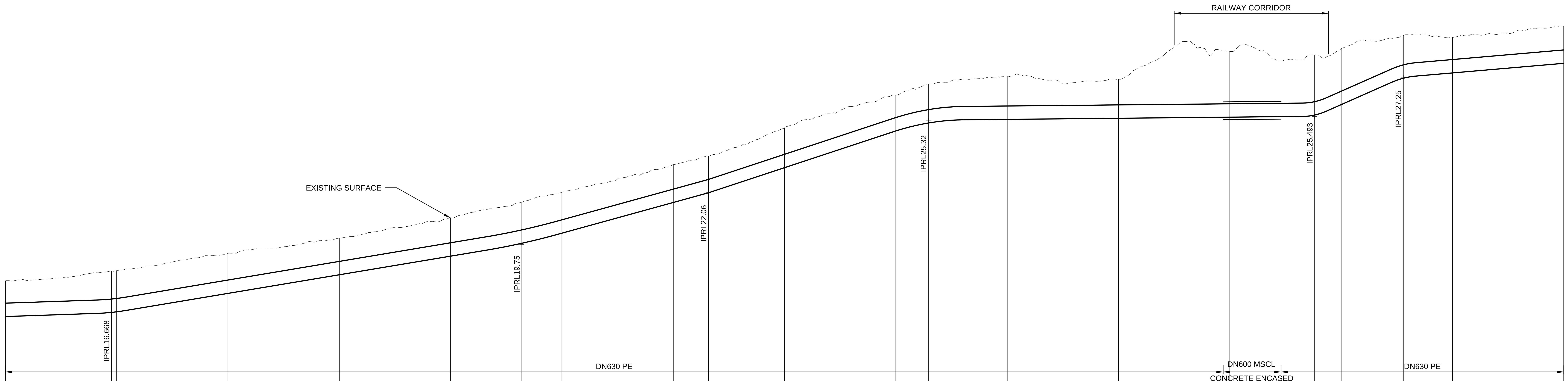

DN630 PE | DN600 MSCL CONCRETE ENCASED | DN630 PE

VERTICAL GEOMETRY: 0.343% | L=13.282m | 1.672% | L=32.480m | 2.755% | 3.301% | L=32.003m | 0.100% | L=10.799m | 4.419% | L=11.112m | 0.861%

HORIZONTAL GEOMETRY: R=-100.00m | R=100.00m

DATUM RL10

CHAINAGE	EXISTING SURFACE RL	DEPTH TO INVERT	INVERT LEVEL
700.00	18.106	1.601	16.505
747.64	18.531	1.841	16.690
750.00	18.561	1.844	16.717
800.00	19.342	1.798	17.543
850.00	20.018	1.638	18.379
900.00	20.937	1.722	19.215
931.98	21.641	1.847	19.794
950.00	22.085	1.839	20.246
1000.00	23.323	1.7	21.623
1015.84	23.697	1.637	22.060
1050.00	24.974	1.786	23.187
1100.00	26.445	1.608	24.837
1114.59	26.941	1.749	25.192
1150.00	27.301	1.946	25.355
1200.00	27.144	1.739	25.405
1250.00	28.398	2.944	25.455
1288.14	28.246	2.695	25.551
1300.00	28.521	2.504	26.017
1327.91	29.120	1.92	27.201
1350.00	29.033	1.592	27.440
1400.00	29.531	1.66	27.871

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\Functional\12221.02 option 2\12221.02FDP01.dwg - 12221.02FDP02
Date/Time: Thu Jun 09, 2016 - 4:17pm --byron.rhodes--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

Written dimensions to take precedence over scale. Contractor shall check and verify all dimensions on site, Discrepancies to be brought to the attention of the Superintendent.

Drawn J.BURNS
Date 22/01/16
AN 1631276
Designed J.BURNS
Date 22/01/16
AN 1631280
Verified S.LEA
Date 23/02/16
AN 1062581
Audited -
Date -
AN
Approved -
Date -
AN

NOTE:
THAT WETLAND DETAILS AND OUTLET CONNECTIONS TO THE HARVESTING SCHEME ARE SUBJECT TO CHANGE. DETAILED DESIGN MUST BE CONSISTENT WITH THE FINAL (AS YET TO BE FORMULATED) WETLAND 2016 FUNCTIONAL DESIGNS

Coords: MGA
Levels: AHD
Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER

PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 2 - PRIMED
DETAIL PLAN
SHEET 02 OF 06
Drawing No. 12221.02FDP02 Rev B
Sheet No. 04 FUNCTIONAL

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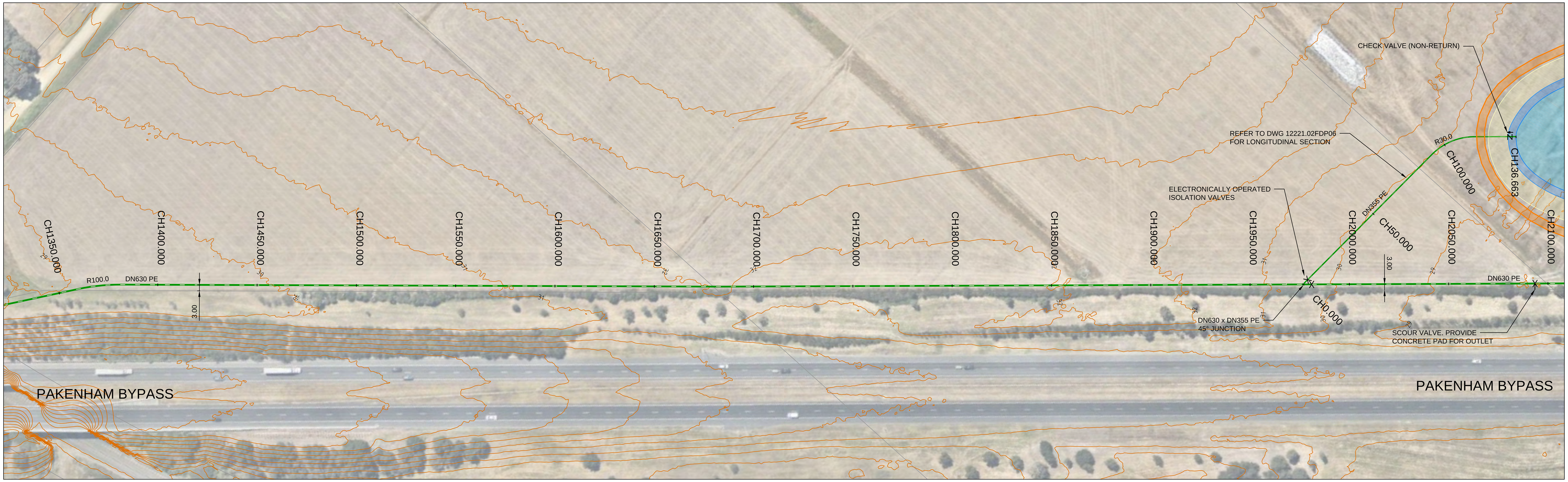

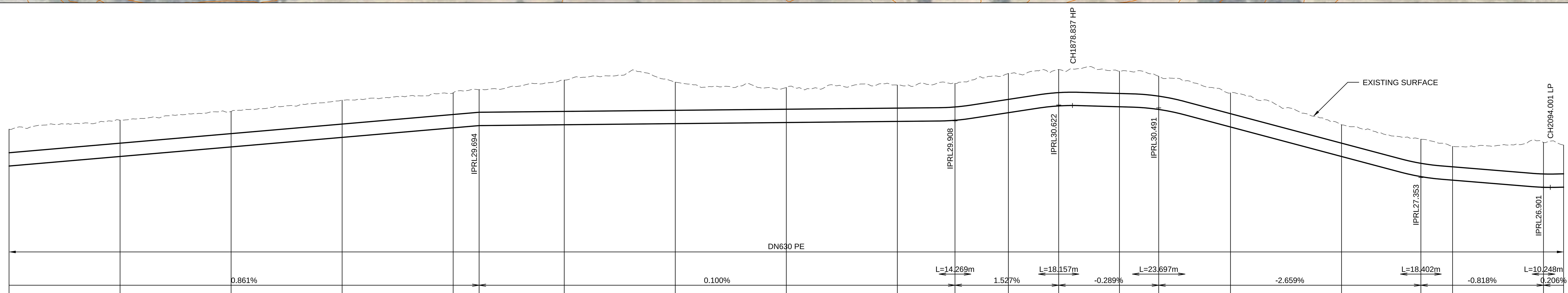

VERTICAL GEOMETRY

HORIZONTAL GEOMETRY

DATUM RL20

CHAINAGE	EXISTING SURFACE RL	DEPTH TO INVERT	INVERT LEVEL
1400.00	29.531	1.66	27.871
1450.00	29.938	1.636	28.302
1500.00	30.331	1.598	28.732
1550.00	30.838	1.675	29.163
1600.00	31.171	1.578	29.594
1611.67	31.311	1.617	29.694
1650.00	31.745	2.013	29.732
1700.00	31.650	1.868	29.782
1750.00	31.410	1.578	29.832
1800.00	31.519	1.636	29.882
1825.95	31.597	1.663	29.934
1850.00	32.046	1.77	30.276
1872.65	32.218	1.638	30.580
1900.00	32.142	1.599	30.543
1917.68	31.919	1.497	30.421
1950.00	31.167	1.535	29.632
2000.00	29.730	1.428	28.303
2035.73	29.080	1.685	27.395
2050.00	28.757	1.521	27.236
2090.94	28.936	2.023	26.914
2100.00	28.812	1.893	26.919

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\functional\12221.02 option 2\ 12221.02FDP01.dwg - 12221.02FDP03
Date/Time: Thu Jun 09, 2016 - 4:18pm --byron.shade--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

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Date 22/01/16
AN 1631276
Designed J.BURNS
Date 22/01/16
AN 1631281
Verified S.LEA
Date 23/02/16
AN 1062582
Audited -
Date -
AN
Approved -
Date -
AN

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Levels: AHD
Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 2 - PRIMED
DETAIL PLAN
SHEET 03 OF 06
Drawing No. 12221.02FDP03 Rev B
Sheet No. 05 FUNCTIONAL

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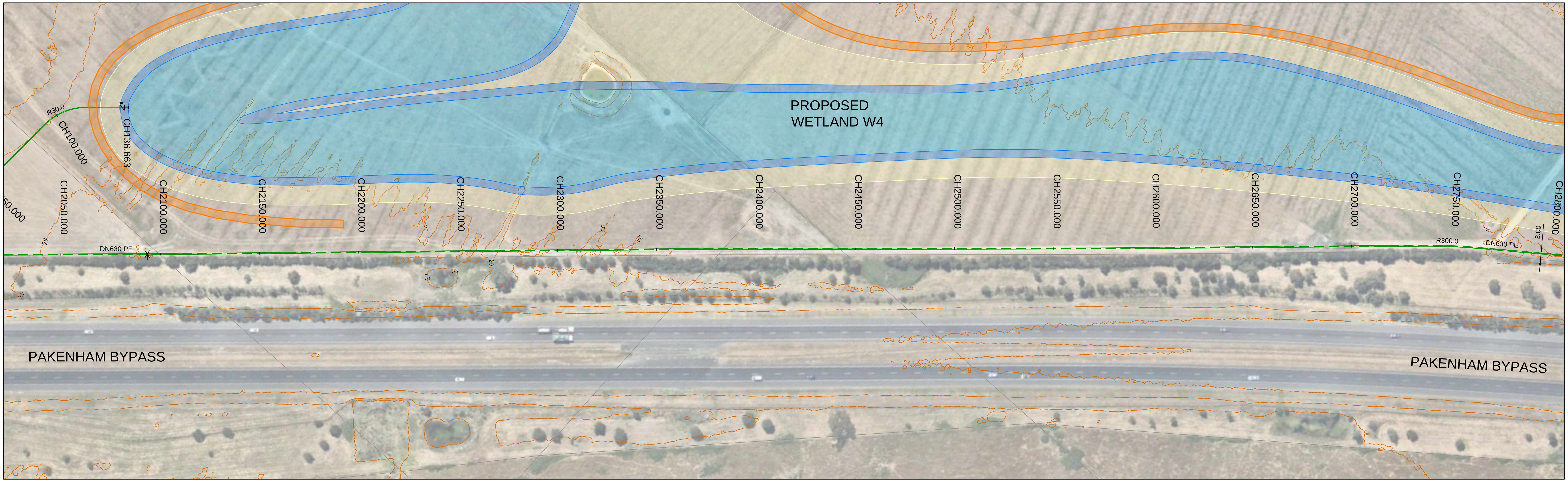

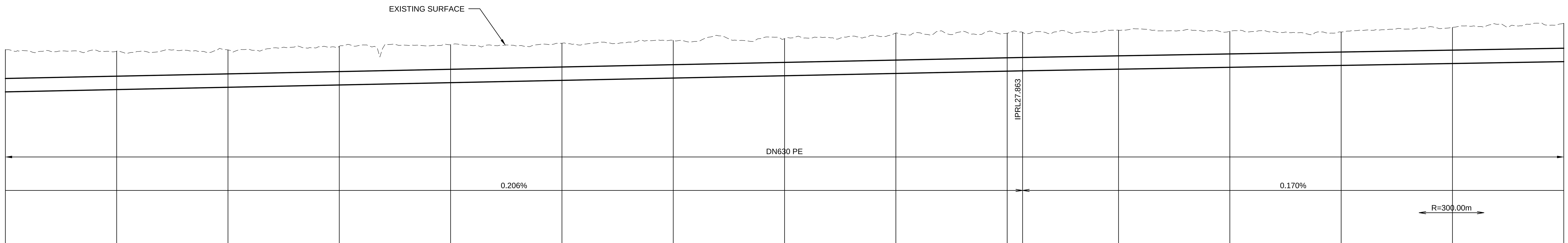

VERTICAL GEOMETRY

HORIZONTAL GEOMETRY

DATUM RL20

EXISTING SURFACE RL	28.812	28.746	28.801	28.962	29.034	29.101	29.225	29.306	29.558	29.551	29.589	29.684	29.632	29.605	29.809	29.994
DEPTH TO INVERT	1.893	1.723	1.675	1.733	1.702	1.665	1.686	1.664	1.812	1.702	1.727	1.748	1.611	1.499	1.618	1.719
INVERT LEVEL	26.919	27.023	27.126	27.229	27.332	27.436	27.539	27.642	27.745	27.849	27.863	27.936	28.021	28.106	28.191	28.276
CHAINAGE	2100.00	2150.00	2200.00	2250.00	2300.00	2350.00	2400.00	2450.00	2500.00	2550.00	2556.91	2600.00	2650.00	2700.00	2750.00	2800.00

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12221.02FDP01.dwg – 12221.02FDP04
Date/Time: Thu Jun 09, 2016 – 4:18pm --byron.shade--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
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Drawn J.BURNS
Date 22/01/16
AN 1631276
Designed J.BURNS
Date 22/01/16
AN 1631282
Verified S.LEA
Date 23/02/16
AN 1062583
Audited -
Date -
AN
Approved -
Date -
AN

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Coords: MGA
Levels: AHD

Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER

PAKENHAM EAST SWH

TRANSFER PIPELINE OPTION 2 - PRIMED

DETAIL PLAN

SHEET 04 OF 06

Drawing No. 12221.02FDP04 Rev B

Sheet No. 06 FUNCTIONAL

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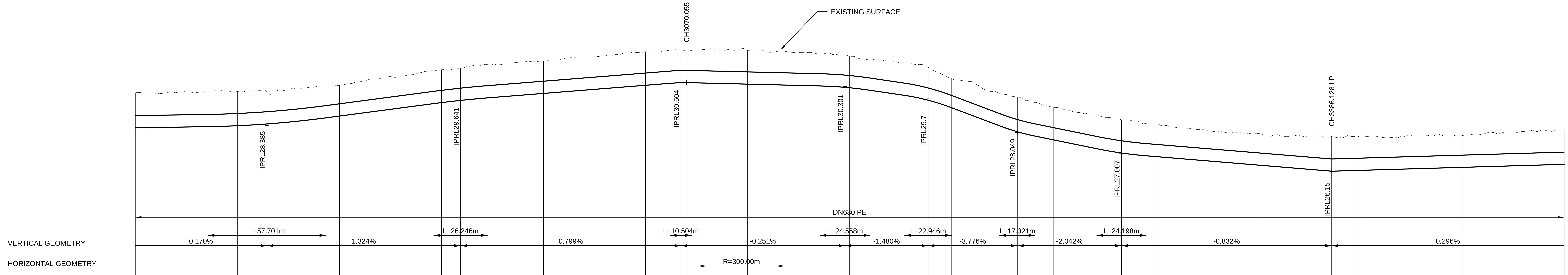

DATUM RL20

CHAINAGE	2800.00	2850.00	2864.53	2900.00	2950.00	2959.39	3000.00	3050.00	3067.32	3100.00	3147.72	3150.00
EXISTING SURFACE RL	29.994	30.063	30.002	30.369	31.127	31.188	31.556	32.009	32.108	32.095	31.852	31.779
DEPTH TO INVERT	1.719	1.682	1.533	1.515	1.612	1.564	1.59	1.644	1.618	1.674	1.588	1.536
INVERT LEVEL	28.276	28.381	28.469	28.855	29.516	29.624	29.966	30.365	30.490	30.421	30.264	30.243

CHAINAGE	3188.39	3200.00	3232.10	3250.00	3283.16	3300.00	3350.00	3386.13	3400.00	3450.00	3500.00
EXISTING SURFACE RL	31.250	30.707	29.792	29.282	28.662	28.463	28.001	27.859	27.879	27.900	28.164
DEPTH TO INVERT	1.616	1.445	1.705	1.598	1.618	1.596	1.551	1.709	1.688	1.561	1.677
INVERT LEVEL	29.634	29.261	28.087	27.684	27.043	26.867	26.451	26.150	26.191	26.339	26.487

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\functional\12221.02 option 2\12221.02FDP01.dwg - 12221.02FDP05
Date/Time: Thu Jun 09, 2016 - 4:18pm --byron.shade--

NOT TO BE USED FOR CONSTRUCTION

REV	AMENDMENTS	DATE	APP'D.
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

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Drawn J.BURNS
Date 22/01/16
AN 1631276
Designed J.BURNS
Date 22/01/16
AN 1631283
Verified S.LEA
Date 23/02/16
AN 1062584
Audited -
Date -
AN
Approved -
Date -
AN

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Coords: MGA
Levels: AHD
Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 2 - PRIMED
DETAIL PLAN
SHEET 05 OF 06
Drawing No. 12221.02FDP05 Rev B
Sheet No. 07 FUNCTIONAL

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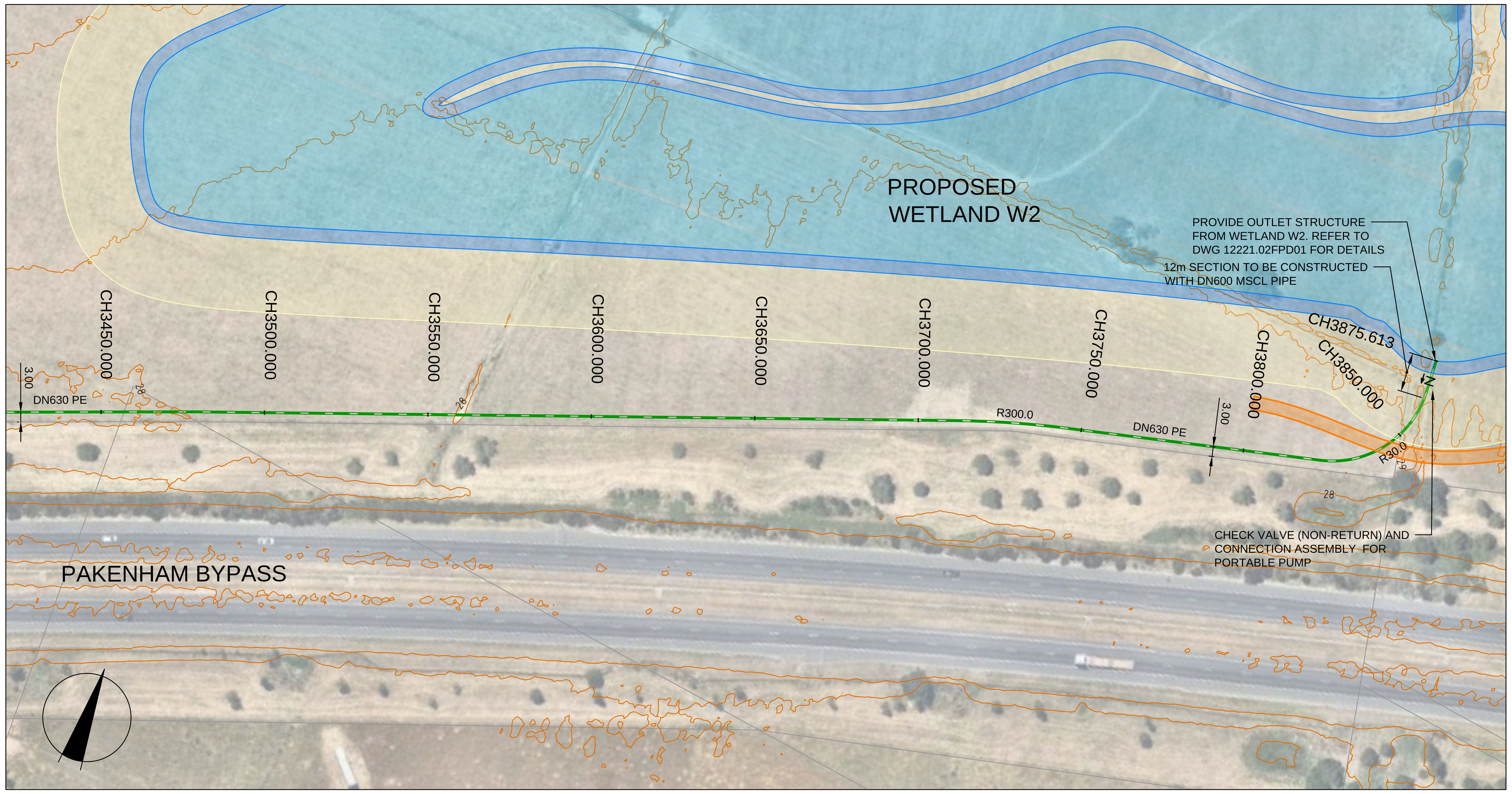
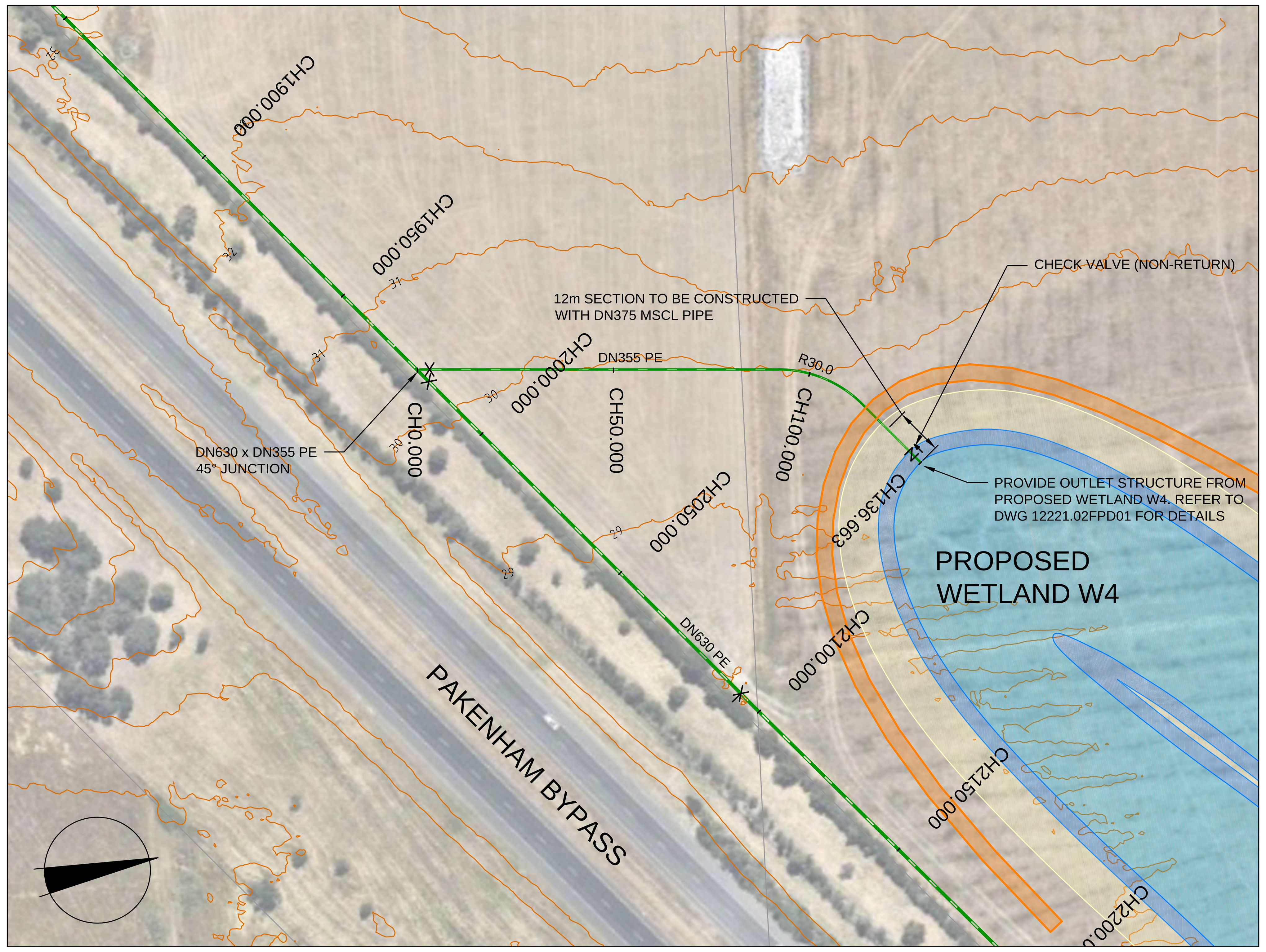
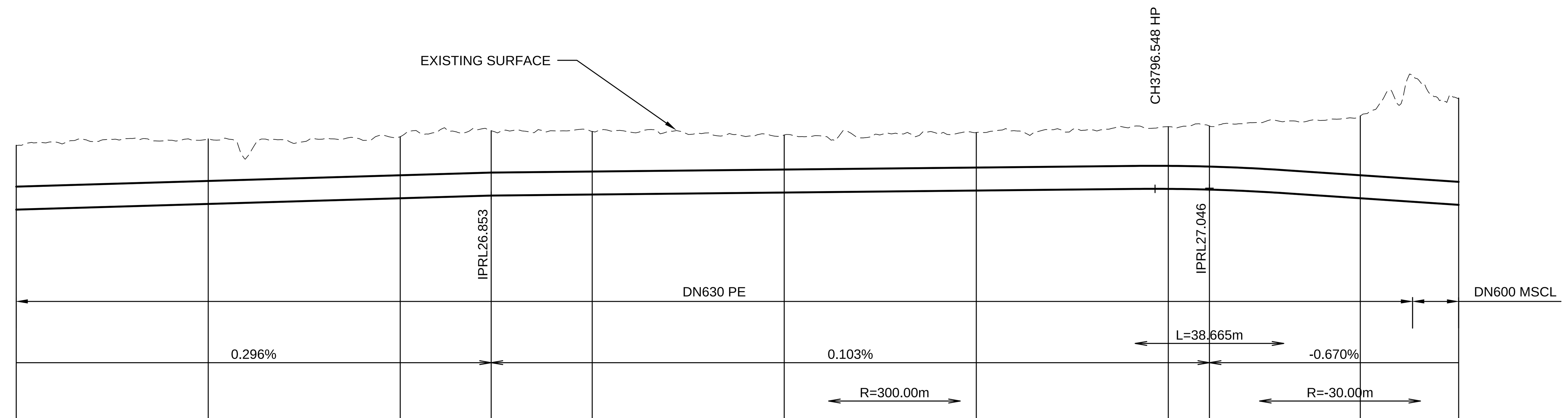
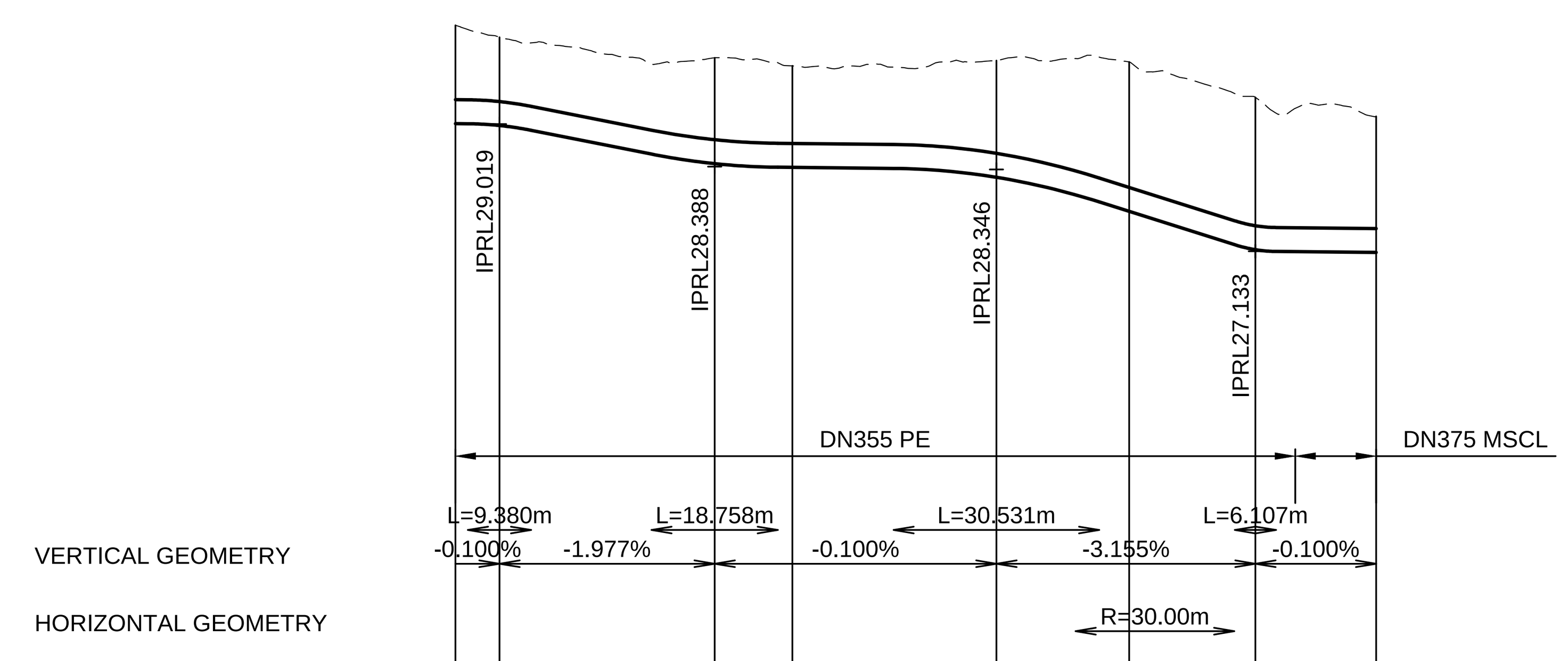






DATUM RL20

EXISTING SURFACE RL	28.164	28.329	28.386	28.542	28.523	28.430	28.495	28.648	28.666	28.928	29.393
DEPTH TO INVERT	1.677	1.694	1.603	1.689	1.643	1.499	1.512	1.621	1.658	2.145	2.781
INVERT LEVEL	26.487	26.635	26.783	26.853	26.880	26.932	26.983	27.027	27.009	26.783	26.600
CHAINAGE	3500.00	3550.00	3600.00	3623.69	3650.00	3700.00	3750.00	3800.00	3810.72	3850.00	3875.61



DATUM RL20

EXISTING SURFACE RL	30.484	30.305	30.002	29.881	29.961	29.939	29.414	29.133
DEPTH TO INVERT	1.458	1.308	1.57	1.505	1.731	2.215	2.257	2.018
INVERT LEVEL	29.026	28.997	28.432	28.376	28.229	27.724	27.156	27.115
CHAINAGE	0.00	6.53	38.47	50.00	80.29	100.00	118.74	136.66

Drawing File: G:\designdata\12200\12221-pakenham east swh\Acad\General\Functional\12221.02 option 2\12221.02FDP01.dwg -- 12221.02FDP06
Date/Time: Thu Jun 09, 2016 - 4:18pm --byron.rhodes--

NOT TO BE USED FOR CONSTRUCTION

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B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
A	ISSUE TO MELBOURNE WATER	22/01/16	TL

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Drawn J.BURNS
Date 22/01/16
AN 1631276
Designed J.BURNS
Date 22/01/16
AN 1631284
Verified S.LEA
Date 23/02/16
AN 1062585
Audited -
Date -
AN
Approved -
Date -
AN

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Coords: MGA
Levels: AHD
Hor 1:1000 0m 10m 20m 40m 60m
Ver 1:100 0m 1m 2m 4m 6m
Scale @ A1/A3 1:1000 / 1:2000

MELBOURNE WATER
PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 2 - PRIMED
DETAIL PLAN
SHEET 06 OF 06
Drawing No. 12221.02FDP06 Rev B
Sheet No. 08 FUNCTIONAL

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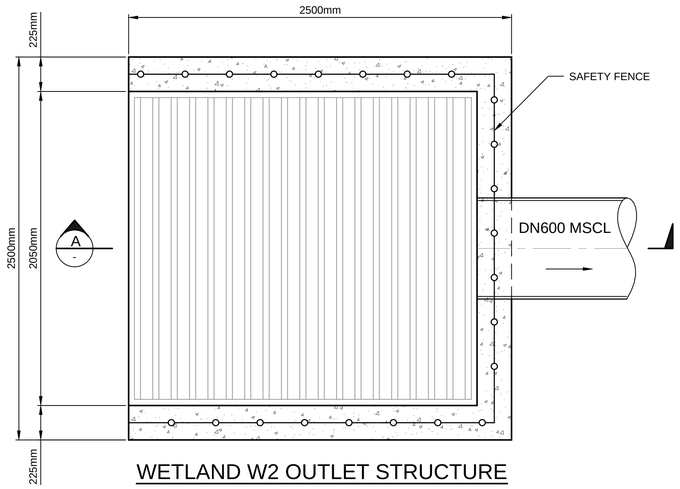
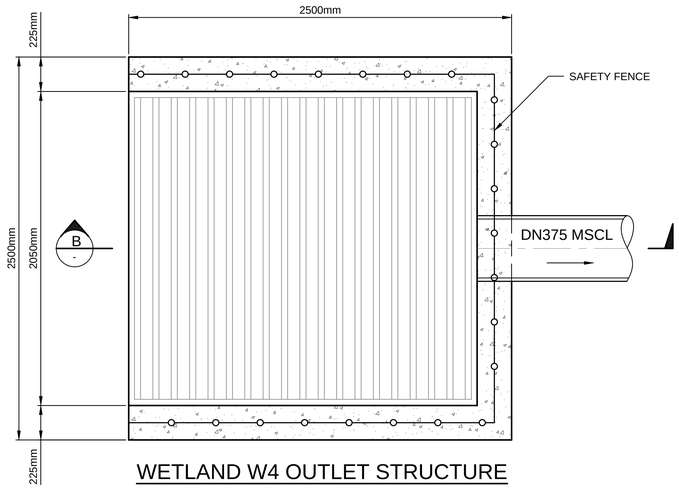
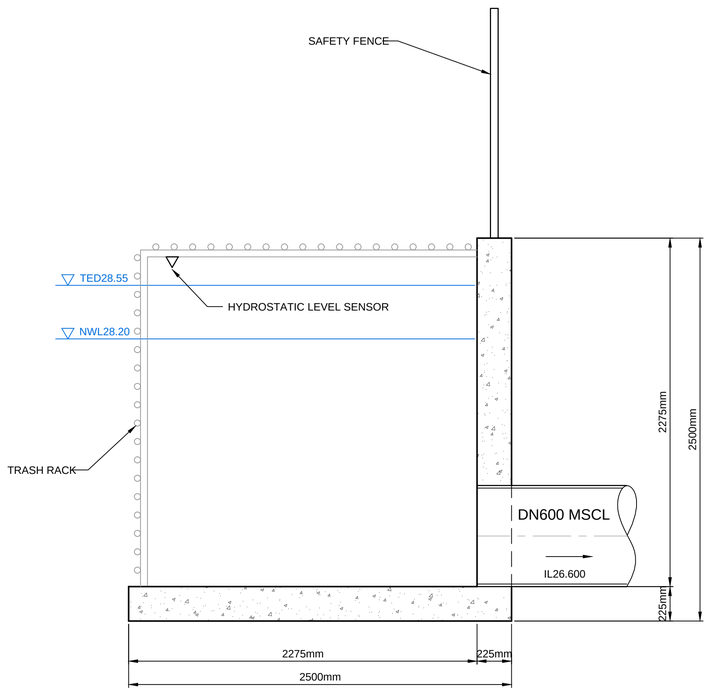


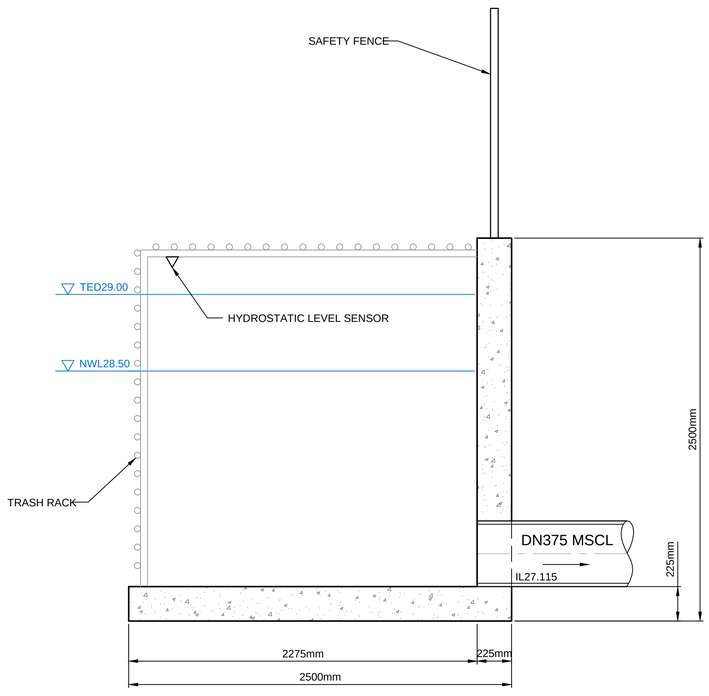
WETLAND W2 OUTLET STRUCTURE
PLAN VIEW
SCALE 1:20



WETLAND W4 OUTLET STRUCTURE
PLAN VIEW
SCALE 1:20



SECTION A
SCALE 1:20



SECTION B
SCALE 1:20

REV	AMENDMENTS	DATE	APP'D.
	NOT TO BE USED FOR CONSTRUCTION		
B	RE-ISSUE TO MELBOURNE WATER	09/06/16	TL
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AN 1631276
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Date 22/01/16
AN 1631285
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Date 23/02/16
AN 1062586
Audited -
Date -
AN
Approved -
Date -
AN

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Coords: MGA
Levels: AHD

Hor 1:20 0m 0.2m 0.4m 0.8m 1.2m

Scale @ A1/A3 1:20 / 1:40

MELBOURNE WATER

PAKENHAM EAST SWH
TRANSFER PIPELINE OPTION 2 - PRIMED
DRAINAGE PIT DETAILS

Drawing No. 12221.02FPD01 Rev B
Sheet No. 09 FUNCTIONAL

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8.7 Appendix G: Infrastructure plans for stormwater options

BUSINESS AS USUAL
BPEMG TREATMENT

RETARDING BASIN/WETLAND 1

RESERVE AREA	95,000 m^2
WETLAND 1 SURFACE AREA	45,200 m^2
SEDIMENT BASIN 2 SURFACE AREA	1,490 m^2
SEDIMENT BASIN 3 SURFACE AREA	3,030 m^2

RETARDING BASIN/WETLAND 2

RESERVE AREA	150,000 m^2
WETLAND 2 SURFACE AREA	55,500 m^2
SEDIMENT BASIN 4 SURFACE AREA	2,400 m^2
SEDIMENT BASIN 5 SURFACE AREA	2,400 m^2

RETARDING BASIN/WETLAND 3

RESERVE AREA	60,000 m^2
WETLAND 3 SURFACE AREA	21,500 m^2
SEDIMENT BASIN 6 SURFACE AREA	1,500 m^2

RETARDING BASIN/WETLAND 4

RESERVE AREA	125,000 m^2
WETLAND 4 SURFACE AREA	42,500 m^2
SEDIMENT BASIN 7 SURFACE AREA	1,500 m^2
SEDIMENT BASIN 8 SURFACE AREA	1,500 m^2

EXISTING DAM

VEGETATED CHANNEL (V1)

SEDIMENT BASIN (S6)

RETARDING BASIN/WETLAND 3

SEDIMENT BASIN (S3)

SEDIMENT BASIN (S2)

RETARDING BASIN/WETLAND 1

EXISTING CULVERTS TWIN 3700x3700

VEGETATED CHANNEL (V2)

EXISTING CULVERTS TWIN 2400x2800

SEDIMENT BASIN (S4)

SEDIMENT BASIN (S5)

SEDIMENT BASIN (S8)

RETARDING BASIN/WETLAND 2

RETARDING BASIN/WETLAND 4

SEDIMENT BASIN (S7)

EXISTING CULVERTS 3(2400x600) + 2(2400 LINK SLABS)

EXISTING CULVERTS 6(2400x900) + 1500 LINK SLAB (CENTRE) & 4(2400 LINK SLABS)

BALD HILL RESERVOIR

LEGEND

- NORMAL WATER LEVEL
- EXTENDED DETENTION DEPTH
- ACCESS TRACK

PAKENHAM EAST STORMWATER HARVESTING

OPTION 1 - BUSINESS AS USUAL - BEST PRACTICE ENVIRONMENTAL MANAGEMENT GUIDELINES TARGETS

SCALE 1:10000 @ A1

REVISION B

DATE: 23/02/16

Drawing File: G:\Designdata\12200\12221-Pakenham East SWH\Acad\General\Concept Wetland Plans\12221GP01 - GPI_1_BAU-BPEMG.dwg - 12221GP01
Date/Time: Mon May 09, 2016 - 9:15am --Julia.Baumann--

BUSINESS AS USUAL
BPEMG TREATMENT
(NO EXTERNAL CATCHMENT)

RETARDING BASIN/WETLAND 1

RESERVE AREA	85,000 m^2
WETLAND 1 SURFACE AREA	28,930 m^2
SEDIMENT BASIN 2 SURFACE AREA	955 m^2
SEDIMENT BASIN 3 SURFACE AREA	1,940 m^2

RETARDING BASIN/WETLAND 2

RESERVE AREA	130,000 m^2
WETLAND 2 SURFACE AREA	35,520 m^2
SEDIMENT BASIN 4 SURFACE AREA	1,775 m^2
SEDIMENT BASIN 5 SURFACE AREA	1,775 m^2

RETARDING BASIN/WETLAND 3

RESERVE AREA	60,000 m^2
WETLAND 3 SURFACE AREA	21,500 m^2
SEDIMENT BASIN 6 SURFACE AREA	2,150 m^2

RETARDING BASIN/WETLAND 4

RESERVE AREA	125,000 m^2
WETLAND 4 SURFACE AREA	42,500 m^2
SEDIMENT BASIN 7 SURFACE AREA	2,125 m^2
SEDIMENT BASIN 8 SURFACE AREA	2,125 m^2

EXISTING DAM

VEGETATED CHANNEL (V1)

SEDIMENT BASIN (S6)

RETARDING BASIN/WETLAND 3

SEDIMENT BASIN (S3)

SEDIMENT BASIN (S2)

RETARDING BASIN/WETLAND 1

EXISTING CULVERTS TWIN 3700x3700

VEGETATED CHANNEL (V2)

EXISTING CULVERTS TWIN 2400x2800

SEDIMENT BASIN (S4)

SEDIMENT BASIN (S5)

SEDIMENT BASIN (S8)

RETARDING BASIN/WETLAND 2

RETARDING BASIN/WETLAND 4

SEDIMENT BASIN (S7)

EXISTING CULVERTS 3(2400x600) + 2(2400 LINK SLABS)

EXISTING CULVERTS 6(2400x900) + 1500 LINK SLAB (CENTRE) & 4(2400 LINK SLABS)

BALD HILL RESERVOIR

LEGEND

- NORMAL WATER LEVEL
- EXTENDED DETENTION DEPTH
- ACCESS TRACK

PAKENHAM EAST STORMWATER HARVESTING

OPTION 1A - BUSINESS AS USUAL - BEST PRACTICE ENVIRONMENTAL MANAGEMENT GUIDELINES TARGETS - NO EXTERNAL CATCHMENT

SCALE 1:10000 @ A1

REVISION A

DATE: 07/03/16

Drawing File: G:\Designdata\12200\12221-Pakenham East SWH\Acad\General\Concept Wetland Plans\12221GP07 - OPT_1A_BAU-BPEMG-NoExt.dwg - 12221GP07
Date/Time: Mon May 09, 2016 - 9:26am --Julia.Baumann--

BUSINESS AS USUAL
SEPP-F8 TREATMENT

RETARDING BASIN/WETLAND 1

RESERVE AREA	155,000 m^2
WETLAND 1 SURFACE AREA	85,880 m^2
SEDIMENT BASIN 2 SURFACE AREA	2,865 m^2
SEDIMENT BASIN 3 SURFACE AREA	5,725 m^2

RETARDING BASIN/WETLAND 2

RESERVE AREA	225,000 m^2
WETLAND 2 SURFACE AREA	111,000 m^2
SEDIMENT BASIN 4 SURFACE AREA	5,550 m^2
SEDIMENT BASIN 5 SURFACE AREA	5,550 m^2

RETARDING BASIN/WETLAND 3

RESERVE AREA	90,000 m^2
WETLAND 3 SURFACE AREA	38,700 m^2
SEDIMENT BASIN 6 SURFACE AREA	3,870 m^2

RETARDING BASIN/WETLAND 4

RESERVE AREA	180,000 m^2
WETLAND 4 SURFACE AREA	76,500 m^2
SEDIMENT BASIN 7 SURFACE AREA	3,825 m^2
SEDIMENT BASIN 8 SURFACE AREA	3,825 m^2

EXISTING DAM

VEGETATED CHANNEL (V1)

SEDIMENT BASIN (S6)

SEDIMENT BASIN (S3)

SEDIMENT BASIN (S2)

RETARDING BASIN/WETLAND 3

RETARDING BASIN/WETLAND 1

EXISTING CULVERTS TWIN 3700x3700

EXISTING CULVERTS TWIN 2400x2800

VEGETATED CHANNEL (V2)

SEDIMENT BASIN (S5)

SEDIMENT BASIN (S4)

RETARDING BASIN/WETLAND 2

RETARDING BASIN/WETLAND 4

SEDIMENT BASIN (S7)

SEDIMENT BASIN (S8)

EXISTING CULVERTS 3(2400x600) + 2(2400 LINK SLABS)

EXISTING CULVERTS 6(2400x900) + 1500 LINK SLAB (CENTRE) & 4(2400 LINK SLABS)

BALD HILL RESERVOIR

LEGEND

- NORMAL WATER LEVEL
- EXTENDED DETENTION DEPTH
- ACCESS TRACK

PAKENHAM EAST STORMWATER HARVESTING

OPTION 2 - BUSINESS AS USUAL - STATE ENVIRONMENTAL PROTECTION POLICY - SCHEDULE F8 TARGETS

SCALE 1:10000 @ A1

REVISION B

DATE: 23/02/16

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BUSINESS AS USUAL
SEPP-F8 TREATMENT
(NO EXTERNAL CATCHMENT)

RETARDING BASIN/WETLAND 1

RESERVE AREA	105,000 m^2
WETLAND 1 SURFACE AREA	50,625 m^2
SEDIMENT BASIN 2 SURFACE AREA	1,685 m^2
SEDIMENT BASIN 3 SURFACE AREA	3,380 m^2

RETARDING BASIN/WETLAND 2

RESERVE AREA	130,000 m^2
WETLAND 2 SURFACE AREA	62,160 m^2
SEDIMENT BASIN 4 SURFACE AREA	3,110 m^2
SEDIMENT BASIN 5 SURFACE AREA	3,110 m^2

RETARDING BASIN/WETLAND 3

RESERVE AREA	90,000 m^2
WETLAND 3 SURFACE AREA	38,700 m^2
SEDIMENT BASIN 6 SURFACE AREA	3,870 m^2

RETARDING BASIN/WETLAND 4

RESERVE AREA	180,000 m^2
WETLAND 4 SURFACE AREA	76,500 m^2
SEDIMENT BASIN 7 SURFACE AREA	3,825 m^2
SEDIMENT BASIN 8 SURFACE AREA	3,825 m^2

EXISTING DAM

VEGETATED CHANNEL (V1)

SEDIMENT BASIN (S6)

SEDIMENT BASIN (S3)

SEDIMENT BASIN (S2)

RETARDING BASIN/WETLAND 3

RETARDING BASIN/WETLAND 1

EXISTING CULVERTS TWIN 3700x3700

VEGETATED CHANNEL (V2)

EXISTING CULVERTS TWIN 2400x2800

SEDIMENT BASIN (S5)

SEDIMENT BASIN (S4)

RETARDING BASIN/WETLAND 2

RETARDING BASIN/WETLAND 4

SEDIMENT BASIN (S7)

SEDIMENT BASIN (S8)

EXISTING CULVERTS 3(2400x600) + 2(2400 LINK SLABS)

EXISTING CULVERTS 6(2400x900) + 1500 LINK SLAB (CENTRE) & 4(2400 LINK SLABS)

BALD HILL RESERVOIR

LEGEND

- NORMAL WATER LEVEL
- EXTENDED DETENTION DEPTH
- ACCESS TRACK

PAKENHAM EAST STORMWATER HARVESTING

OPTION 2A - BUSINESS AS USUAL - STATE ENVIRONMENTAL PROTECTION POLICY - SCHEDULE F8 TARGETS - NO EXTERNAL CATCHMENT

SCALE 1:10000 @ A1

REVISION A

DATE: 07/03/16

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STORMWATER HARVESTING
SEPP-F8 TREATMENT
OPTION 3 - GRAVITY PIPELINE

RETARDING BASIN/WETLAND 1

RESERVE AREA	95,000 m^2
WETLAND 1 SURFACE AREA	48,365 m^2
SEDIMENT BASIN 2 SURFACE AREA	2,420 m^2
SEDIMENT BASIN 3 SURFACE AREA	2,420 m^2

RETARDING BASIN/WETLAND 2

RESERVE AREA	150,000 m^2
WETLAND 2 SURFACE AREA	59,385 m^2
SEDIMENT BASIN 4 SURFACE AREA	2,970 m^2
SEDIMENT BASIN 5 SURFACE AREA	2,970 m^2

RETARDING BASIN/WETLAND 3

RESERVE AREA	60,000 m^2
WETLAND 3 SURFACE AREA	23,005 m^2
SEDIMENT BASIN 6 SURFACE AREA	2,300 m^2

RETARDING BASIN/WETLAND 4

RESERVE AREA	125,000 m^2
WETLAND 4 SURFACE AREA	45,475 m^2
SEDIMENT BASIN 7 SURFACE AREA	2,275 m^2
SEDIMENT BASIN 8 SURFACE AREA	2,275 m^2

EXISTING DAM

VEGETATED CHANNEL (V1)

SEDIMENT BASIN (S3)

SEDIMENT BASIN (S2)

RETARDING BASIN/WETLAND 1

RETARDING BASIN/WETLAND 3

SEDIMENT BASIN (S6)

EXISTING CULVERTS TWIN 3700x3700

EXISTING CULVERTS TWIN 2400x2800

VEGETATED CHANNEL (V2)

SEDIMENT BASIN (S4)

SEDIMENT BASIN (S5)

RETARDING BASIN/WETLAND 2

RETARDING BASIN/WETLAND 4

SEDIMENT BASIN (S7)

SEDIMENT BASIN (S8)

EXISTING CULVERTS 3(2400x600) + 2(2400 LINK SLABS)

EXISTING CULVERTS 6(2400x900) + 1500 LINK SLAB (CENTRE) & 4(2400 LINK SLABS)

BALD HILL RESERVOIR

LEGEND

- NORMAL WATER LEVEL
- EXTENDED DETENTION DEPTH
- ACCESS TRACK
- STORMWATER HARVESTING PIPELINE

PAKENHAM EAST STORMWATER HARVESTING

OPTION 3-G - STORMWATER HARVESTING - STATE ENVIRONMENTAL PROTECTION POLICY - SCHEDULE F8 TARGETS - GRAVITY PIPELINE

SCALE 1:10000 @ A1

REVISION B

DATE: 23/02/16

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STORMWATER HARVESTING
SEPP-F8 TREATMENT
OPTION 3 - PRIMED PIPELINE

RETARDING BASIN/WETLAND 1

RESERVE AREA	95,000 m^2
WETLAND 1 SURFACE AREA	48,365 m^2
SEDIMENT BASIN 2 SURFACE AREA	2,420 m^2
SEDIMENT BASIN 3 SURFACE AREA	2,420 m^2

RETARDING BASIN/WETLAND 2

RESERVE AREA	150,000 m^2
WETLAND 2 SURFACE AREA	59,385 m^2
SEDIMENT BASIN 4 SURFACE AREA	2,970 m^2
SEDIMENT BASIN 5 SURFACE AREA	2,970 m^2

RETARDING BASIN/WETLAND 3

RESERVE AREA	60,000 m^2
WETLAND 3 SURFACE AREA	23,005 m^2
SEDIMENT BASIN 6 SURFACE AREA	2,300 m^2

RETARDING BASIN/WETLAND 4

RESERVE AREA	125,000 m^2
WETLAND 4 SURFACE AREA	45,475 m^2
SEDIMENT BASIN 7 SURFACE AREA	2,275 m^2
SEDIMENT BASIN 8 SURFACE AREA	2,275 m^2

EXISTING DAM

VEGETATED CHANNEL (V1)

SEDIMENT BASIN (S3)

SEDIMENT BASIN (S2)

RETARDING BASIN/WETLAND 1

RETARDING BASIN/WETLAND 3

SEDIMENT BASIN (S6)

EXISTING CULVERTS TWIN 3700x3700

EXISTING CULVERTS TWIN 2400x2800

VEGETATED CHANNEL (V2)

SEDIMENT BASIN (S4)

SEDIMENT BASIN (S5)

RETARDING BASIN/WETLAND 2

RETARDING BASIN/WETLAND 4

SEDIMENT BASIN (S7)

SEDIMENT BASIN (S8)

EXISTING CULVERTS 3(2400x600) + 2(2400 LINK SLABS)

EXISTING CULVERTS 6(2400x900) + 1500 LINK SLAB (CENTRE) & 4(2400 LINK SLABS)

BALD HILL RESERVOIR

LEGEND

- NORMAL WATER LEVEL
- EXTENDED DETENTION DEPTH
- ACCESS TRACK
- STORMWATER HARVESTING PIPELINE

PAKENHAM EAST STORMWATER HARVESTING

OPTION 3-P - STORMWATER HARVESTING - STATE ENVIRONMENTAL PROTECTION POLICY - SCHEDULE F8 TARGETS - PRIMED PIPELINE

SCALE 1:10000 @ A1

REVISION B

DATE: 23/02/16

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Date/Time: Mon May 09, 2016 - 9:55am --Julia.Baumann--

STORMWATER HARVESTING
SEPP-F8 TREATMENT
OPTION 4 - GRAVITY PIPELINE

RETARDING BASIN/WETLAND 1

RESERVE AREA	175,000 m^2
WETLAND 1 SURFACE AREA	79,550 m^2
SEDIMENT BASIN 0 SURFACE AREA	2,650 m^2
SEDIMENT BASIN 2 SURFACE AREA	2,650 m^2
SEDIMENT BASIN 3 SURFACE AREA	2,650 m^2

RETARDING BASIN/WETLAND 2

RESERVE AREA	150,000 m^2
WETLAND 2 SURFACE AREA	55,500 m^2
SEDIMENT BASIN 4 SURFACE AREA	2,775 m^2
SEDIMENT BASIN 5 SURFACE AREA	2,775 m^2

RETARDING BASIN/WETLAND 3

RESERVE AREA	60,000 m^2
WETLAND 3 SURFACE AREA	21,500 m^2
SEDIMENT BASIN 6 SURFACE AREA	2,150 m^2

RETARDING BASIN/WETLAND 4

RESERVE AREA	125,000 m^2
WETLAND 4 SURFACE AREA	42,500 m^2
SEDIMENT BASIN 7 SURFACE AREA	2,125 m^2
SEDIMENT BASIN 8 SURFACE AREA	2,125 m^2

EXISTING DAM

VEGETATED CHANNEL (V1)

SEDIMENT BASIN (S0)

SEDIMENT BASIN (S3)

SEDIMENT BASIN (S2)

RETARDING BASIN/WETLAND 1

RETARDING BASIN/WETLAND 3

SEDIMENT BASIN (S6)

EXISTING CULVERTS TWIN 3700x3700

EXISTING CULVERTS TWIN 2400x2800

VEGETATED CHANNEL (V2)

SEDIMENT BASIN (S4)

SEDIMENT BASIN (S5)

RETARDING BASIN/WETLAND 2

RETARDING BASIN/WETLAND 4

SEDIMENT BASIN (S7)

SEDIMENT BASIN (S8)

EXISTING CULVERTS 3(2400x600) + 2(2400 LINK SLABS)

EXISTING CULVERTS 6(2400x900) + 1500 LINK SLAB (CENTRE) & 4(2400 LINK SLABS)

BALD HILL RESERVOIR

LEGEND

- NORMAL WATER LEVEL
- EXTENDED DETENTION DEPTH
- ACCESS TRACK
- STORMWATER HARVESTING PIPELINE

PAKENHAM EAST STORMWATER HARVESTING

OPTION 4-G - STORMWATER HARVESTING - STATE ENVIRONMENTAL PROTECTION POLICY - SCHEDULE F8 TARGETS - GRAVITY PIPELINE

SCALE 1:10000 @ A1

REVISION B

DATE: 23/02/16

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Date/Time: Mon May 09, 2016 - 10:09am --Julia.Baumann--

STORMWATER HARVESTING
SEPP-F8 TREATMENT
OPTION 4 - PRIMED PIPELINE

RETARDING BASIN/WETLAND 1

RESERVE AREA	175,000 m^2
WETLAND 1 SURFACE AREA	79,550 m^2
SEDIMENT BASIN 0 SURFACE AREA	2,650 m^2
SEDIMENT BASIN 2 SURFACE AREA	2,650 m^2
SEDIMENT BASIN 3 SURFACE AREA	2,650 m^2

RETARDING BASIN/WETLAND 2

RESERVE AREA	150,000 m^2
WETLAND 2 SURFACE AREA	55,500 m^2
SEDIMENT BASIN 4 SURFACE AREA	2,775 m^2
SEDIMENT BASIN 5 SURFACE AREA	2,775 m^2

RETARDING BASIN/WETLAND 3

RESERVE AREA	60,000 m^2
WETLAND 3 SURFACE AREA	21,500 m^2
SEDIMENT BASIN 6 SURFACE AREA	2,150 m^2

RETARDING BASIN/WETLAND 4

RESERVE AREA	125,000 m^2
WETLAND 4 SURFACE AREA	42,500 m^2
SEDIMENT BASIN 7 SURFACE AREA	2,125 m^2
SEDIMENT BASIN 8 SURFACE AREA	2,125 m^2

EXISTING DAM

VEGETATED CHANNEL (V1)

SEDIMENT BASIN (S0)

SEDIMENT BASIN (S3)

SEDIMENT BASIN (S2)

RETARDING BASIN/WETLAND 1

RETARDING BASIN/WETLAND 3

SEDIMENT BASIN (S6)

EXISTING CULVERTS TWIN 3700x3700

EXISTING CULVERTS TWIN 2400x2800

VEGETATED CHANNEL (V2)

SEDIMENT BASIN (S4)

SEDIMENT BASIN (S5)

RETARDING BASIN/WETLAND 2

RETARDING BASIN/WETLAND 4

SEDIMENT BASIN (S7)

SEDIMENT BASIN (S8)

EXISTING CULVERTS 3(2400x600) + 2(2400 LINK SLABS)

EXISTING CULVERTS 6(2400x900) + 1500 LINK SLAB (CENTRE) & 4(2400 LINK SLABS)

BALD HILL RESERVOIR

LEGEND

- NORMAL WATER LEVEL
- EXTENDED DETENTION DEPTH
- ACCESS TRACK
- STORMWATER HARVESTING PIPELINE

PAKENHAM EAST STORMWATER HARVESTING

OPTION 4-P - STORMWATER HARVESTING - STATE ENVIRONMENTAL PROTECTION POLICY - SCHEDULE F8 TARGETS - PRIMED PIPELINE

SCALE 1:10000 @ A1

REVISION B

DATE: 23/02/16

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Date/Time: Mon May 09, 2016 - 10:04am --Julia.Baumann--