Memo

Subject	McPherson Precinct Structure Plan - SEPP F8 Water Quality Assessment
Distribution	Metropolitan Planning Authority, Melbourne Water Corporation
Date	3 December 2015
Project	McPherson Precinct Structure Plan

This memo has been prepared by Alluvium Consulting Australia (Alluvium) for the Metropolitan Planning Authority and Melbourne Water Corporation to provide advice regarding the sizing of water quality treatment assets to meet SEPP F8 targets for the Baillieu Creek catchment within the McPherson Precinct Structure Plan (PSP).

Background

In order to meet the receiving water requirements associated with the State Environmental Protection Policy (Waters of Victoria) (SEPP), stormwater runoff from urban development is expected to be treated to achieve "best practice" pollution reduction targets. In general, these best practice pollutant reduction targets are considered to be:

- 80% reduction in total Suspended Solids loads
- 45% reduction in total Nitrogen loads
- 45% reduction in total Phosphorus loads

These targets are based upon meeting the requirements of SEPP Schedule F7, which relates to the Yarra and Port Phillip Bay catchment. The arrangements in the current stormwater management strategy (SWMS) for McPherson PSP have been designed to achieve these targets.

However, McPherson PSP lies within the Westernport catchment and, therefore, development in this area should comply with water quality targets set out in Schedule F8: Waters of Western Port and Catchment. Based upon a previous study commissioned by Melbourne Water, the following best practice targets are likely to be required to meet the SEPP F8 requirements:

- 93% reduction in total Suspended Solids loads
- 63% reduction in total Nitrogen loads
- 66% reduction in total Phosphorus loads

For purposes of this investigation and as advised by Melbourne Water, a target reduction of 93% for TSS has been adopted to comply with the SEPP F8 water quality objectives.

Alluvium has investigated what would be required to modify the existing sedimentation basin and wetland concept designs within the existing SWMS in order to meet the higher reduction target. This investigation used the MUSIC software to model treatment areas required to meet the targets for a range of scenarios outlined below (Table 1). These scenarios were modelled for two extended detention depths (EDD): 0.35 m and 0.5 m.

Table 1. Scenarios modelled in this investigation

Scenario	TSS reduction target (%)	Strategy
1. Current Best Practice (10% SB to WL ratio)	80	maintain 10% ratio of sedimentation basin NWL area to wetland NWL area
2. SEPP F8 (10% SB to WL ratio)	93	maintain 10% ratio of sedimentation basin NWL area to wetland NWL area
3. SEPP F8 (increase sediment basin only)	93	wetland NWL area to match scenario 1, increase sedimentation basin NWL area only to achieve SEPP F8 TSS reduction target
4. SEPP F8 (25% SB to WL ratio)	93	maintain 25% ratio of sedimentation basin NWL area to wetland NWL area to achieve SEPP F8 TSS reduction target
5. SEPP F8 (25% SB to WL ratio, reduced TSS target to 90%)	90	maintain 25% ratio of sedimentation basin NWL area to wetland NWL area to achieve reduced SEPP F8 TSS reduction target of 90%
6. SEPP F8 (20% SB to WL ratio, reduced TSS target to 85%)	85	maintain 20% ratio of sedimentation basin NWL area to wetland NWL area to achieve reduced SEPP F8 TSS reduction target of 85%

MUSIC model set up

The following input data was used in setting up the MUSIC model using a control catchment to enable comparison of scenarios (Table 2). For the purposes of this assessment and to enable more detailed analysis of scenario performance the sediment basin component in MUSIC has been modelled separate to the wetland node. A screen shot of the MUSIC model is shown below (Figure 1).

Table 2. MUSIC catchment and input data

Area	67 ha
Fraction impervious	0.6
Climate data	Koo Wee Rup 6min rainfall Koo Wee Rup Monthly Areal PET
Extended Detention Depth (EDD)	0.35 m 0.50 m
Average Depth (wetland)	0.4 m
Average Depth (sedimentation basin)	1 m

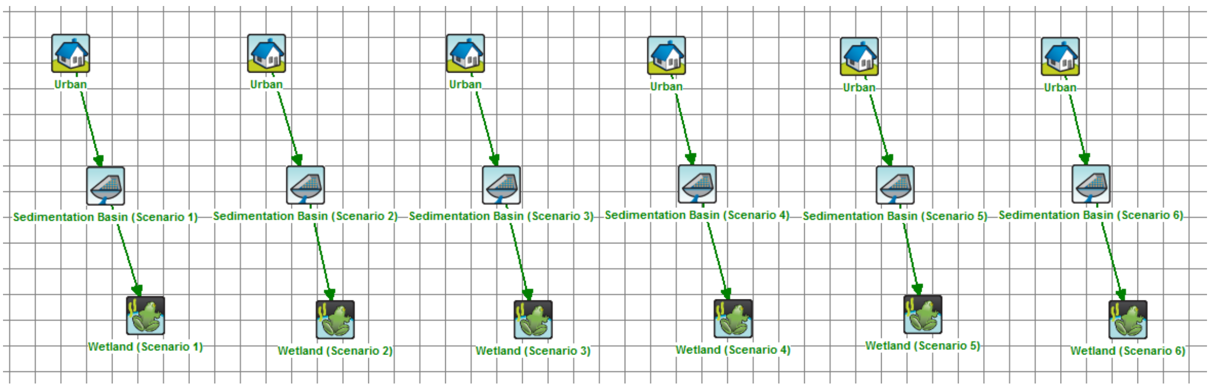

Figure 1. *Screenshot of the MUSIC model showing nodes for each scenario*

Results

Pollutant reduction results and treatment areas for different scenarios for each EDD are shown graphically below (Figure 2 and Figure 3) and in table form on the following page (Table 3 and

Table 4).

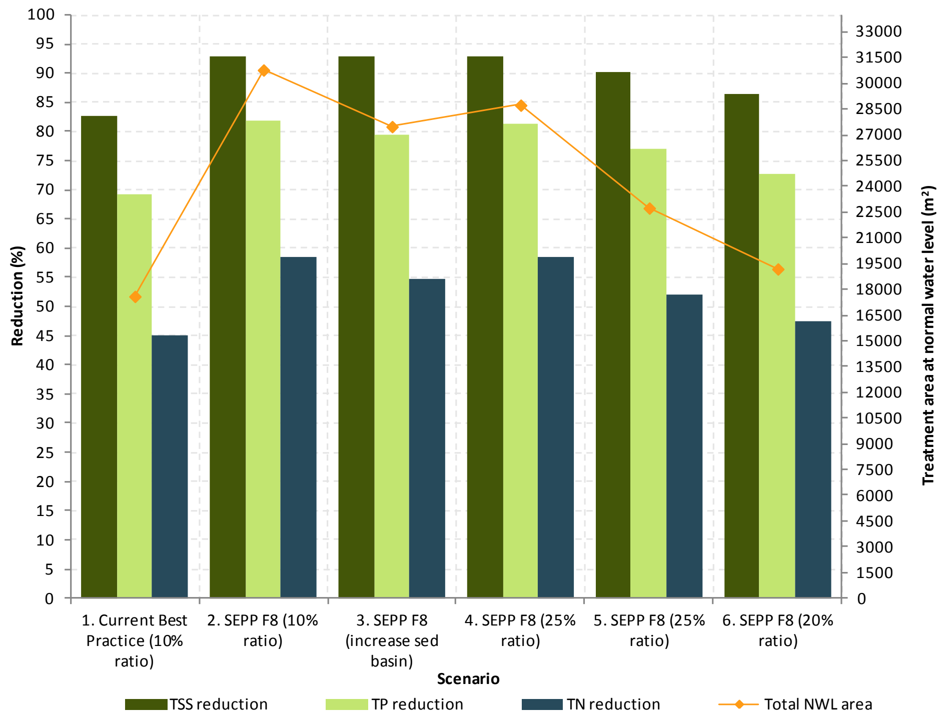

Figure 2. *Pollution reductions and required treatment areas for each scenario with an extended detention depth of 0.35 m. Scenario 1 represents current design arrangement.*

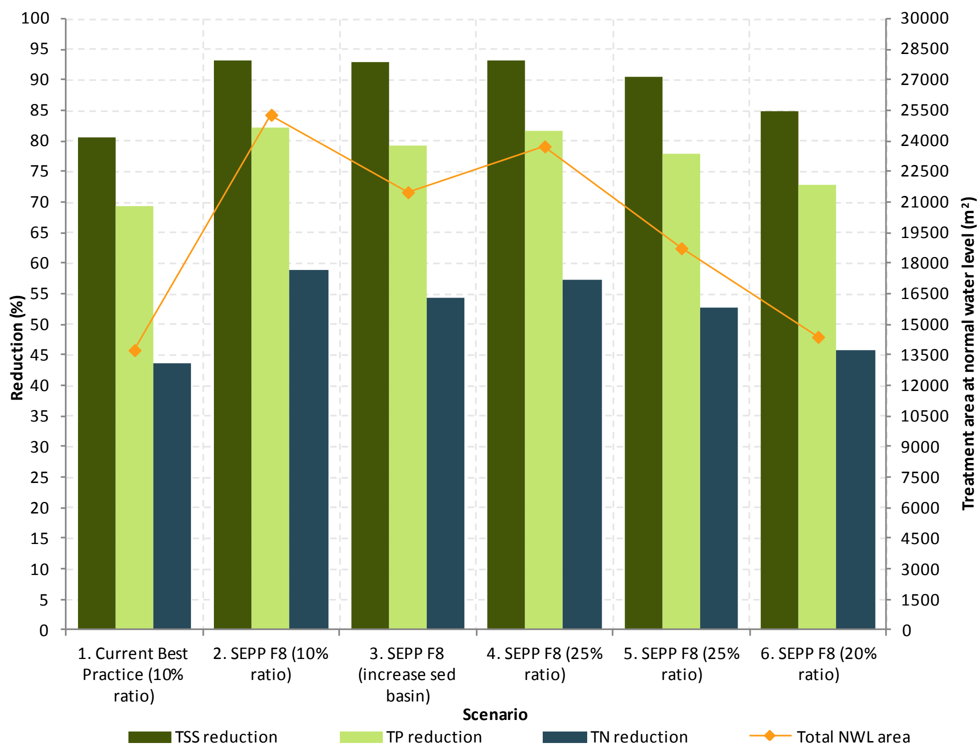

Figure 3. *Pollution reductions and required treatment areas for each scenario with an extended detention depth of 0. 5 m*

Table 3. Results for EDD = 0.35 m

Scenario	Sedimentation Basin Area at NWL (m^2)	Macrophyte Zone Area at NWL (m^2)	Total area (m^2)	TSS Reduction (%)	TP Reduction (%)	TN Reduction (%)	Treatment area % of catchment	Comparison of NWL footprint to Scenario 1
1. Current Best Practice (10% SB to WL ratio)	1600	16000	17600	82.6	69.3	45.1	2.63%	
2. SEPP F8 (10% SB to WL ratio)	2800	28000	30800	93	81.9	58.5	4.60%	75% increase in NWL footprint.
3. SEPP F8 (increase sediment basin only)	11500	16000	27500	92.9	79.5	54.6	4.10%	56% increase in NWL footprint.
4. SEPP F8 (25% SB to WL ratio)	5750	23000	28750	93	81.4	58.4	4.29%	63% increase in NWL footprint.
5. SEPP F8 (25% SB to WL ratio, reduced TSS target to 90%)	4550	18200	22750	90.2	76.9	52.1	3.40%	29% increase in NWL footprint.
6. SEPP F8 (20% SB to WL ratio, reduced TSS target to 85%)	3200	16000	19200	86.5	72.6	47.5	2.87%	9% increase in NWL footprint.

Table 4. Results for EDD = 0.5 m

Scenario	Sedimentation Basin Area at NWL (m^2)	Macrophyte Zone Area at NWL (m^2)	Total area (m^2)	TSS Reduction (%)	TP Reduction (%)	TN Reduction (%)	Treatment area % of catchment	Comparison of NWL footprint to Scenario 1
1. Current Best Practice (10% SB to WL ratio)	1250	12500	13750	80.7	69.4	43.6	2.05%	
2. SEPP F8 (10% SB to WL ratio)	2300	23000	25300	93.3	82.2	59	3.78%	84% increase in NWL footprint.
3. SEPP F8 (increase sediment basin only)	9000	12500	21500	93	79.2	54.3	3.21%	56% increase in NWL footprint.
4. SEPP F8 (25% SB to WL ratio)	4750	19000	23750	93.3	81.7	57.4	3.54%	73% increase in NWL footprint.
5. SEPP F8 (25% SB to WL ratio, reduced TSS target to 90%)	3750	15000	18750	90.5	77.8	52.8	2.80%	36% increase in NWL footprint.
6. SEPP F8 (20% SB to WL ratio, reduced TSS target to 85%)	2400	12000	14400	85	72.7	45.7	2.15%	5% increase in NWL footprint.

*Note inundation frequency and residence time analysis has not been completed as part of this study to determine viability of 0.5m EDD.

A comparison of results between the two different EDDs for each scenario is shown in **Error! Not a valid bookmark self-reference.**. This table compares results for each scenario for the two depths, then compares each scenario with an EDD of 0.5 m to the current design arrangement (Scenario 1, EDD = 0.35 m).

Table 5. Comparison of treatment areas between different EDDs for each scenario and of each EDD = 0.5 m scenario to the current design arrangement

	EDD = 0.35 m		EDD = 0.5 m		
Scenario	**Total area (m^2)**	**TSS Reduction (%)**	**Total area (m^2)**	**TSS Reduction (%)**	**Compare total area for each scenario**
1. Current Best Practice (10% SB to WL ratio)	17600	82.6	13750	80.7	22% *decrease* in area for EDD = 0.5 m
2. SEPP F8 (10% SB to WL ratio)	30800	93	25300	93.3	18% *decrease* in area for EDD = 0.5 m
3. SEPP F8 (increase sediment basin only)	27500	92.9	21500	93	22% *decrease* in area for EDD = 0.5 m
4. SEPP F8 (25% SB to WL ratio)	28750	93	23750	93.3	17% *decrease* in area for EDD = 0.5 m
5. SEPP F8 (25% SB to WL ratio, reduced TSS target to 90%)	22750	90.2	18750	90.5	18% *decrease* in area for EDD = 0.5 m
6. SEPP F8 (20% SB to WL ratio, reduced TSS target to 85%)	19200	86.5	14400	85	25% *decrease* in area for EDD = 0.5 m

*Note inundation frequency and residence time analysis has not been completed as part of this study to determine viability of 0.5m EDD.

A separate analysis was undertaken on the control catchment (with an EDD 0.35m) to identify the point at which increasing in sediment basin size starts to diminish in terms of return for % TSS removal. Figure 4 shows that for the control catchment with an EDD of 0.35m a significant increase in area above 3000m2 (approx 70% TSS removal) is required to gain small increases in percentage of TSS treatment. Based on this it suggests that the sediment basin performance efficiency versus size typically peaks at approximately 70% TSS removal. Treatment gains beyond this will require a significant increase size (i.e. an extra 5-8% TSS removal will require doubling of the sediment basin NWL area).

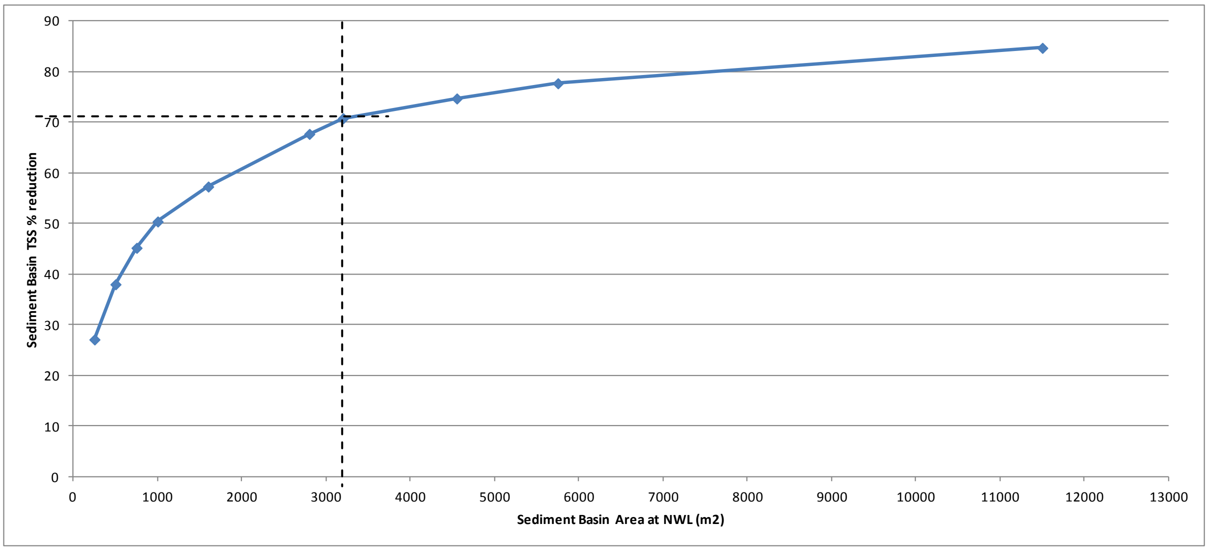

Figure 4. *Sediment basin diminishing performance based on control catchment and EDD of 0.35*

Note: Results presented in Tables 3 to 5 are the combined pollutant removal of the sediment basin and wetland zones. Figure 4 displays the TSS removal performance of the sediment basin only.

Discussion

The results of the analysis above show that an increase in total wetland NWL of approximately 50 to 75% is required over current best practice to meet the SEPP F8 targets. In terms of meeting the SEPP F8 target the following points are also highlighted for consideration for each of the scenario results:

- Scenario 2: Maintaining a 10% sediment basin to wetland ratio in line with current design practices will require the greatest increase in additional area of all the scenarios (approximately 75 to 85%).
- Scenario 3: Only increasing the sediment basin size has least impact on footprint size of all the scenarios (approximately 56%). However the sediment basin size increase is approximately equal that of the wetland zone and effectively will appear as a small lake upstream of the wetland. This treatment train is not in line with current best practice design and may lead to water turnover, stratification and algae bloom issues.
- Scenario 4: Increasing the sediment basin to wetland ratio to 25% will require the least increase in additional area of all the scenarios (approximately 63 to 73%), while still meeting the SEPP F8 TSS target.
- Scenario 5: Increasing the sediment basin to wetland ratio to 25% and reducing the SEPP F8 target to 90% TSS removal will reduce the required additional footprint size approximately by 20% over the other options (increase in footprint of approximately 30% over scenario 1).
- Scenario 6: Increasing the sediment basin to wetland ratio to 25% and reducing the SEPP F8 target to 85% TSS removal will reduce the required additional footprint size by 50% over the other options (increase in footprint of approximately 10% over scenario 1). This is largely due to the 85% TSS removal target being located within the zone of higher efficiency for asset size versus pollutant removal (refer to figure 4).