ZAM-WSUD

Zero Additional Maintenance Water Sensitive Urban Design

Handbook

DRAFT

Water Sensitive Urban Design without ongoing maintenance requirements for asset owners.

MANNINGHAM

Melbourne Water

CRC for Water Sensitive Cities

The ZAM-WSUD project is a collaboration between Manningham City Council, Melbourne Water, the Co-operative Research Centre for Water Sensitive Cities and Monash Water for Liveability Centre. The project is supported by the City of Glen Eira.

The project was initiated by Manningham City Council and received funding support through the Melbourne Water Living Rivers Program. The project also received a financial contribution from the Co-operative Research Centre for Water Sensitive Cities.

Laboratory testing conducted at the Monash Water for Liveability Centre.

Construction works were completed by Roadside Services & Solutions and prototypes were constructed by Versini.

Published in 2015 by Manningham City Council.

Contact: Simon Brink simon.brink@manningham.vic.gov.au

Contents

What is ZAM-WSUD ?

Zero Additional Maintenance Water Sensitive Urban Design (ZAM-WSUD) is a water sensitive urban design system that has been designed so that the ongoing maintenance implications for the asset owner are negligible. ZAM-WSUD systems are designed such that overall maintenance requirements at the installation location are not increased compared to the maintenance requirement for the installation site prior to the construction of a ZAM-WSUD asset.

Why ZAM-WSUD is Important ?

Becoming a water sensitive city involves physical changes to stormwater infrastructure systems such that stormwater is treated prior to discharge into waterways. Water Sensitive Urban Design is one approach to stormwater treatment that typically utilises biofiltration to treat stormwater at the local scale. Biofiltration systems allow stormwater to pass through vegetated sand media which removes nutrients and other pollutants prior to discharge to waterways via the drainage network.

If the long term objective of treating the majority of stormwater prior to discharge to waterways is to be achieved by local biofiltration systems, a very large number of these systems will be required. Each of these assets typically requires ongoing maintenance to continue to function effectively.

Asset owners are now identifying that the long term ongoing maintenance requirements of biofiltration systems can be significant. Consequently there is significant long term value for asset owners (and communities) in developing and implementing Water Sensitive Urban Design systems with zero or very low maintenance implications for asset owners.

This handbook provides practical design and construction details for urban street scale water sensitive urban design systems with zero or very low maintenance implications based on ZAM-WSUD installations that have been constructed to date.

Importantly the ZAM-WSUD design philosophy can also be extended broadly to other types of WSUD installations. As a design criteria 'ZAM-WSUD' sets maintainability objectives to best ensure that new WSUD assets will have minimal maintenance requirements for asset owners. ZAM-WSUD systems have been demonstrated to be feasible for street scale installations and may also be practical for medium and larger scale biofiltration systems. Setting 'ZAM-WSUD' as a design objective or requirement encourages designers to be innovative and pro-active in improving the maintainability of new stormwater treatment systems.

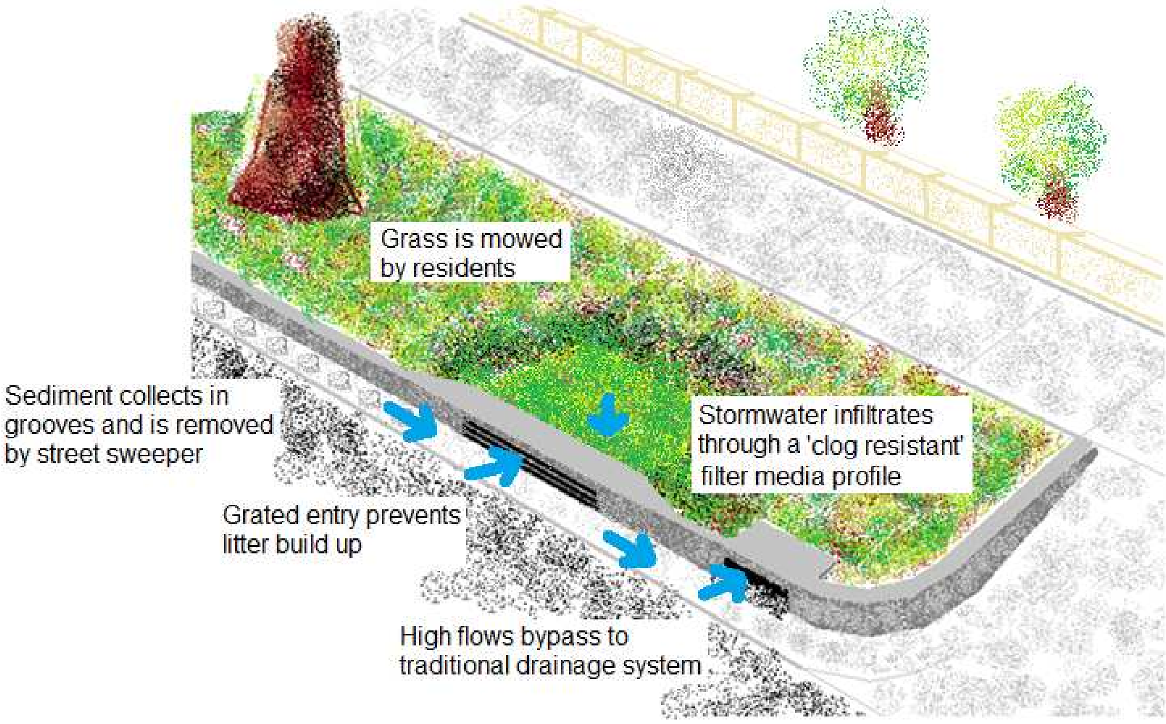
ZAM WSUD Initiatives

The ZAM-WSUD project investigated typical maintenance requirements for street scale water sensitive urban design systems, and adopted various alternative design solutions that removed ongoing maintenance for asset owners.

Alternative design solutions implemented in the ZAM-WSUD trials were:

- Sediment grooves
- Soft leaf buffalo Grass
- 'Clog resistant' filter media profile
- Litter guard inlets

ZAM-WSUD designs were developed primarily for the retrofit of typical suburban residential streetscapes with grassed nature strips, but are also suitable for new developments.



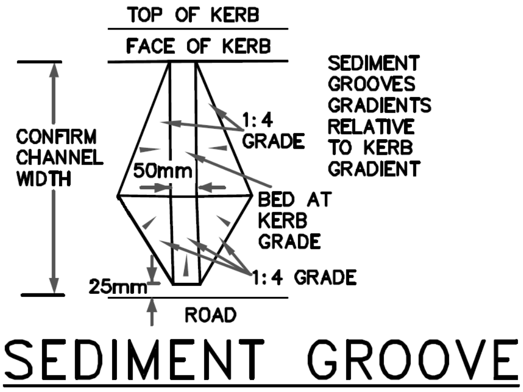
Schematic of a typical ZAM-WSUD installation

Sediment grooves

Biofiltration systems can be susceptible to filter media clogging if large amounts of fine sediment (typically silts) enter the biofiltration system and form a thin impervious surface layer, preventing water entry to subsurface layers.

Sediment collection prior to a biofiltration system reduces sediment quantities entering the biofilter, reducing the risk of clogging and helping to ensure that systems can function effectively in the long term without requiring sediment removal and/or filter media replacement.

Appropriately dimensioned sediment groves constructed in the concrete channel prior to a biofilter inlet have been shown to be effective at trapping sediment.



Deposition in a sediment grove prototype

Sediment groves have been designed so that collected sediment will be effectively removed by street sweepers during routing street sweeping, (typically every 5 to 6 weeks). Field testing (using a MacDonald Johnston VT605 Sweeper) confirmed that 1V:4H side and rear gradients were optimal to allow sediment grooves to be clean out by a street sweeper. The sediment groove bed gradient is designed as flat and level with the kerb invert to prevent excessive water ponding. Bed width was selected as 50mm to ensure adequate collection capacity while moderating risks to cyclists.

Field trials to design sediment grooves

Sediment groves during construction

Soft leaf buffalo grass

WSUD systems typically utilise low level riparian vegetation to assist nutrient and pollutant removal during infiltration. Vegetated systems require some maintenance from asset owners such as occasional trimming and removal of excess plant matter to maintain aesthetics, prevent vegetation over-crowding and to ensure that nutrients are removed from the biofiltration system.

Research trials previously undertaken at Monash University (Payne et Alia, 2014) identified that soft leaf buffalo grass was suitable for grassed biofilter WSUD applications. The soft leaf buffalo effectively removes nutrients and pollutants from stormwater passing through a sand filtration system.

The ZAM-WSUD research project identified that retaining grass as the vegetation cover could potentially remove the need for additional ongoing vegetation maintenance. Pre-existing grass mowing arrangements (by residents, Council or others) can continue and will provide regular removal of vegetation growth, effectively removing nutrients from the biofiltration system and ensuring that the system continues to effectively treat stormwater system.

The Palmetto SS100 cultivar was identified as particularly suitable due to characteristics such as: drought tolerance, shade tolerance, frost tolerance, slow growth rate, wear tolerance and low growth height.

Preliminary field trials undertaken at the Manningham depot in 2014/15 confirmed the suitability of the Palmetto SS100 cultivar for an in-field grassed ZAM-WSUD installation.

Palmetto SS100 cultivar

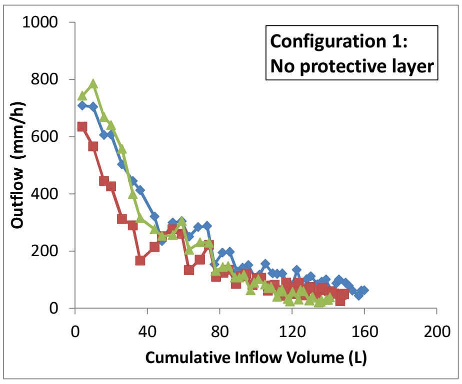
Field trials, mid summer, after mowing.

Buffalo grass can be successfully established in spring, summer and early autumn. Successful establishment requires top dressing and regular watering for a least the first month after planting.

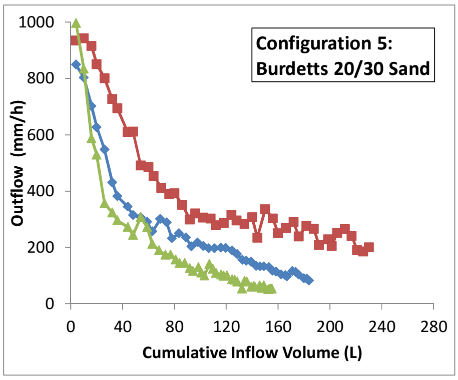
'Clog resistant' filter media profile

Biofilter media clogging is typically caused by the formation of a thin impervious layer of sediment at the top of the FAWB specification filter media sand.

A preliminary literature review by Monash University researchers indicated the potential to reduce the incidence of surface layer blocking by the addition of a course sand layer above the FAWB specification layer. Laboratory trials undertaken at Monash University as part of the ZAM-WSUD project (Hatt et alia, 2014) confirmed this.



FAWB specification control (300mm)



20/30 Sand (100mm) above FAWB Spec (200mm)

Dosing various filter media profiles in trial columns with a typical 18 month stormwater nutrient load over a 15 day period confirmed the effectiveness of a course sand layer at reducing filter media susceptibility to clogging.

Suitable sands for the protection layer have a high percentage of particles between 0.5mm and 2mm in diameter, and very little fine sand, silt and clays (preferably 3% or less).

Particle Size (mm)	
Fine Gravel (2.0mm)	2
Very Coarse Sand (1.0mm)	13
Coarse Sand (0.5mm)	61
Medium Sand (0.25mm)	21
Fine Sand (0.15mm)	1
Very Fine Sand (0.05)	2
Silt and Clay (<0.05mm)	trace
Hydraulic Conductivity (mm/hr) Drainage	1316
Texture	Off white sand

20/30 sand particle size distribution

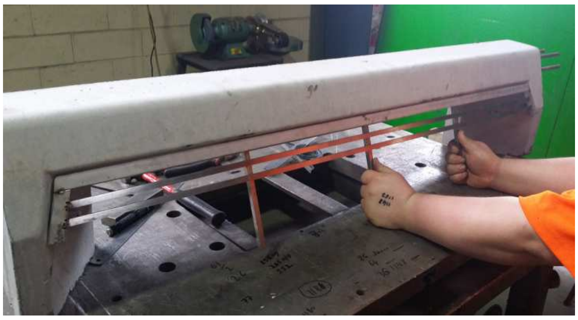
Note: Previous field observations have shown that biofilter hydraulic conductivity typically falls initially over the first 12 months after installation, but then recovers after this as plant root growth, soil biota, and wetting & drying cycles take effect and increase the porosity and hydraulic conductivity of soils. As such the inclusion of a protective layer is expected to provide a filter media with significant long term resilience against clogging.

Litter guard inlets

Typical biofilter systems are designed to allow litter to enter the filtration area where it will be retained on the surface. This has benefits in terms preventing litter entry to waterways, but also has maintenance implications as community expectations are that litter is regularly removed from WSUD assets. This community expectation can create significant ongoing maintenance requirements for asset owners.

ZAM-WSUD systems installed in trials included inlet grates with 20mm gaps between bars such that larger litter will bypass the biofiltration system. Square bars were used to reduce the potential for litter to jam between bars. Litter smaller than 20mm in size is able pass through the inlet grates and would generally be expected to be collected during grass mowing. Inlet grates have also been designed so that the inlet grill is flush with the existing kerb so that the face can be effectively cleaned by street sweepers. Bypass flow will also remove litter from the face of the inlet grate. This design ensures that there is no long term collection of litter and other debris on the inlet grate.

To prevent abrasive damage from stainless steel street sweeper brushes, 304 stainless steel has been identified as the preferred construction material for grates. Hot dip galvanised steel will also be effective, but may be susceptible to long term removal of the galvanising coating on the front face. During trails it was confirmed that simple grates could be constructed in 304 stainless steel at a similar price to hot dip galvanised steel. For more complex grates the cost to construct in 304 stainless steel were significantly higher than hot dip galvanised steel.



Grated inlet for a barrier kerb – 304SS

Grated inlet for rollover kerb – hot dip galv. steel

As part of overall catchment strategies, asset owners may also wish to consider the inclusion of gross pollutant traps elsewhere in the stormwater network to complement ZAM-WSUD installations. At this stage 'Zero Additional Maintenance Gross Pollutant Traps' (ZAM-GPTs) have not yet been developed, but a three year research project is currently underway to develop a street scale very low maintenance Gross Pollutant Trap system (VLM-GPT).

Practical ZAM-WSUD Examples

Grassed

Prototype at the Manningham Depot, Blackburn Road, Doncaster East

Park Avenue, Doncaster, single barrier kerb installation

Hummel Way, Doncaster, single barrier kerb installation

Edwin Street, Templestowe, single barrier kerb installation

Sanctuary Place, Templestowe, roll over kerb installations (3 no.)

Ruffey Lake Park, Victoria Street car park, Doncaster, barrier kerb installations (5 no.)

Vegetated

Vegetated WSUD systems can also achieve the 'ZAM-WSUD' objective of no additional maintenance. For areas where feature landscaping is existing or proposed for aesthetic reasons, appropriate selection of plant types for a vegetated ZAM-WSUD system can allow a WSUD system to be installed with similar maintenance requirements to a typical landscaped area such that the design criteria of 'zero additional maintenance' is achieved.

Highview Drive, Doncaster, Vegetated ZAM-WSUD design,

Site Selection

A wide range of factors need to be considered when assessing the suitability of a proposed site for a ZAM-WSUD system such as:

Strategic planning

WSUD systems offer greatest benefits to waterways in catchments where there is no other previously constructed stormwater treatment infrastructure, (such as a treatment wetland). As a consequence installations are most beneficial when strategically coordinated in accordance with an overall stormwater management plan for the catchment.

Catchment area and size

WSUD systems aim to break the direct link between impervious areas and the stormwater network. To be most effective systems should generally be located just upstream of a side entry or grated stormwater pit to allow stormwater from a large catchment to be collected and treated.

The ZAM-WSUD system size needs to be proportional to impervious catchment area that drains into the biofilter to ensure that systems provide effective stormwater treatment and are resistant to clogging.

A treatment area of 1-2% of the impervious catchment area is conserved ideal for biofiltration systems. As ZAM-WSUD systems include additional measures to provide resilience to clogging (sediment groves and modified filter media profile) and allow infiltration into soils beyond the treatment area (i.e. on the batter slopes), ZAM-WSUD systems are expected to be able function effectively with larger catchment areas compared to traditional WSUD systems.

Small sized, single inlet ZAM-WSUD systems with a $2m^2$ treatment area are expected to be effective for impervious catchment areas between approximately $100m^2$ and $400m^2$.

Road gradient

Mowable ZAM-WSUD systems have been constructed and are operating successfully on roads with gradients up to 1V:10H.

For roads with steeper gradients than this, it may be difficult to design mowable ZAM-WSUD systems with batters that do not exceed 1V:5H that can adequately contain water.

For roads with gradients steeper than up to 1V:15H that have significant cross fall, it may be necessary to include some velocity reduction structures within the inlet tray for grated inlets with elongated horizontal openings (such as those shown on the standard drawings for barrier and SM kerbing). Inlet reduction structures can consist of rockwork (20mm to 40mm diameter) embedded in the concrete inlet tray.

Underground services

Conflicts with existing underground services can make ZAM-WSUD retrofit installations impractical and/or very costly in many instances. As road reserves typically contain many underground services, it essential to obtain underground services information when assessing the suitability of a potential ZAM-WSUD site.

Excavation clearance distances to power poles in accordance with authority requirements also need to be considered.

ZAM-WSUD systems require a connection to the piped drainage network, preferably to an existing stormwater pit. Consequently ZAM-WSUD systems are most cost effective when constructed in close proximity to existing drainage assets, preferably an existing drainage pit.

Vegetation

ZAM-WSUD systems should be constructed away from trees and large shrubs to minimise the potential for tree root entry into agi drains.

Vehicle compaction

Vehicles parking on, or driving over, biofilter systems will compact the filter media reducing hydraulic conductivity. This can increase susceptibility to clogging. Consequently systems should generally be located where the incidence of vehicles parking on the nature strip is expected to be low.

Nature strip width and gradient

ZAM-WSUD systems are generally practical where the nature strip width is at least 2m wide and the footpath level is not significantly elevated (more than 10cm) above the level of the top of kerb. This ensures pedestrian safety by ensuring that batter slopes generally do not exceed 1V:5H.

Resident and community acceptance of ZAM-WSUD assets

Gaining community acceptance of ZAM-WSUD assets is essential to any successful installation. This is particularly important for installations outside residential properties where residents will be responsible for mowing of the grass. For these installations it is appropriate to engage residents as part of the site selection process. If residents are unsupportive, it may be appropriate to seek an alternative location for the ZAM-WSUD asset. An asset which has received acceptance from adjacent residents prior to construction will have a far better long term prospects than an asset that has been installed without appropriate consultation and/or acceptance.

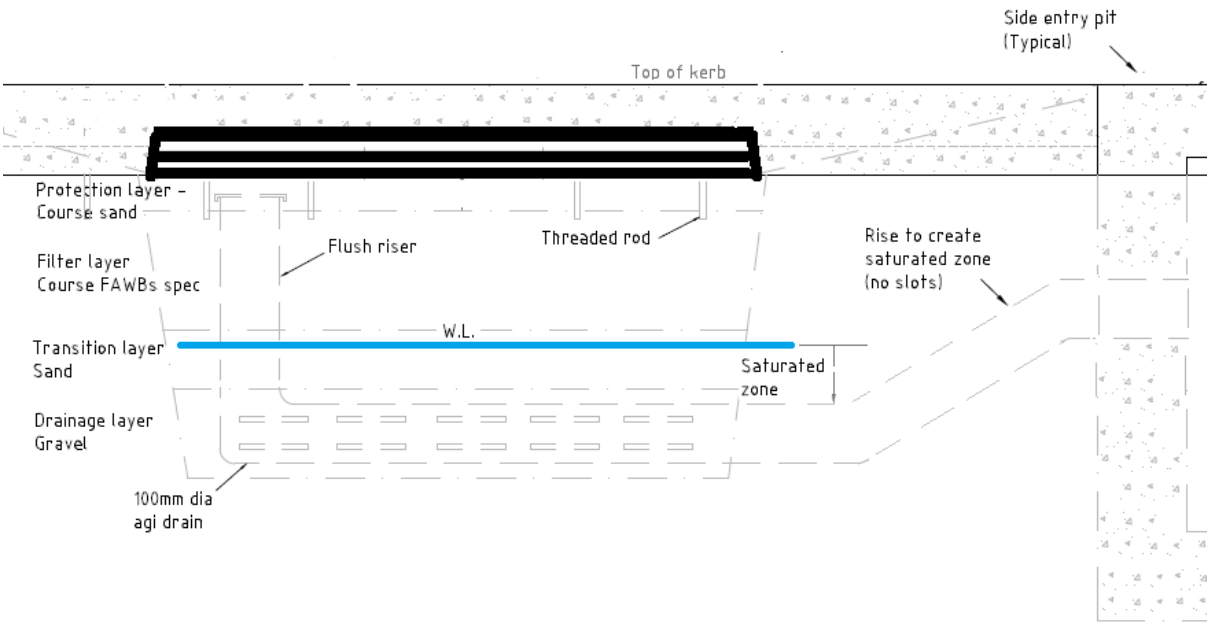
Detailed Design

Key factors to consider when designing a ZAM-WSUD system include:

Saturated zone

The saturated zone holds water and is very important for ensuring that ZAM-WSUD systems are resilient during extended dry periods. ZAM-WSUD systems need to be designed and constructed to ensure that a submerged zone is created with the saturated water level set just below the level of the FAWB specification filter media.

Submerged zones are generally created by using a geomembrane to seal the bottom of the ZAM-WSUD system. In heavy, impermeable clay soils a geomembrane may not be required to create a saturated zone. A slotted agi pipe is installed at the base of the treatment profile to ensure adequate drainage of the FAWB specification layer. The agi pipe needs to be connected to solid pipe with a raised elbow configuration to store water at the base of the ZAM-WSUD system.



Saturated zone creation using unslotted pipe bends

Minimising trip hazards

ZAM-WSUD systems modify nature strip levels, and include some level changes. Detailed design should seek to minimise additional pedestrian trip hazards. Design elements that can reduce trip hazard potential include:

- utilising a double lintel (back to back) to provide a 400mm wide step to assist persons existing vehicles, and providing a visual point of difference compared to adjacent kerbing
- Limiting step down height from the top of kerb to the ZAM-WSUD bed to approx. 200mm
- Selecting sites in proximity to street lighting
- allowing for a 300mm strip adjacent to footpaths with a cross fall not exceeding 1V:10H

Protection of road subgrade

Excessive cyclic localised saturation and drying of road subgrade and subbase materials can accelerate structural deterioration and/or subsidence of this material. Including an impermeable geomembrane layer between the filter media and the road subgrade and subbase materials will limit localised water inflow to subgrade materials and any associated accelerated road pavement degradation.

Vandalism protection and structural integrity

Installations need to be robust such that they are not susceptible to physical damage or vandalism. Inlet grates should include legs cast into concrete so that they cannot be removed. Concrete thickening (to 150mm min) and steel bar reinforcement is appropriate at inlet locations to prevent cracking.

Concrete Apron

A concrete apron at the back of kerbing improves mowability by allowing grass to be mowed without requiring specialised edge trimming equipment such as a brush cutter.

Concrete Apron Retrofit, Edwin Street, Templestowe

Construction

As many elements of the ZAM-WSUD system are relatively new, effective communication with contractors is essential to ensure that constructed assets are fit for purpose.

Many requirements are similar for other road construction works such as underground services checks, traffic and pedestrian management plans and in some cases road opening permits.

Considerations specifically relevant to ZAM-WSUD installations include:

Validation of Materials

For a WSUD system to function effectively, correct sand types must be used. Sand types for biofilters are now commercially available through major suppliers, and consequently visual inspections and the provision of receipts from suppliers may be adequate in many cases to demonstrate that the correct sand types have been used.

If there is any concern about the suitability of materials being used, samples can be taken and sent to a NATA approved geotechnical laboratory for hydraulic conductivity testing and particle size analysis to confirm whether the material used is suitable.

It may be appropriate to collect and retain filter media samples at the time of construction so that if there are any later concerns or contractual disputes about system performance, uncontaminated samples are available for testing.

Filter media materials used for installations

Preventing filter media contamination

Contamination of filter media sands with excessive construction dirt can cause clogging and failure of the filter media. An appropriate methodology needs to be developed by contractors to ensure that this does not occur. Suitable protection measures during construction include placing and removing a sacrificial sand layer, placing a cover over the filter media or blocking the inlet until the construction site has been fully cleaned.

Sediment groove construction

Sediment grooves constructed to date have been constructed by hand. The method used involved roughly constructing kerbing, rough hand trowel construction, mould pressing, slurry placement, mould pressing (again) and hand trowel finishing.



Sediment groove installation, Park Avenue, Doncaster

After construction completion, concrete should be protected from vehicles for at least 4 days to minimise the risk of cracking.

Grass Watering

It is essential that buffalo grass is kept moist during transport, immediately after placement and for the first month at least after placement. If grass dries out in the period immediately after installation, it may not fully recover. Appropriate arrangements need be made for regular watering.

References

Belinda Hatt, Veljko Prodanovic & Ana Deletic (2014) *Zero Additional Maintenance WSUD Systems: Clogging Potential of Alternative Filter Media Arrangements.* Monash University Water for Liveability Centre

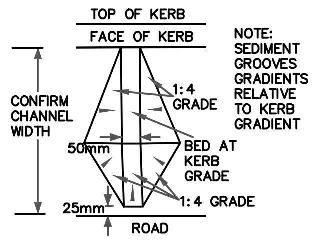
Emily G. I. Payne, Tracey Pham, Perran L. M. Cook, Tim D. Fletcher, Belinda E. Hatt & Ana Deletic (2014) *Biofilter design for effective nitrogen removal from stormwater – influence of plant species, inflow hydrology and use of a saturated zone.* Water Science and Technology 69.6.

ZAM-WSUD Toolkit

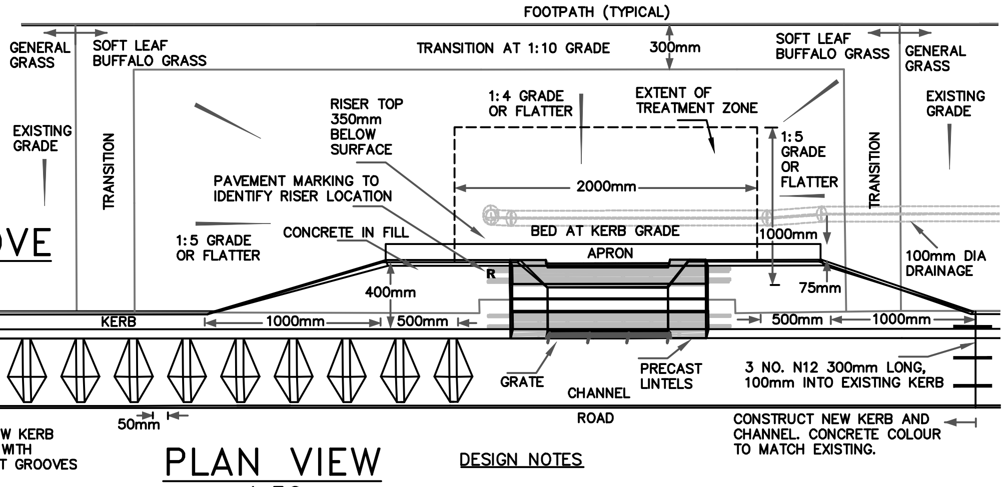
Standard drawings and a technical specification (refer to subsequent pages) has been developed to assist future ZAM-WSUD installations.

- Standards drawings are for:
    - Barrier kerb
    - SM kerb
    - Roll over kerb
    - Mountable kerb

This documentation should be used in conjunction with site specific plans and general technical specifications for concrete, road works, drainage, etc.



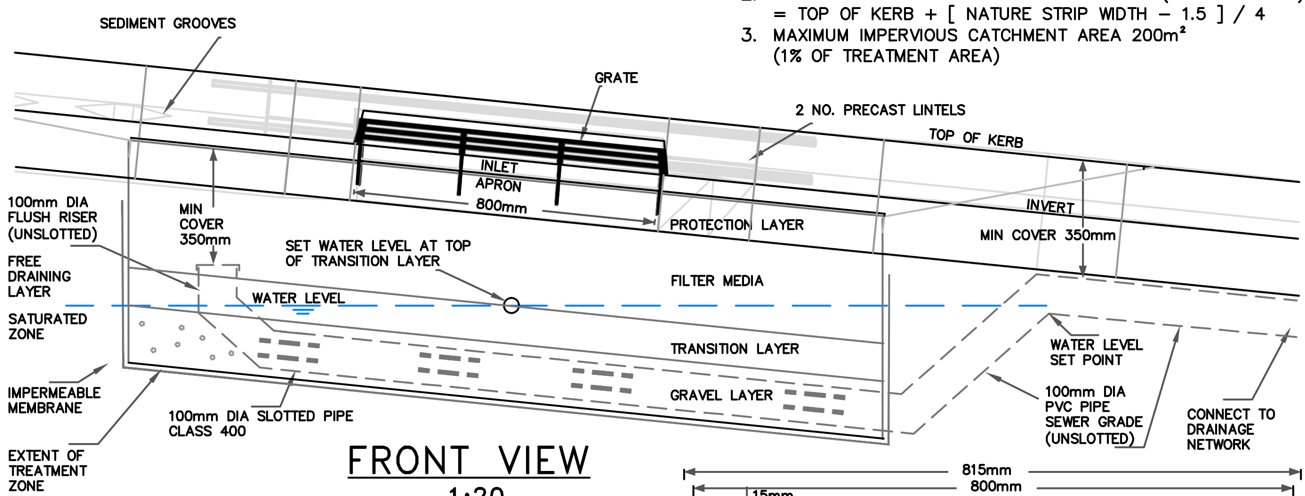
SEDIMENT GROOVE
1:20



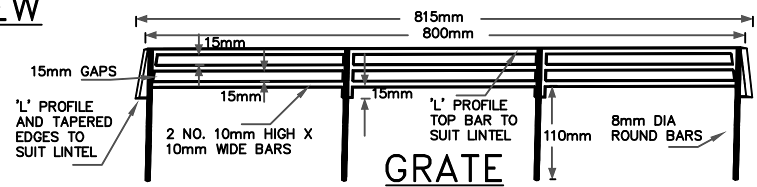
PLAN VIEW
1:50

DESIGN NOTES

1. UNSUITABLE FOR ROAD GRADIENTS EXCEEDING 1V:10H
2. MAXIMUM ALLOWABLE HEIGHT OF FOOTPATH (0m BED WIDTH) = TOP OF KERB + [NATURE STRIP WIDTH – 1.5] / 4
3. MAXIMUM IMPERVIOUS CATCHMENT AREA 200m² (1% OF TREATMENT AREA)

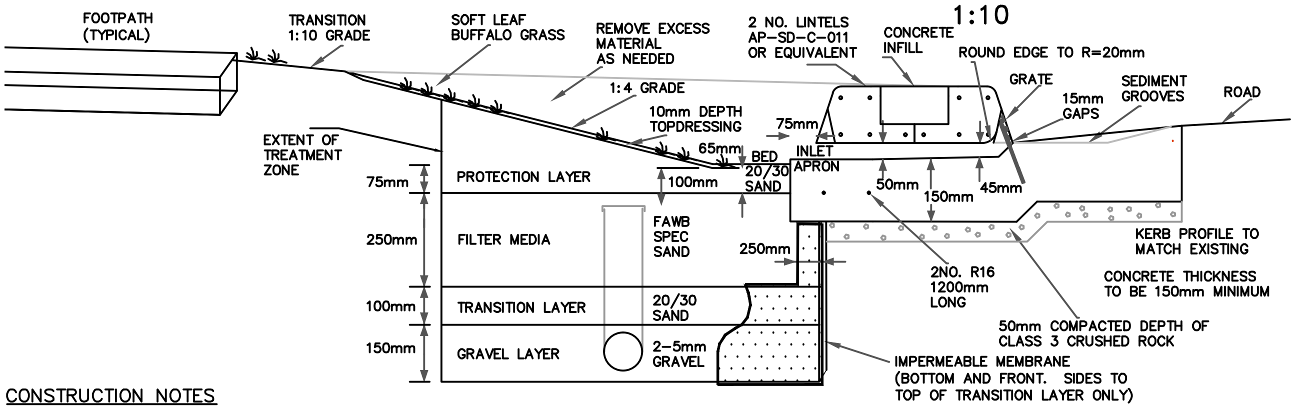


FRONT VIEW
1:20



GRATE
1:10

NOTES
1. GRATE TO BE CONSTRUCTED FROM 304 STAINLESS STEEL.
2. CONTRACTOR TO ENSURE THAT GRATE SIZE TO FITS LINTEL USED



CONSTRUCTION NOTES

1 LINTEL CONCRETE TO BE 40MPA MIN.
2 ALL OTHER CONCRETE TO BE 20MPA MIN.
3 SOFT LEAF BUFFALO GRASS TO BE TYPE 'PALMETTO SS100' ONLY, SAND GROWN, WASHED CLEAN.

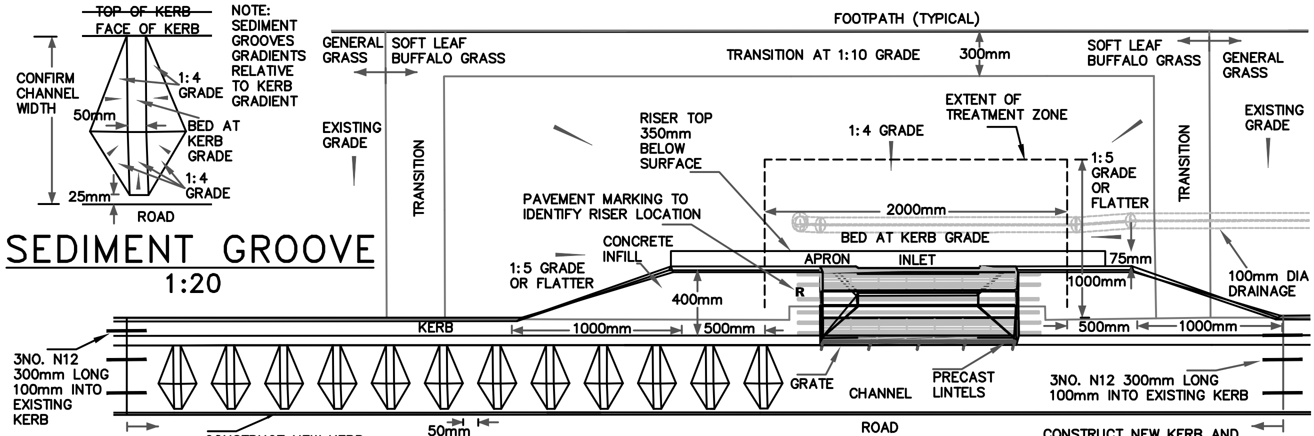
TYPICAL SECTION
1:20

WARNING
BEWARE UNDERGROUND SERVICES
CONTACT MELBOURNE ONE CALL DIAL BEFORE YOU DIG ON 1100 AT LEAST 48 HOURS BEFORE COMMENCING EXCAVATIONS.

ZAM WSUD – FOR BARRIER KERB

DRAWN BY: S. BRINK CHECKED:	STANDARD DRAWING A4/
REVISON DATE: 30th March 2015	

PRINTED: 30 March 2015 3:53 PM

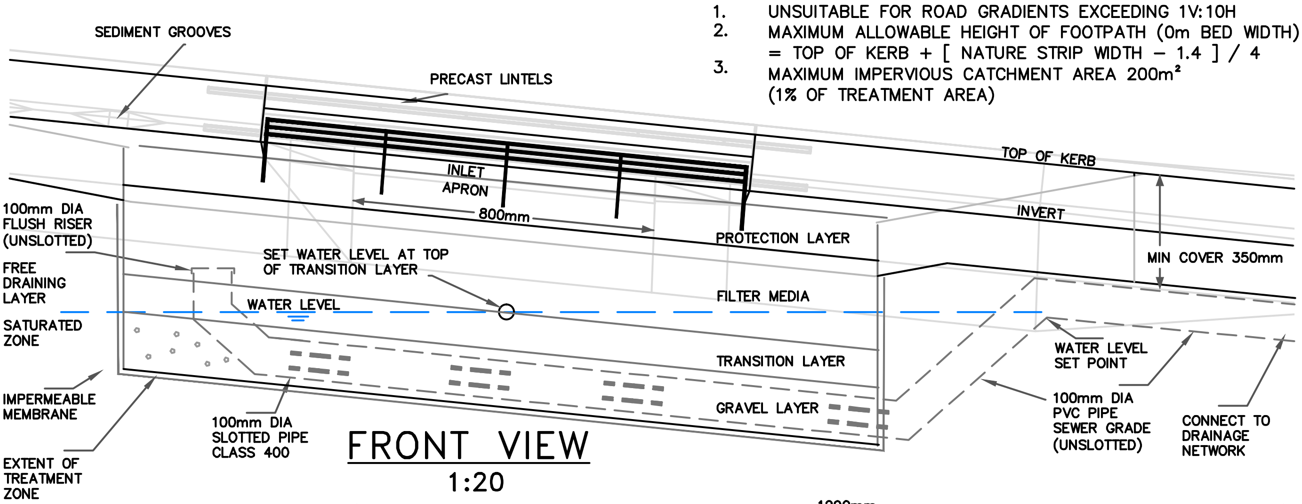


SEDIMENT GROOVE
1:20

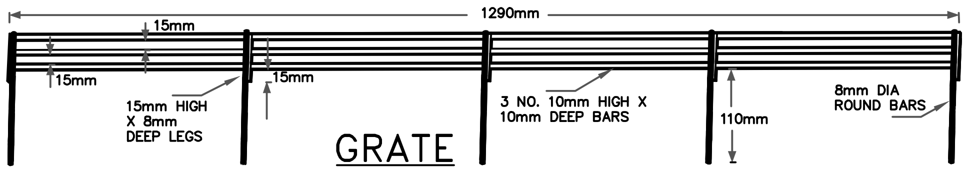
PLAN VIEW
1:50

DESIGN NOTES

1. UNSUITABLE FOR ROAD GRADIENTS EXCEEDING 1V:10H
2. MAXIMUM ALLOWABLE HEIGHT OF FOOTPATH (0m BED WIDTH) = TOP OF KERB + [NATURE STRIP WIDTH – 1.4] / 4
3. MAXIMUM IMPERVIOUS CATCHMENT AREA 200m² (1% OF TREATMENT AREA)

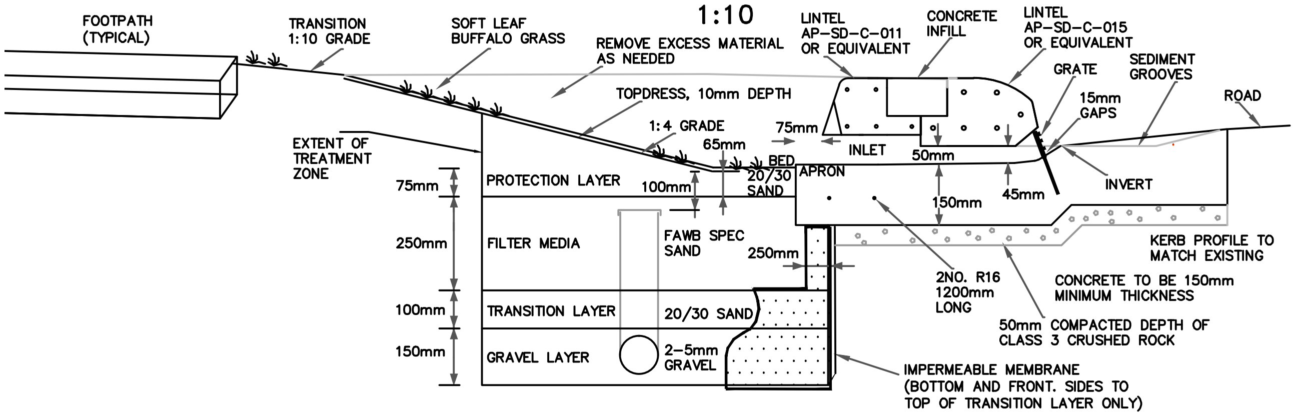


FRONT VIEW
1:20



NOTES
1. GRATE TO BE CONSTRUCTED FROM 304 STAINLESS STEEL
2. CONTRACTOR TO ENSURE THAT GRATE SIZE TO FITS LINTEL USED

GRATE
1:10



TYPICAL SECTION
1:20

CONSTRUCTION NOTES

1 LINTEL CONCRETE TO BE 40MPA MIN.
2 ALL OTHER CONCRETE TO BE 20MPA MIN.
3 SOFT LEAF BUFFALO GRASS TO BE TYPE 'PALMETTO SS100' ONLY, SAND GROWN, WASHED CLEAN.

WARNING
BEWARE UNDERGROUND SERVICES
CONTACT MELBOURNE ONE CALL DIAL BEFORE YOU DIG ON 1100 AT LEAST 48 HOURS BEFORE COMMENCING EXCAVATIONS.

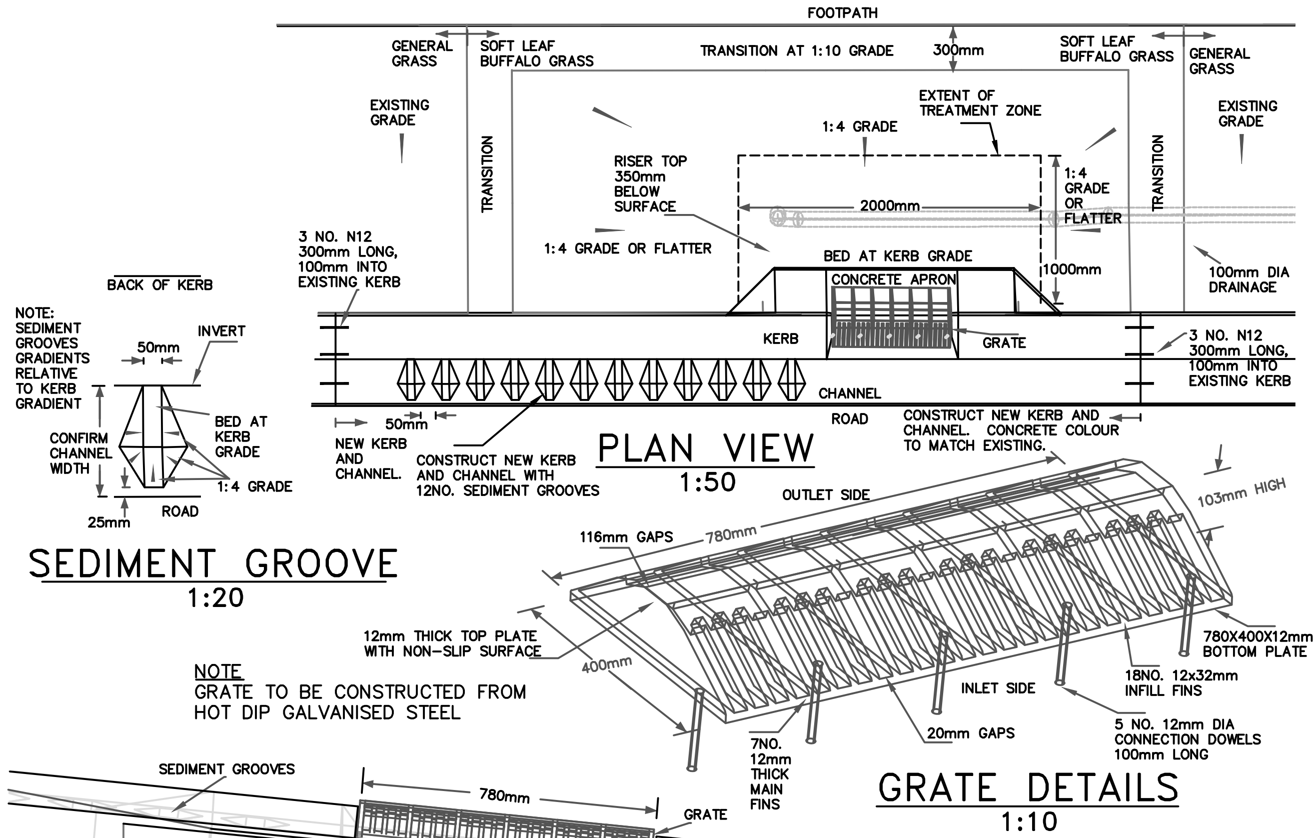
ZAM WSUD – FOR SEMI MOUNTABLE KERB

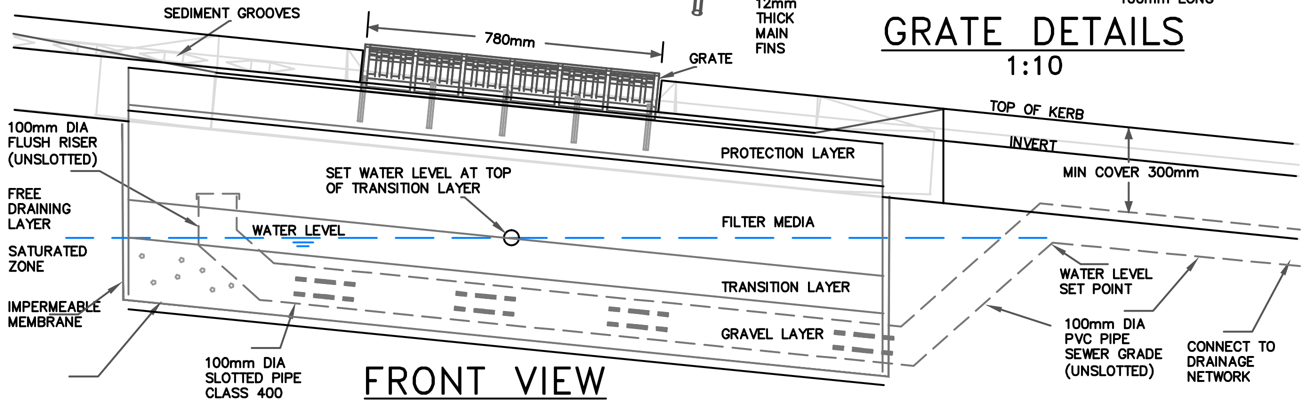
DRAWN: S. BRINK CHECKED:

DATE: 30th March 2015

STANDARD DRAWING A4/

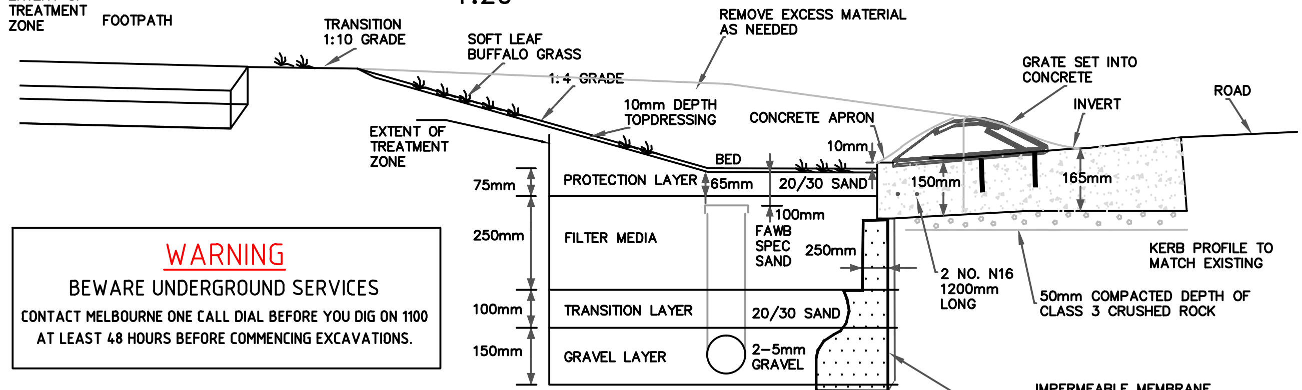
PRINTED: 30 March 2015 3:52 PM





FRONT VIEW

1:20



WARNING

BEWARE UNDERGROUND SERVICES

CONTACT MELBOURNE ONE CALL DIAL BEFORE YOU DIG ON 1100 AT LEAST 48 HOURS BEFORE COMMENCING EXCAVATIONS.

TYPICAL SECTION

1:20

DESIGN NOTES

1. UNSUITABLE FOR ROAD GRADIENTS EXCEEDING 1V:10H
2. MAXIMUM ALLOWABLE HEIGHT OF FOOTPATH (0m BED WIDTH) = TOP OF KERB + [NATURE STRIP WIDTH – 1.1] / 4
3. MAXIMUM IMPERVIOUS CATCHMENT AREA 200m² (1% OF TREATMENT AREA)

CONSTRUCTION NOTES

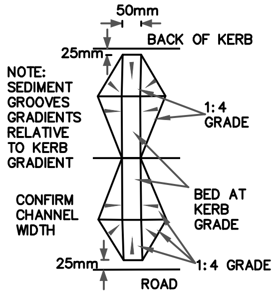
1 CONCRETE TO BE 20MPA MIN.
2 SOFT LEAF BUFFALO GRASS TO BE TYPE 'PALMETTO SS100' ONLY, SAND GROWN, WASHED CLEAN.

ZAM WSUD – FOR ROLL OVER KERB

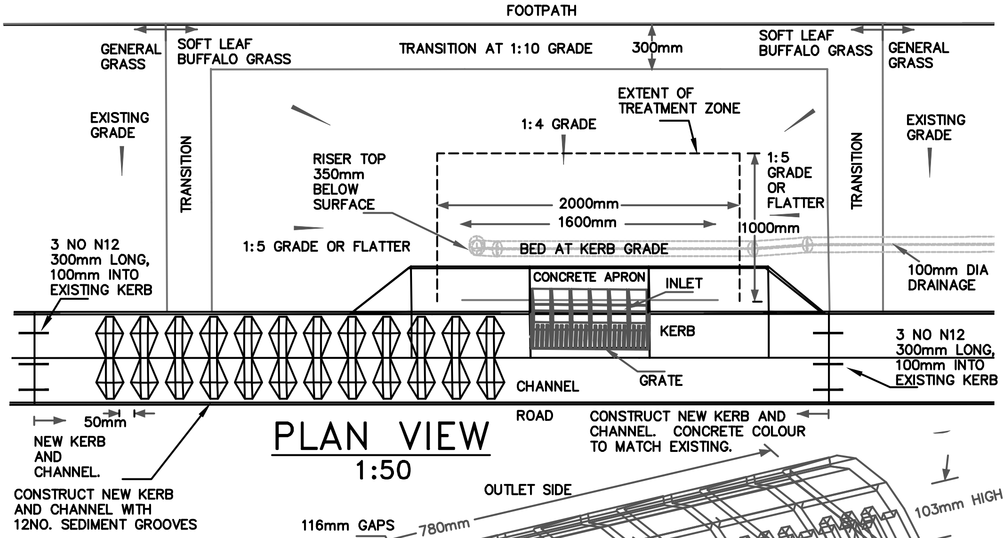
DRAWN: S. BRINK CHECKED:

DATE: 2nd April 2015

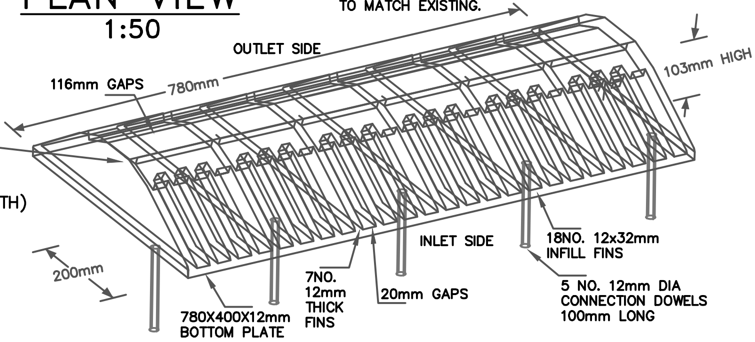
STANDARD DRAWING A4/



SEDIMENT GROOVE
1:20



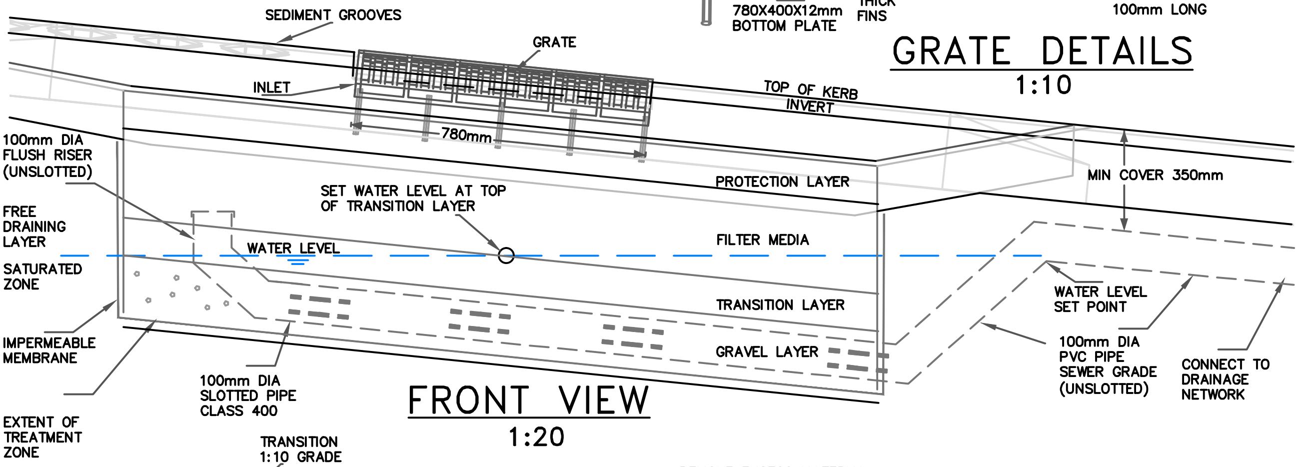
PLAN VIEW
1:50



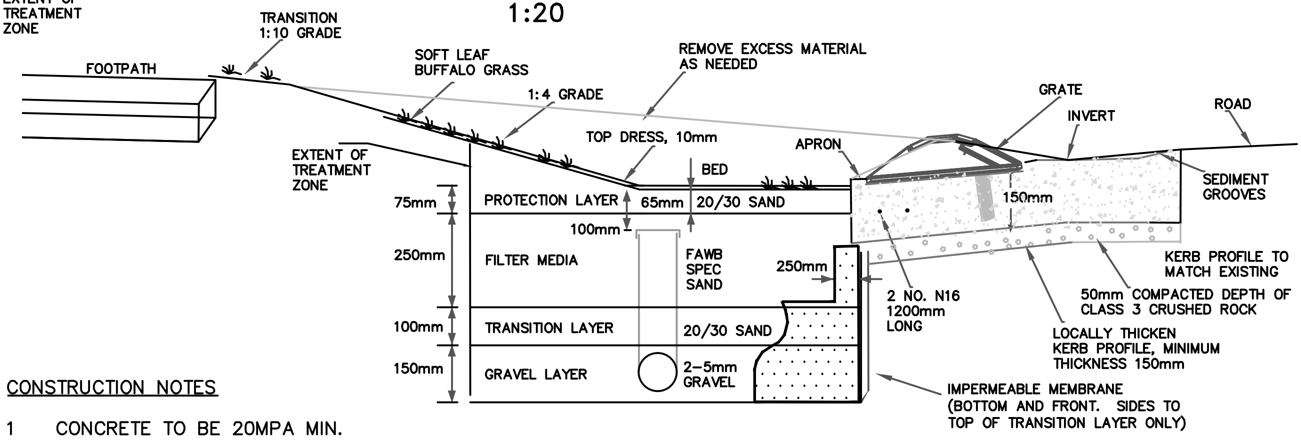
GRATE DETAILS
1:10

DESIGN NOTES

1. UNSUITABLE FOR ROAD GRADIENTS EXCEEDING 1V:10H
2. MAXIMUM ALLOWABLE HEIGHT OF FOOTPATH (0m BED WIDTH) = TOP OF KERB + [NATURE STRIP WIDTH – 0.8] / 4
3. MAXIMUM IMPERVIOUS CATCHMENT AREA 200m² (1% OF TREATMENT AREA)



FRONT VIEW
1:20



CONSTRUCTION NOTES

1 CONCRETE TO BE 20MPA MIN.
2 SOFT LEAF BUFFALO GRASS TO BE TYPE 'PALMETTO SS100' ONLY, SAND GROWN, WASHED CLEAN.
3 GRATE TO BE CONSTRUCTED FROM HOT DIP GALVANISED STEEL.

TYPICAL SECTION
1:20

WARNING
BEWARE UNDERGROUND SERVICES
CONTACT MELBOURNE ONE CALL DIAL BEFORE YOU DIG ON 1100
AT LEAST 48 HOURS BEFORE COMMENCING EXCAVATIONS.

ZAM WSUD – FOR MOUNTABLE M2 KERB

DRAWN: S. BRINK CHECKED:	STANDARD DRAWING A4/
DATE: 2nd April 2015	

ZAM-WSUD

Zero Additional Maintenance Water Sensitive Urban Design

Technical Specification

DRAFT

MANNINGHAM

Melbourne Water

CRC for Water Sensitive Cities

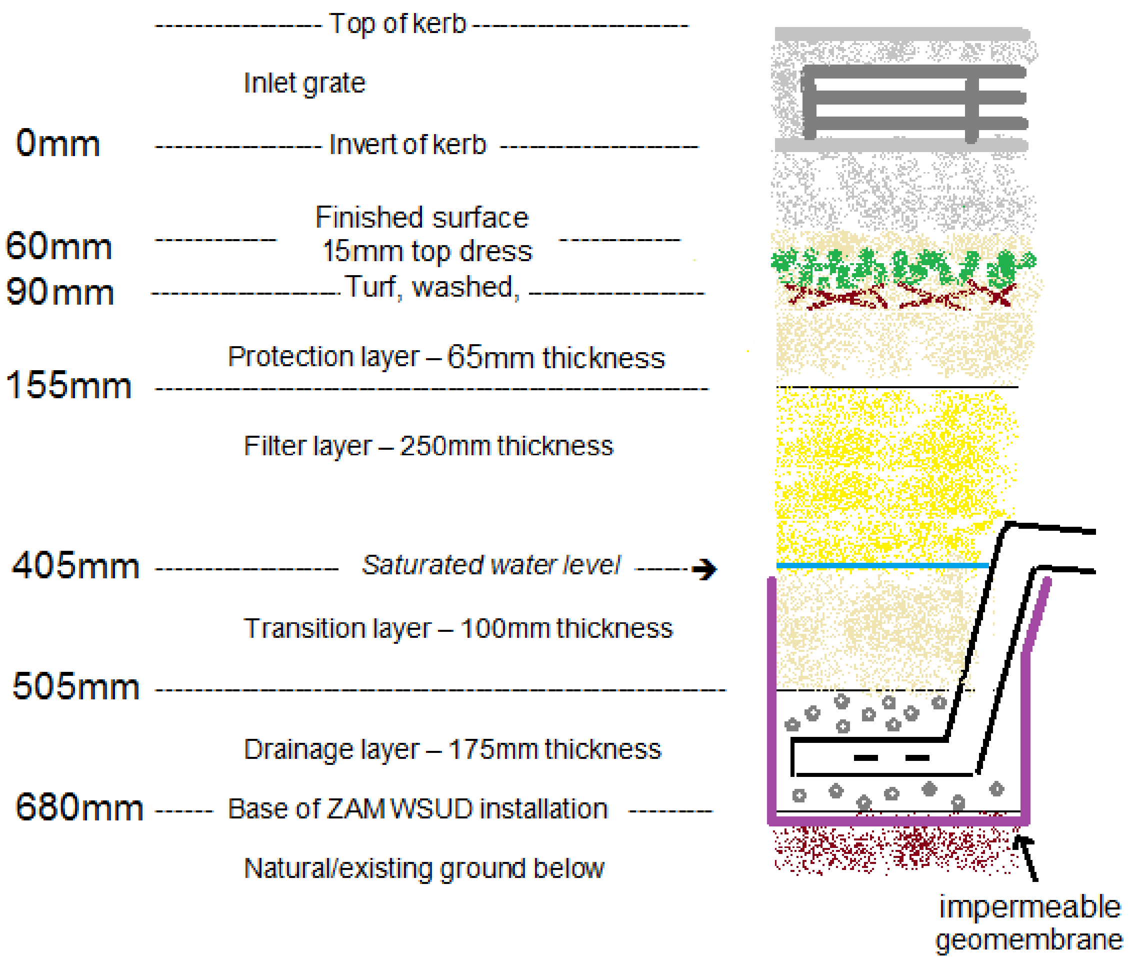
General

Zero Additional Maintenance Water Sensitive Urban Design (ZAM-WSUD) installations shall be constructed in accordance with these technical specifications, except where otherwise noted on the design plans.

ZAM-WSUD Filter Media Profile

For grassed ZAM-WSUD installations, the filter media profile shall be in accordance with the following schematic, unless otherwise noted on the plans.

Depth Below Invert of Kerb



For landscaped ZAM-WSUD installations, featuring larger vegetation such as shrubs over 0.6m in height, the depth of the transition layer is to be increased to 350mm.

Lintel Details

Lintels are to be reinforced concrete, prefabricated. Concrete for precast lintels shall to be 50MPa minimum. Concrete lintel supports are to be provided where required and where shown on standard drawings.

Inlet grates

Inlet grates for barrier and SM2 kerb shall be constructed from 304 stainless steel and shall be in accordance with the standard drawings. Any bolts or fixings in contact with the grate must also be 304 stainless steel (or a similar compatible stainless steel).

Inlet grates for rollover and mountable kerb shall be hot dip galvanized steel and shall be in accordance with the standard drawings. Any bolts or fixings in contact with the grate must also be hot dip galvanized.

Samples of all fabricated steel grates shall be approved by the superintendent/ superintendent's representative prior to installation.

Turf

Description: Soft Leaf Buffalo grass, washed and grown in a sand media

Suitable product: Soft Leaf Buffalo – Cultivar type: Palmetto SS100

Turf placed directly above filter media profile must be free of loose clay soil material and washed to the satisfaction of the superintendent/superintendent's representative prior to placement. Turf placed elsewhere does not need to washed.

Turf should be grown in a sand media to allow ease of cleaning prior to placement. Contractors should request that turf is supplied with as little soil material as practical to minimise turf cleaning requirements. Note that turf survival time, particularly with minimal soil, is relatively short, so contractors need to ensure that all turf is planted within 24 hours of delivery to best ensure turf survival. It is recommended that the contractor contract turf suppliers as early as possible to ensure supply at the required time.

Turf must be well watered immediately after planting, every day for the first week, and every two to three days subsequently (unless significant rain has fallen) for the first month after planting. Grass needs to be thoroughly watered. Minimum watering volumes can be determined by Bureau of Meteorology evapotranspiration (ETo) data from the closest weather station available at www.bom.gov.au/watl/eto/ Watering volumes must exceed net rainfall deficit (Net = Rainfall – ETo). If planting is done in late spring or summer, turf must be watered regularly for the first three months. Watering is the contractor's responsibility, unless otherwise specified.

Palmetto SS100 shall be used unless otherwise approved by the superintendent/ superintendent's representative. Information on Palmetto SS100 and local supplier details can be found at: www.palmetto.com.au

Impermeable Membrane

A 100 micron (minimum) thick geofabric impermeable membrane shall be provided:

- At the base and all sides of the ZAM-WSUD installation up to or above the bottom of the filter media layer to form the saturated zone, and
- On any side of the ZAM-WSUD asset facing a road pavement up to the bottom of kerb level, including on adjacent sides to a minimum of 0.25m width.

Refer to standard drawings for details.

Protection Layer

Description: 20/30 sand

Suitable products

- Burdetts - 20/30 sand (preferred) Contact: (03) 9789 8266 Andrew Burdett
- Daisys – 23 Course White Sand Contact: (03) 9870 4322 Greg Fitzgerald

Note: The majority of the protection layer is to be placed initially (65mm depth). The remainder is to be placed on top of turf as top dressing (10mm depth).

	20/30 sand
Particle Size (mm)	
Fine Gravel (2.0mm)	2
Very Coarse Sand (1.0mm)	13
Coarse Sand (0.5mm)	61
Medium Sand (0.25mm)	21
Fine Sand (0.15mm)	1
Very Fine Sand (0.05)	2
Silt and Clay (<0.05mm)	trace
Hydraulic Conductivity (mm/hr) Drainage	1316
Texture	Off white sand
Sample No	**662**

Burdetts - 20/30 sand – Particle Size Distribution

	Coarse White Washed Sand
pH (1:5 water)	6.5
Electrical conductivity (mS/cm)	0.010
Total Salts (ppm)	30
Particle Size (mm)	
Fine Gravel (2.0mm)	1
Very Coarse Sand (1.0mm)	13
Coarse Sand (0.5mm)	73
Medium Sand (0.25mm)	8
Fine Sand (0.15mm)	2
Very Fine Sand (0.05)	3
Silt and Clay (<0.05mm)	2
Hydraulic Conductivity (mm/hr) Drainage	2536

Daisys – 23 Course White Sand – Particle Size Distribution

Filter Layer

Description: FAWB specification sand

FAWB Specification

Description	Allowable Proportion	Particle Size
Clay/silt	<3%	<0.05mm
Very fine sand	5-10%	0.05-0.15mm
Fine sand	10-25%	0.15-0.25mm
Medium to Course sand	60-70%	0.25-1.0mm
Course sand	7-10%	1.0-2.0mm
Fine gravel	<3%	2.0-3.4mm
Other gravel	0%	>3.4mm

FAWB Specification – Particle Size Distribution

Suitable products

- Daisys - Bio Drain Filter Sand

	Bio Drain Filter Sand
pH (1:5 water)	5.6
Electrical conductivity (mS/cm)	0.012
Total Salts (ppm)	36
Particle Size (mm)	
Fine Gravel (2.0mm)	1
Very Coarse Sand (1.0mm)	7
Coarse Sand (0.5mm)	21
Medium Sand (0.25mm)	39
Fine Sand (0.15mm)	23
Very Fine Sand (0.05)	7
Silt and Clay (<0.05mm)	2
Hydraulic Conductivity (mm/hr) Drainage	297

Daisys - Bio Drain Filter Sand – Particle Size Distribution

Transition Layer

Description: 20/30 sand

Suitable products

- Burdetts - 20/30 sand Contact: 9789 8266 Andrew Burdett
- Daisys – 23 Course White Sand Contact: 9870 4322 Greg Fitzgerald

Refer to particle size distribution information above.

Drainage Layer

Description: No fines gravel, 2.5mm nominal diameter screenings.

Note: screenings generally range in size between approx. 1.5mm and 4mm diameter.

Finished Surface Profile

The contractor shall ensure that the finished surface profile is suitable for the mower type used to mow the grass at the location of the installation. Grade transitions are to be smooth enough to ensure that the mowers do not bottom out and cause damage to grass and/or mowers.

Mower type	Mowing width	Back Gradient	Side Gradient
Hand	0.5m	1V:4H or flatter	1V:5H or flatter
Small ride on	1.05m	1V:5H or flatter	1V:6H or flatter
Kabota	2.0m	1V:6H or flatter	1V:6H or flatter

To ensure pedestrian safety, cross fall within 300mm of footpaths is not to be steeper than 1V:10H gradient.

Plumbing

Drainage pipes to be 150mm diameter PVC, sewer grade.

Slotted drainage pipes shall be either:

- 150mm diameter PVC, sewer grade, slots to be 1mm width, 100mm long, 12 slots per meter minimum, or
- Class 400 agi drain, 150mm diameter.

Concrete Apron

To allow maintenance of grass directly behind the back of kerb without requiring the use of an edge trimmer, a concrete apron shall be provided at the back of the kerb. The concrete apron shall be 50mm wide minimum, 150mm thickness. Top of the concrete shall match the finished surface level of the 20/30 protection layer prior to the placement of turf.

Construction Inspections

The superintendent/superintendent's representative shall be provided with the opportunity to inspect works at each site at the following stages:

- At set out.
- Completion of plumbing works and impermeable membrane placement, prior to placement of gravel drainage material.
- Completion of placement of any subsequent layers at the request of the superintendent/superintendent's representative.

A minimum of 24 hours notice is to be given by the contractor prior to inspections.

Photos shall be taken at the completion of each layer, including showing evidence of the finished level of the top of each layer using a tape measure of similar.

Site Clean Up and Maintenance

Contractors are responsible for restoration, clean up and maintenance of all sites at the completion of construction and throughout the defects liability period to the satisfaction of the superintendent/superintendent's representative and local residents. This includes watering of planted turf and grass (unless otherwise specified) and the immediate replacement of grass in any areas where establishment has been unsuccessful.

The use of fertilizer to enhance grass growth is not permitted.

ZAM-WSUD Trial Site Inspection

Contractors and construction workers shall, where practical, inspect at least one previously completed ZAM-WSUD site prior to commencing construction.

Refer to Table 1 for ZAM-WSUD installation locations.

Site	Suburb	Melways Reference	No.	Type	Adjacent Land Use	Road Gradient	Kerb Type	Installation Size
Manningham Depot, 620-628 Blackburn Road (staff car park)	Doncaster East	34 D3	2	Grass (prototypes)	Car park	Flat	Barrier	3m x 1.5m
Sanctuary Place, the Domain	Templestowe	34E1	3	Grass	Residential / Council Reserve	1:30	Rollover	2m x 4m each
Hummel Way	Doncaster	33F12	3	Grass	Council	1:12 and 1:30	Barrier	2m x 4m each
Ruffey lake Park (Victoria St Carpark)	Doncaster	33J10	1	Grass	Council Reserve	Flat	Barrier	35m x 1.5m
Park Reserve (26 & 38 Park Avenue)	Doncaster	32J12	2	Grass	Council Reserve	Flat	Barrier	2m x 8m each
Edwin Reserve (5 Edwin Road)	Templestowe	33G3	1	Grass	Council Reserve	Flat	Barrier	2.5m x 7.5m
Bond St Shops, (Corner Bond Street and Highview Drive)	Doncaster	47F2	4	Landscaped	Commercial	1:15	Barrier	$4m^2$ each

Table 1 – ZAM-WSUD installations, March 2015