

Land East of Hook Lane, Westergate

West Sussex

OWNERS MANUAL

Relating to Surface Water Drainage Maintenance

The site has been designed in accordance with Sustainable Drainage Systems (SUDS) techniques.

The SUDS Manual (CIRIA C697) states that "Sedimentation is one of the primary removal mechanisms in SUDS. Most pollution in runoff is attached to sediment particles and therefore removal of sediment results in a significant reduction in pollutant loads".

In order to remove sedimentation the surface water drainage design utilises deep seal trapped gullies throughout, catchpit manholes upstream of the surface water storage/infiltration devices and distribution tanks within the permeable paved areas.

Detailed drawings are attached for the permeable paving, cellular infiltration blankets and distribution tanks

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- 6) Maintenance Schedule for filter trenches and porous pipework
- 7) Maintenance Schedule for swales and ditches
- 8) Maintenance Schedule for solid wall pipes
- 9) Reasons for Maintenance

1) **Explanation of the Surface Water Drainage System**

The Principle of SUDs has been adopted for the whole of the site, calculations have been carried out using MicroDrainage with a storm return period of 100 years and an allowance of 30% for climate change.

Generally roof water drains direct to the domestic drainage system within each curtilage and from there will be directed to the below ground surface water network

Hardstanding areas and access roads or drives, drain to trapped gullies. All of these systems outfall to the surface water drainage system within the site.

The parking bays within the site are proposed to be lined permeable paving systems to provide a level of pre-treatment of surface water prior to discharging to the below ground surface water network.

Plots 1-33 and 39-79

Attenuation of the surface water flows is proposed using below ground cellular storage tanks as well as a SuDS attenuation basin at the south eastern corner of the site.

The final discharge from the site will be passed via a petrol interceptor to provide the required level of treatment in accordance with the SuDS manual Ciria C753.

The run-off from the site will eventually discharge to the existing ordinary watercourse along the eastern boundary of the site via a surface water pumping station.

A 1m easement will be kept between the fences of plots 58-60, 66 and the edge of the existing ditch to allow a route for future maintenance. The fences along the edge of these plots will have removable panels to allow for major maintenance operations if required in the future.

Maintenance of the surface water pumping system and petrol interceptor will be in accordance with the manufacturer's recommendations.

Plots 34-38

Run –off from the roofs are conveyed directly into the new swales proposed at the north eastern boundary of the site with a final discharge proposed to the existing ditch north of the site.

2) Maintenance Schedule for permeable paving

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Brushing & vacuuming	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weed.	As required.
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required.
	Remedial work to any depression's, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
Monitoring	Initial Inspection	Monthly for 3 months after installation.
	Inspect for evidence of poor operation and/or weed growth.	3-monthly, 48h after large storms.
	If required take remedial action.	
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.

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3) Maintenance Schedule for catchpits and gullies

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Remove sediment and oil deposits from all trapped gullies.	Annually, or as required.
	Remove sediment structures upstream of the cellular storage tanks.	Annually, or as required.
Remedial actions	Repair/rehabilitation of inlets, outlets, overflows and vents.	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms

4) Maintenance Schedule Cellular storage

Maintenance Schedule	Required Action	Recommended Frequency
Regular	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance)	Monthly

maintenance	Inspect catchpits and clear silt / debris as necessary	Monthly for 3 months, then six monthly.
Remedial actions	Repair/rehabilitation of inlets, outlets, overflows and vents.	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms

5) Maintenance Schedule for Detention basins

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Litter and debris removal.	Monthly
	Grass cutting – for spillways and access routes.	Monthly (during growing season), or as required.
	Grass cutting – meadow grass in and around basin.	Half yearly (spring before nesting season, and autumn).
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
	Tidy all dead growth before start of growing season.	Annually.
	Remove sediment from inlets, outlet and forebay.	Annually (or as required).
Occasional maintenance	Re-seed areas of poor vegetation growth.	Annually (or as required).
	Prune and trim trees and remove cuttings.	2 years (or as required).

Remedial actions	Repair of erosion or other damage by re-turfing or reseeding.	As required
	Re-level uneven surfaces and reinstate design levels.	As required.
	Repair/rehabilitation of inlets, outlets and overflows.	As required.
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly/ after large storms.
	Inspect banksides, structures, pipework etc. for evidence of physical damage.	Monthly/ after large storms.
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.
	Check flow control device and other mechanical devices.	Half yearly.

6) Maintenance Schedule for Filter trenches and porous pipework

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Litter and debris removal from trench surface, access chambers and pre-treatment devices.	Monthly (or as required).
	Removal and washing of exposed stones on the trench surface.	Annual (bi-annual the first year) or when silt is evident on the surface.
	Trimming of any roots that may be causing blockages.	Annual (semi-annual the first year).
	Remove weeds on the trench surface.	Monthly (at start, then as required).
	Removal of sediment from pre-treatment devices.	Six monthly

Occasional maintenance	Remove tree roots or trees that grow close to the trench.	As required.
	At locations with high pollution loads, remove surface geotextile and replace, ad wash or replace filter media.	Five yearly.
Remedial actions	Clear perforated pipework of blockages.	As required.
	Rehabilitate infiltration or filtration surfaces.	As required.
	Replace geotextiles and clean and replace filter media, if clogging occurs.	As required.
	Inspect inlets, outlets and inspection points for blockages, clogging, standing water and structural damage.	As required.
Monitoring	Inspect pre-treatment systems, inlets, trench surfaces and perforated pipework for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.

7) Maintenance Schedule Ditches and Swales

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Litter and debris removal.	Monthly (or as required).
	Grass cutting – to retain grass height within specified design range. Close cut around outlet & structure. 100 – 150mm generally.	Monthly (during growing season), or as required.
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible.	Annually
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required.	Annually, or if bare soil is exposed over 10% or more of the swale treatment area.

Remedial actions	Repair erosion or other damage by re-turfing or reseeded.	As required
	Re-level uneven surfaces and reinstate design levels.	As required.
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip.	As required.
	Remove and dispose of oils or petrol residues using safe standard practices.	As required.
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation. Record areas where water is ponding for >48 hours.	Monthly, or when required.
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.

8) Maintenance Schedule for solid wall pipes

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Inspect chambers and manholes for evidence of pipes operating correctly and take remedial action if necessary, to include jetting of pipework.	Monthly for 3 months, then annually

9) Reasons for Maintenance

Surface water contains variable amounts of sediment which settles out at certain locations and could cause blockages if left.

Road gullies also trap oil and prevent it entering the surface water sewer system.

APPENDIX (1)

DRAINAGE LAYOUTS

DWG Nos.BSO/E4462/450,451,452&453

[illegible]

Path (um)

See BSOE4462/462
for details of swale
drainage

See BSOE4462/462
for details of swale
drainage

1:200 KEYPLAN

NOTES

1. F.W. & S.W. house drainage is to be constructed in accordance with the Building Regulations & BS5931 & the WFC Guide Sewers for Adoption 6th Edition & Interim Addendum.
 2. Drains are to be constructed using factory jointed vitrified clay pipes to BS EN 252-1001 "Super Strength" specification (i.e. 1000mm Sd or similar) or uPVC drainage pipework to BS4660 & BS4661, bedded & backfilled in accordance with manufacturers instructions.
 3. Location of sewers & lateral drains to be in accordance with the WFC Guide Sewers for Adoption 6th Edition & Interim Addendum and specific requirements of Southern Water.
 4. Scheduling of drain trenches adjacent to dwelling or other structure to be in accordance with BS5931 Fig. 9.
 5. Access fittings & inspection chambers as table below:
- | TYPE | DEPTH RANGE | DESCRIPTION |
|------|----------------|---------------------------------------|
| 1 | 0.6m to 0.9m | Access chamber for roof & area drains |
| 2 | 0.9m to 1.2m | Access chamber for roof & area drains |
| 3 | 1.2m to 1.5m | Access chamber for roof & area drains |
| 4 | 1.5m to 1.8m | Access chamber for roof & area drains |
| 5 | 1.8m to 2.1m | Access chamber for roof & area drains |
| 6 | 2.1m to 2.4m | Access chamber for roof & area drains |
| 7 | 2.4m to 2.7m | Access chamber for roof & area drains |
| 8 | 2.7m to 3.0m | Access chamber for roof & area drains |
| 9 | 3.0m to 3.3m | Access chamber for roof & area drains |
| 10 | 3.3m to 3.6m | Access chamber for roof & area drains |
| 11 | 3.6m to 3.9m | Access chamber for roof & area drains |
| 12 | 3.9m to 4.2m | Access chamber for roof & area drains |
| 13 | 4.2m to 4.5m | Access chamber for roof & area drains |
| 14 | 4.5m to 4.8m | Access chamber for roof & area drains |
| 15 | 4.8m to 5.1m | Access chamber for roof & area drains |
| 16 | 5.1m to 5.4m | Access chamber for roof & area drains |
| 17 | 5.4m to 5.7m | Access chamber for roof & area drains |
| 18 | 5.7m to 6.0m | Access chamber for roof & area drains |
| 19 | 6.0m to 6.3m | Access chamber for roof & area drains |
| 20 | 6.3m to 6.6m | Access chamber for roof & area drains |
| 21 | 6.6m to 6.9m | Access chamber for roof & area drains |
| 22 | 6.9m to 7.2m | Access chamber for roof & area drains |
| 23 | 7.2m to 7.5m | Access chamber for roof & area drains |
| 24 | 7.5m to 7.8m | Access chamber for roof & area drains |
| 25 | 7.8m to 8.1m | Access chamber for roof & area drains |
| 26 | 8.1m to 8.4m | Access chamber for roof & area drains |
| 27 | 8.4m to 8.7m | Access chamber for roof & area drains |
| 28 | 8.7m to 9.0m | Access chamber for roof & area drains |
| 29 | 9.0m to 9.3m | Access chamber for roof & area drains |
| 30 | 9.3m to 9.6m | Access chamber for roof & area drains |
| 31 | 9.6m to 9.9m | Access chamber for roof & area drains |
| 32 | 9.9m to 10.2m | Access chamber for roof & area drains |
| 33 | 10.2m to 10.5m | Access chamber for roof & area drains |
| 34 | 10.5m to 10.8m | Access chamber for roof & area drains |
| 35 | 10.8m to 11.1m | Access chamber for roof & area drains |
| 36 | 11.1m to 11.4m | Access chamber for roof & area drains |
| 37 | 11.4m to 11.7m | Access chamber for roof & area drains |
| 38 | 11.7m to 12.0m | Access chamber for roof & area drains |
| 39 | 12.0m to 12.3m | Access chamber for roof & area drains |
| 40 | 12.3m to 12.6m | Access chamber for roof & area drains |
| 41 | 12.6m to 12.9m | Access chamber for roof & area drains |
| 42 | 12.9m to 13.2m | Access chamber for roof & area drains |
| 43 | 13.2m to 13.5m | Access chamber for roof & area drains |
| 44 | 13.5m to 13.8m | Access chamber for roof & area drains |
| 45 | 13.8m to 14.1m | Access chamber for roof & area drains |
| 46 | 14.1m to 14.4m | Access chamber for roof & area drains |
| 47 | 14.4m to 14.7m | Access chamber for roof & area drains |
| 48 | 14.7m to 15.0m | Access chamber for roof & area drains |
| 49 | 15.0m to 15.3m | Access chamber for roof & area drains |
| 50 | 15.3m to 15.6m | Access chamber for roof & area drains |
| 51 | 15.6m to 15.9m | Access chamber for roof & area drains |
| 52 | 15.9m to 16.2m | Access chamber for roof & area drains |
| 53 | 16.2m to 16.5m | Access chamber for roof & area drains |
| 54 | 16.5m to 16.8m | Access chamber for roof & area drains |
| 55 | 16.8m to 17.1m | Access chamber for roof & area drains |
| 56 | 17.1m to 17.4m | Access chamber for roof & area drains |
| 57 | 17.4m to 17.7m | Access chamber for roof & area drains |
| 58 | 17.7m to 18.0m | Access chamber for roof & area drains |
| 59 | 18.0m to 18.3m | Access chamber for roof & area drains |
| 60 | 18.3m to 18.6m | Access chamber for roof & area drains |
| 61 | 18.6m to 18.9m | Access chamber for roof & area drains |
| 62 | 18.9m to 19.2m | Access chamber for roof & area drains |
| 63 | 19.2m to 19.5m | Access chamber for roof & area drains |
| 64 | 19.5m to 19.8m | Access chamber for roof & area drains |
| 65 | 19.8m to 20.1m | Access chamber for roof & area drains |
| 66 | 20.1m to 20.4m | Access chamber for roof & area drains |
| 67 | 20.4m to 20.7m | Access chamber for roof & area drains |
| 68 | 20.7m to 21.0m | Access chamber for roof & area drains |
| 69 | 21.0m to 21.3m | Access chamber for roof & area drains |
| 70 | 21.3m to 21.6m | Access chamber for roof & area drains |
| 71 | 21.6m to 21.9m | Access chamber for roof & area drains |
| 72 | 21.9m to 22.2m | Access chamber for roof & area drains |
| 73 | 22.2m to 22.5m | Access chamber for roof & area drains |
| 74 | 22.5m to 22.8m | Access chamber for roof & area drains |
| 75 | 22.8m to 23.1m | Access chamber for roof & area drains |
| 76 | 23.1m to 23.4m | Access chamber for roof & area drains |
| 77 | 23.4m to 23.7m | Access chamber for roof & area drains |
| 78 | 23.7m to 24.0m | Access chamber for roof & area drains |
| 79 | 24.0m to 24.3m | Access chamber for roof & area drains |
| 80 | 24.3m to 24.6m | Access chamber for roof & area drains |
| 81 | 24.6m to 24.9m | Access chamber for roof & area drains |
| 82 | 24.9m to 25.2m | Access chamber for roof & area drains |
| 83 | 25.2m to 25.5m | Access chamber for roof & area drains |
| 84 | 25.5m to 25.8m | Access chamber for roof & area drains |
| 85 | 25.8m to 26.1m | Access chamber for roof & area drains |
| 86 | 26.1m to 26.4m | Access chamber for roof & area drains |
| 87 | 26.4m to 26.7m | Access chamber for roof & area drains |
| 88 | 26.7m to 27.0m | Access chamber for roof & area drains |
| 89 | 27.0m to 27.3m | Access chamber for roof & area drains |
| 90 | 27.3m to 27.6m | Access chamber for roof & area drains |
| 91 | 27.6m to 27.9m | Access chamber for roof & area drains |
| 92 | 27.9m to 28.2m | Access chamber for roof & area drains |
| 93 | 28.2m to 28.5m | Access chamber for roof & area drains |
| 94 | 28.5m to 28.8m | Access chamber for roof & area drains |
| 95 | 28.8m to 29.1m | Access chamber for roof & area drains |
| 96 | 29.1m to 29.4m | Access chamber for roof & area drains |
| 97 | 29.4m to 29.7m | Access chamber for roof & area drains |
| 98 | 29.7m to 30.0m | Access chamber for roof & area drains |
| 99 | 30.0m to 30.3m | Access chamber for roof & area drains |
| 100 | 30.3m to 30.6m | Access chamber for roof & area drains |
6. As an alternative to the construction of domestic drainage chambers deeper than 1.0m, the "Omega Non-entry Inspection Chamber", 500mm dia, polypropylene chamber to a maximum depth of 3.0m may be used subject to the approval of the local building inspector or the HWS Inspector.
 7. Cover levels indicated on the Drainage Schedules are nominal & may be adjusted to suit finished ground levels as necessary.
 8. Generally inspection chamber covers should be Grade D400 in trafficked areas Grade B125 in parking areas and occasional traffic and A15 in pedestrian only areas.
 9. Rainwater downpipes to be connected direct to drain using an appropriate adaptor & removable section of downpipe to permit rodding access.
 10. The positions of SVPs, sub stacks, WC outlets, back inlet gullies etc. & rainwater downpipes are to be accurately located from the house type working drawings.
 11. Generally FW drains are to be laid to falls of 1 in 40. SW drains are to be laid to falls of 1 in 60, both in 100mm diameter pipes. SW pipes are to be 100mm diameter when serving 2 dwellings or more. FW pipes are to be 150mm diameter when serving 10 dwellings or more unless stated otherwise, or where a schedule is provided.
 12. Gullies situated in areas accessible to wheeled vehicles to be of suitable construction for trafficked areas.
 13. Where land drain is identified on the Architect's details, connect into nearest SW system.
 14. This drawing should be read in conjunction with the Architect's and Structural Engineer's design drawings and specification.
 15. Site layout based on Carlton Design Partnership Site Layout, drawing number 100/04/SL, Revision 1, dated November 2016.
 16. Topographic Survey as per Site Line Site Survey, drawing number 300/2001A, dated February 2016.
 17. Architectural Details based on Carlton Design Partnership Site Layout, drawing number 100/04/SL, dated November 2016.
 18. This drawing should be read in conjunction with Foul Water Sewer Longitudinal Sections (BSO/E4462/211 & 212), Surface Water Sewer Longitudinal Sections (BSO/E4462/221 & 222), S104 Adoption Layout (BSO/E4462/401), FW & SW Manhole Schedules & S104 Construction Details (BSO/E4462/110 to 114), other Domestic Drainage Layouts, Domestic Drainage Construction Details (BSO/E4462/401 & 402), Surface Water Alternation Details (BSO/E4462/403 & 404) and Control Chamber Construction Details (BSO/E4462/405).
 19. Where backfilling is less than 1.0m for domestic drainage, backfilling to be accommodated with internal benching.
 20. ANY VARIANCE OR DISCREPANCY MUST BE REPORTED BACK TO RCP ENGINEERING BEFORE WORK BEGINS.

KEY

- Site Boundary
(Based on Carlton Design Partnership Site Layout, drawing number 100/04/SL, Revision 1, dated March 2017)
- Finished Floor Level & Garage Finished Floor Level
- Hydrobrake S1
- Private Surface Water Sewers
- Private Surface Water Rising Main
- Adaptable Foul Water Sewers
- Adaptable Foul Water Rising Main
- Private Surface Water Domestic Drainage
- Private Foul Water Domestic Drainage
- House connection via 300mm dia. shallow access chamber not more than 600mm deep
- Rodding Eye
- Road Gully and Connection
- Yard Gully and Connection
- X-Box Channel or similar
- Threshold drain
- Permeable Paving
- Fin Drain
- Cellular Storage
- Roof Protection Areas
(Refer to ACD True Reference Plan Drawing Number BDVS20440-03 received in .dwg format 22/11/2016 for details)
- Tree Protection Fencing
(Refer to ACD True Reference Plan Drawing Number BDVS20440-03 received in .dwg format 22/11/2016 for details)
- Extents of "No Dig" Concrete Slab Road & Footway Construction, Subject to Approval from Arborescens.
- Extents of 30-40mm No Fibre Stone to BS EN 1242 F8 Filler Material over "No Dig" Areas.
Subject to Approval from Arborescens.
- Knee Rail - Subject to External Works
- Indicative low level landscaping - Subject to Landscaping Information

CDM NOTES

1. **EXISTING SERVICES.** Depth of existing services must be determined prior to works commencing. The contractor is responsible for establishing underground services in accordance with HSE Guidance note HS (G3) 47. Any services which would be within the proposed construction layers must be lowered to below the sub-base.

SCALE BAR 1:200 at A1

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Rev.	Date	Details	By	Chkd	Appd
E	02.06.17	Trash screen added to outfall	SLW	KJ	TS
D	08.03.17	Personnel Doors removed from garages as per CDP's dwgs.	KJ	SLW	TS
C	07.03.17	Sheds & Bin locations updated to accord with External Works Layouts. Parking areas & swales revised. Issued for Tender	SLW	IDC	TS
B	17.02.17	Surface water drainage revised to accommodate swales	SLW	IDC	TS
		Notes added to outfall			
		S27 removed from scheme			

Client: DAVID WILSON HOMES WHERE QUALITY LIVES

Site:- Hook Lane Westergate West Sussex

Drawing Title:- DOMESTIC DRAINAGE LAYOUT

SHEET 2 OF 4

Date: January 2017 Scales: 1:200 at A1

Drawn: AC Checked: TRS Approved: TRS

Drawing No. BSO/E4462/452 E

TENDER ISSUE

SUBJECT TO ADOPTING AUTHORITY APPROVAL

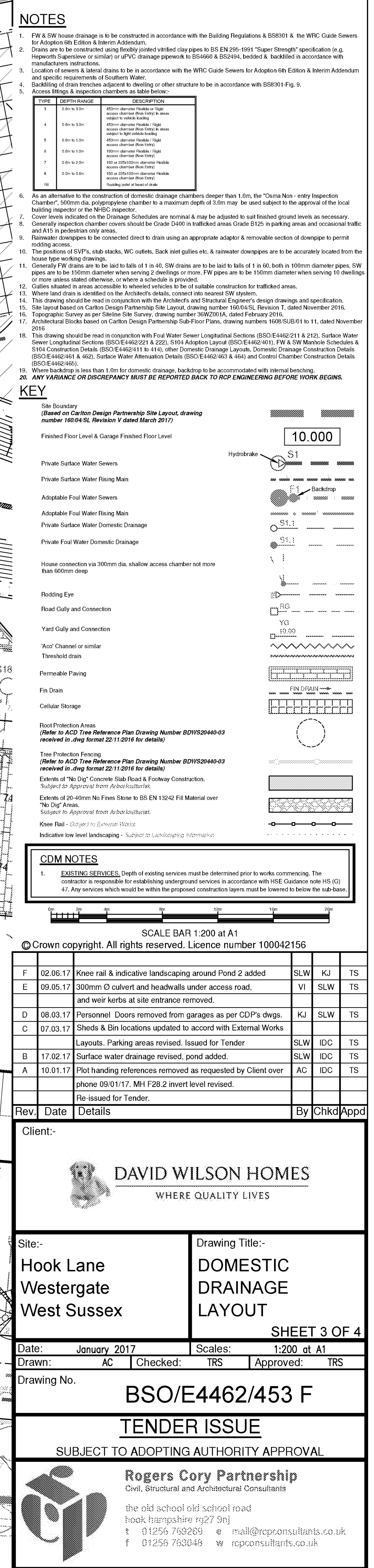
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Outlet pipe to be fitted with Trash screen

Outgoing 225mm dia outfall pipe (i.e. 19maod) located within northern part of ditch. Pipe clearance works required circa 18m downstream of outfall. requires Council to serve notice under Land Drainage Act 1991



APPENDIX (2)

SURFACE WATER CALCULATIONS

Rogers Cory Partnership		Page 1
The Old School Old School Road Hook Hampshire RG27 9NJ	Hook Lane Westergate West Sussex	
Date 02/06/2017 16:05 File 4462-SW2 - slw review.mdx	Designed by SLW Checked by TS	
Micro Drainage	Network 2014.1.1	

Existing Network Details for 4462-SW2A.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	62.242	0.417	149.3	0.129	5.00	0.0	0.600	o	225
1.001	9.519	0.259	36.8	0.119	0.00	0.0	0.600	o	225
2.000	5.152	0.118	43.7	0.012	5.00	0.0	0.600	o	150
2.001	19.712	0.384	51.3	0.000	0.00	0.0	0.600	o	150
3.000	10.972	0.115	95.4	0.040	5.00	0.0	0.600	o	150
3.001	24.027	0.202	118.9	0.064	0.00	0.0	0.600	o	225
2.002	46.170	0.156	296.0	0.070	0.00	0.0	0.600	o	225
4.000	23.063	0.675	34.2	0.061	5.00	0.0	0.600	o	150
1.002	54.451	0.176	309.4	0.089	0.00	0.0	0.600	o	375
5.000	28.633	0.412	69.5	0.086	5.00	0.0	0.600	o	225
5.001	18.791	0.303	62.0	0.059	0.00	0.0	0.600	o	225
6.000	15.345	0.077	200.0	0.000	5.00	0.0	0.600	o	150
5.002	7.018	0.098	71.6	0.000	0.00	0.0	0.600	o	150
7.000	17.122	0.098	174.7	0.000	5.00	0.0	0.600	o	225
7.001	18.355	0.062	296.0	0.000	0.00	0.0	0.600	o	225
7.002	14.494	0.049	296.5	0.034	0.00	0.0	0.600	o	225
7.003	14.976	0.051	296.5	0.022	0.00	0.0	0.600	o	225

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	8.102	0.129	0.0	1.07	42.5
1.001	8.685	0.248	0.0	2.16	86.1
2.000	9.159	0.012	0.0	1.53	27.0
2.001	9.041	0.012	0.0	1.41	24.9
3.000	8.974	0.040	0.0	1.03	18.2
3.001	8.859	0.104	0.0	1.20	47.6
2.002	8.582	0.186	0.0	0.75	30.0
4.000	9.226	0.061	0.0	1.73	30.5
1.002	8.276	0.584	0.0	1.02	113.2
5.000	9.133	0.086	0.0	1.57	62.5
5.001	8.726	0.145	0.0	1.66	66.1
6.000	7.150	0.000	0.0	0.71	12.5
5.002	7.073	0.145	0.0	1.19	21.0
7.000	8.810	0.000	0.0	0.99	39.2
7.001	8.712	0.000	0.0	0.75	30.0
7.002	8.650	0.034	0.0	0.75	30.0
7.003	8.601	0.056	0.0	0.75	30.0

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Existing Network Details for 4462-SW2A.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
7.004	48.501	0.114	427.1	0.059	0.00	0.0	0.600	o	225
7.005	5.949	0.014	427.1	0.036	0.00	0.0	0.600	o	225
7.006	4.402	0.010	427.1	0.016	0.00	0.0	0.600	o	225
7.007	37.370	0.087	427.1	0.058	0.00	0.0	0.600	o	300
1.003	14.331	0.029	500.0	0.035	0.00	0.0	0.600	o	450
1.004	31.931	0.064	498.9	0.065	0.00	0.0	0.600	o	450
8.000	9.581	0.093	103.0	0.024	5.00	0.0	0.600	o	150
8.001	10.256	0.059	174.8	0.048	0.00	0.0	0.600	o	150
8.002	42.619	0.144	296.9	0.045	0.00	0.0	0.600	o	225
8.003	7.645	0.026	296.9	0.000	0.00	0.0	0.600	o	225
8.004	6.882	0.239	28.8	0.000	0.00	0.0	0.600	o	225
1.005	32.855	0.066	500.0	0.023	0.00	0.0	0.600	o	525
1.006	7.738	0.015	515.9	0.073	0.00	0.0	0.600	o	525
1.007	8.726	0.009	1016.0	0.000	0.00	0.0	0.600	o	600
1.008	4.000	0.012	324.4	0.000	0.00	0.0	0.600	o	600

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
7.004	8.551	0.115	0.0	0.63	24.9
7.005	8.437	0.151	0.0	0.63	24.9
7.006	8.423	0.167	0.0	0.63	24.9
7.007	8.338	0.225	0.0	0.75	53.3
1.003	6.675	0.989	0.0	0.90	143.5
1.004	6.647	1.054	0.0	0.90	143.7
8.000	6.793	0.024	0.0	0.99	17.5
8.001	8.700	0.072	0.0	0.76	13.4
8.002	8.566	0.117	0.0	0.75	30.0
8.003	8.423	0.117	0.0	0.75	30.0
8.004	8.397	0.117	0.0	2.45	97.4
1.005	6.508	1.194	0.0	0.99	215.4
1.006	6.442	1.267	0.0	0.98	212.0
1.007	6.352	1.267	0.0	0.76	213.6
1.008	6.344	1.267	0.0	1.35	380.7

Free Flowing Outfall Details for 4462-SW2A.SWS

Outfall Pipe Number	Outfall C. Name	Level I. (m)	Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	1	9.282	6.331	0.000	0	0

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Simulation Criteria for 4462-SW2A.SWS

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha	Storage 2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	3	Number of Storage Structures	3
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for 4462-SW2A.SWS

Hydro-Brake Optimum® Manhole: 8, DS/PN: 1.003, Volume (m³): 12.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	6.675
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.7	0.800	9.6	2.000	10.0	4.000	13.9	7.000	18.1
0.200	8.3	1.000	9.0	2.200	10.5	4.500	14.7	7.500	18.7
0.300	9.2	1.200	7.9	2.400	10.9	5.000	15.4	8.000	19.3
0.400	9.6	1.400	8.5	2.600	11.3	5.500	16.2	8.500	19.9
0.500	9.8	1.600	9.0	3.000	12.1	6.000	16.8	9.000	20.5
0.600	9.8	1.800	9.5	3.500	13.0	6.500	17.5	9.500	21.0

Hydro-Brake Optimum® Manhole: 5, DS/PN: 1.006, Volume (m³): 13.0

Unit Reference	MD-SHE-0147-1080-1280-1080
Design Head (m)	1.280
Design Flow (l/s)	10.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	147
Invert Level (m)	6.442
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.280	10.8	Kick-Flo®	0.822	8.7
Flush-Flo™	0.378	10.8	Mean Flow over Head Range	-	9.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.3	0.600	10.4	1.600	12.0	2.600	15.1	5.000	20.6
0.200	10.1	0.800	9.1	1.800	12.7	3.000	16.1	5.500	21.6
0.300	10.7	1.000	9.6	2.000	13.3	3.500	17.4	6.000	22.5
0.400	10.8	1.200	10.4	2.200	13.9	4.000	18.5	6.500	23.4
0.500	10.6	1.400	11.2	2.400	14.5	4.500	19.6	7.000	24.2

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Hydro-Brake Optimum® Manhole: 5, DS/PN: 1.006, Volume (m³): 13.0

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
7.500	25.0	8.000	25.8	8.500	26.6	9.000	27.3	9.500	28.0

Depth/Flow Relationship Manhole: 4, DS/PN: 1.007, Volume (m³): 7.1

Invert Level (m) 6.427

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1700	0.700	6.1700	1.300	6.1700	1.900	6.1700	2.500	6.1700
0.200	6.1700	0.800	6.1700	1.400	6.1700	2.000	6.1700	2.600	6.1700
0.300	6.1700	0.900	6.1700	1.500	6.1700	2.100	6.1700	2.700	6.1700
0.400	6.1700	1.000	6.1700	1.600	6.1700	2.200	6.1700	2.800	6.1700
0.500	6.1700	1.100	6.1700	1.700	6.1700	2.300	6.1700	2.900	6.1700
0.600	6.1700	1.200	6.1700	1.800	6.1700	2.400	6.1700	3.000	6.1700

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Storage Structures for 4462-SW2A.SWS

Cellular Storage Manhole: 34, DS/PN: 6.000

Invert Level (m) 7.163 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	480.0	952.0	3.600	0.0	1050.8	7.200	0.0	1050.8
0.400	480.0	1001.4	4.000	0.0	1050.8	7.600	0.0	1050.8
0.800	480.0	1050.7	4.400	0.0	1050.8	8.000	0.0	1050.8
1.200	480.0	1050.8	4.800	0.0	1050.8	8.400	0.0	1050.8
1.201	0.0	1050.8	5.200	0.0	1050.8	8.800	0.0	1050.8
2.000	0.0	1050.8	5.600	0.0	1050.8	9.200	0.0	1050.8
2.001	0.0	1050.8	6.000	0.0	1050.8	9.600	0.0	1050.8
2.800	0.0	1050.8	6.400	0.0	1050.8	10.000	0.0	1050.8
3.200	0.0	1050.8	6.800	0.0	1050.8			

Tank or Pond Manhole: 8, DS/PN: 1.003

Invert Level (m) 8.462

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	173.0	1.000	398.0	1.300	1465.0

Complex Manhole: 5, DS/PN: 1.006

Cellular Storage

Invert Level (m) 7.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	250.0	100.0	3.600	0.0	148.0	7.200	0.0	148.0
0.400	250.0	116.0	4.000	0.0	148.0	7.600	0.0	148.0
0.800	250.0	132.0	4.400	0.0	148.0	8.000	0.0	148.0
0.801	0.0	148.0	4.800	0.0	148.0	8.400	0.0	148.0
1.201	0.0	148.0	5.200	0.0	148.0	8.800	0.0	148.0
1.600	0.0	148.0	5.600	0.0	148.0	9.200	0.0	148.0
1.601	0.0	148.0	6.000	0.0	148.0	9.600	0.0	148.0
2.800	0.0	148.0	6.400	0.0	148.0	10.000	0.0	148.0
3.200	0.0	148.0	6.800	0.0	148.0			

Tank or Pond

Invert Level (m) 8.200

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	216.0	0.750	355.0	0.751	0.0

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4462-SW2A.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,
 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	0/F Act.	Lvl Exc.
1.000	15 Winter	1	0%	30/15 Summer				
1.001	15 Winter	1	0%	30/15 Summer				
2.000	15 Winter	1	0%	100/15 Summer				
2.001	15 Winter	1	0%	30/15 Summer				
3.000	15 Winter	1	0%	30/15 Summer				
3.001	15 Winter	1	0%	30/15 Summer				
2.002	15 Winter	1	0%	30/15 Summer				
4.000	15 Winter	1	0%	100/15 Summer				
1.002	15 Winter	1	0%	30/15 Summer				
5.000	15 Winter	1	0%	100/15 Winter				
5.001	15 Winter	1	0%	100/15 Summer				
6.000	240 Winter	1	0%	1/60 Summer				
5.002	15 Winter	1	0%	1/15 Summer				
7.000	360 Winter	1	0%	100/15 Summer				
7.001	15 Winter	1	0%	100/15 Summer				
7.002	15 Winter	1	0%	30/15 Summer				
7.003	15 Winter	1	0%	30/15 Summer				
7.004	15 Winter	1	0%	30/15 Summer				
7.005	15 Winter	1	0%	30/15 Summer				
7.006	15 Winter	1	0%	30/15 Summer				
7.007	15 Winter	1	0%	30/15 Summer				
1.003	15 Winter	1	0%	1/15 Summer				
1.004	120 Winter	1	0%	1/15 Winter				
8.000	15 Winter	1	0%	30/15 Summer				
8.001	15 Winter	1	0%	30/15 Summer				
8.002	15 Winter	1	0%	30/15 Summer				
8.003	15 Winter	1	0%	30/15 Summer				
8.004	15 Winter	1	0%					
1.005	120 Winter	1	0%	1/15 Summer				
1.006	120 Winter	1	0%	1/15 Summer				
1.007	120 Winter	1	0%	1/15 Winter				
1.008	15 Summer	1	0%					

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4462-SW2A.SWS

PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap.	0'flow (l/s)	Pipe Flow (l/s)	Status
1.000	11	9.201	-0.126	0.000	0.38	0.0	15.5	OK
1.001	10	8.783	-0.127	0.000	0.39	0.0	28.0	OK
2.000	14	9.185	-0.124	0.000	0.07	0.0	1.5	OK
2.001	13	9.066	-0.125	0.000	0.06	0.0	1.5	OK
3.000	16	9.031	-0.093	0.000	0.31	0.0	5.0	OK
3.001	15	8.939	-0.145	0.000	0.27	0.0	11.8	OK
2.002	12	8.724	-0.083	0.000	0.70	0.0	20.0	OK
4.000	28	9.279	-0.097	0.000	0.26	0.0	7.7	OK
1.002	9	8.540	-0.111	0.000	0.56	0.0	59.0	OK
5.000	19	9.204	-0.159	0.000	0.18	0.0	10.7	OK
5.001	18	8.809	-0.142	0.000	0.29	0.0	17.0	OK
6.000	34	7.390	0.090	0.000	0.53	0.0	6.2	SURCHARGED
5.002	17	8.262	1.039	0.000	0.33	0.0	5.8	SURCHARGED
7.000	27	8.810	-0.225	0.000	0.00	0.0	0.0	OK
7.001	26	8.712	-0.225	0.000	0.00	0.0	0.0	OK
7.002	25	8.713	-0.162	0.000	0.13	0.0	3.5	OK
7.003	24	8.686	-0.140	0.000	0.22	0.0	5.7	OK
7.004	23	8.663	-0.113	0.000	0.47	0.0	11.3	OK
7.005	22	8.571	-0.091	0.000	0.63	0.0	14.3	OK
7.006	21	8.553	-0.095	0.000	0.63	0.0	15.6	OK
7.007	20	8.532	-0.106	0.000	0.40	0.0	19.8	OK
1.003	8	8.513	1.388	0.000	0.11	0.0	9.6	SURCHARGED
1.004	7	7.582	0.485	0.000	0.10	0.0	12.5	SURCHARGED
8.000	33	8.838	-0.105	0.000	0.19	0.0	3.0	OK
8.001	32	8.792	-0.058	0.000	0.68	0.0	8.1	OK
8.002	31	8.673	-0.119	0.000	0.44	0.0	12.5	OK
8.003	30	8.538	-0.110	0.000	0.52	0.0	12.3	OK
8.004	29	8.461	-0.161	0.000	0.18	0.0	12.3	OK
1.005	6	7.580	0.547	0.000	0.10	0.0	18.6	SURCHARGED
1.006	5	7.579	0.611	0.000	0.08	0.0	10.0	SURCHARGED
1.007	4	7.448	0.496	0.000	0.04	0.0	6.2	SURCHARGED
1.008	3	6.410	-0.534	0.000	0.03	0.0	6.2	OK

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4462-SW2A.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,
 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	0/F Act.	Lvl Exc.
1.000	15 Winter	30	0%	30/15 Summer				
1.001	15 Winter	30	0%	30/15 Summer				
2.000	15 Winter	30	0%	100/15 Summer				
2.001	15 Winter	30	0%	30/15 Summer				
3.000	15 Winter	30	0%	30/15 Summer				
3.001	15 Winter	30	0%	30/15 Summer				
2.002	15 Winter	30	0%	30/15 Summer				
4.000	15 Winter	30	0%	100/15 Summer				
1.002	15 Winter	30	0%	30/15 Summer				
5.000	15 Winter	30	0%	100/15 Winter				
5.001	15 Winter	30	0%	100/15 Summer				
6.000	600 Winter	30	0%	1/60 Summer				
5.002	30 Winter	30	0%	1/15 Summer				
7.000	15 Winter	30	0%	100/15 Summer				
7.001	15 Winter	30	0%	100/15 Summer				
7.002	15 Winter	30	0%	30/15 Summer				
7.003	15 Winter	30	0%	30/15 Summer				
7.004	15 Winter	30	0%	30/15 Summer				
7.005	30 Winter	30	0%	30/15 Summer				
7.006	30 Winter	30	0%	30/15 Summer				
7.007	30 Winter	30	0%	30/15 Summer				
1.003	30 Winter	30	0%	1/15 Summer				
1.004	180 Winter	30	0%	1/15 Winter				
8.000	15 Winter	30	0%	30/15 Summer				
8.001	15 Winter	30	0%	30/15 Summer				
8.002	15 Winter	30	0%	30/15 Summer				
8.003	15 Winter	30	0%	30/15 Summer				
8.004	15 Winter	30	0%					
1.005	180 Winter	30	0%	1/15 Summer				
1.006	180 Winter	30	0%	1/15 Summer				

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The Old School Old School Road Hook Hampshire RG27 9NJ	Hook Lane Westergate West Sussex	
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Micro Drainage	Network 2014.1.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4462-SW2A.SWS

PN	Storm	Return Period	Climate Change	First X Surge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.007	180 Winter	30	0%	1/15 Winter				
1.008	15 Summer	30	0%					

PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	11	9.392	0.065	0.000	0.85	0.0	34.7	SURCHARGED
1.001	10	9.100	0.190	0.000	0.83	0.0	59.3	SURCHARGED
2.000	14	9.243	-0.066	0.000	0.17	0.0	3.7	OK
2.001	13	9.238	0.047	0.000	0.22	0.0	5.3	SURCHARGED
3.000	16	9.323	0.199	0.000	0.60	0.0	9.9	SURCHARGED
3.001	15	9.290	0.206	0.000	0.58	0.0	25.4	SURCHARGED
2.002	12	9.230	0.423	0.000	1.38	0.0	39.5	SURCHARGED
4.000	28	9.315	-0.061	0.000	0.65	0.0	18.8	OK
1.002	9	8.931	0.280	0.000	1.27	0.0	133.9	SURCHARGED
5.000	19	9.245	-0.118	0.000	0.45	0.0	26.2	OK
5.001	18	8.876	-0.075	0.000	0.76	0.0	45.2	OK
6.000	34	7.813	0.513	0.000	0.54	0.0	6.3	SURCHARGED
5.002	17	8.588	1.365	0.000	0.21	0.0	3.7	SURCHARGED
7.000	27	8.927	-0.108	0.000	0.01	0.0	0.5	OK
7.001	26	8.929	-0.008	0.000	0.08	0.0	2.1	OK
7.002	25	8.955	0.080	0.000	0.26	0.0	6.8	SURCHARGED
7.003	24	8.954	0.128	0.000	0.38	0.0	10.1	SURCHARGED
7.004	23	8.941	0.165	0.000	1.02	0.0	24.3	SURCHARGED
7.005	22	8.872	0.210	0.000	1.19	0.0	27.0	SURCHARGED
7.006	21	8.866	0.218	0.000	1.19	0.0	29.4	SURCHARGED
7.007	20	8.860	0.222	0.000	0.83	0.0	41.2	SURCHARGED
1.003	8	8.845	1.720	0.000	0.12	0.0	9.8	SURCHARGED
1.004	7	7.906	0.809	0.000	0.12	0.0	14.7	SURCHARGED
8.000	33	9.051	0.108	0.000	0.49	0.0	7.6	SURCHARGED
8.001	32	9.027	0.177	0.000	1.72	0.0	20.5	SURCHARGED
8.002	31	8.856	0.065	0.000	1.13	0.0	32.3	SURCHARGED
8.003	30	8.864	0.017	0.000	1.36	0.0	32.5	SURCHARGED
8.004	29	8.505	-0.117	0.000	0.47	0.0	32.4	OK
1.005	6	7.902	0.869	0.000	0.14	0.0	25.7	SURCHARGED
1.006	5	7.901	0.933	0.000	0.07	0.0	8.6	SURCHARGED
1.007	4	7.770	0.818	0.000	0.04	0.0	6.2	SURCHARGED
1.008	3	6.410	-0.534	0.000	0.03	0.0	6.2	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4462-SW2A.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status OFF

Inertia Status OFF

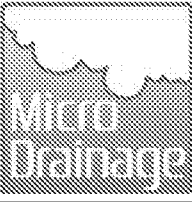
Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,
1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	0/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%	30/15 Summer				
1.001	15 Winter	100	+30%	30/15 Summer				
2.000	15 Winter	100	+30%	100/15 Summer				
2.001	15 Winter	100	+30%	30/15 Summer				
3.000	15 Winter	100	+30%	30/15 Summer				
3.001	15 Winter	100	+30%	30/15 Summer				
2.002	15 Winter	100	+30%	30/15 Summer				
4.000	15 Winter	100	+30%	100/15 Summer				
1.002	30 Winter	100	+30%	30/15 Summer				
5.000	15 Winter	100	+30%	100/15 Winter				
5.001	15 Winter	100	+30%	100/15 Summer				
6.000	720 Winter	100	+30%	1/60 Summer				
5.002	30 Winter	100	+30%	1/15 Summer				
7.000	15 Winter	100	+30%	100/15 Summer				
7.001	15 Winter	100	+30%	100/15 Summer				
7.002	15 Winter	100	+30%	30/15 Summer				
7.003	15 Winter	100	+30%	30/15 Summer				
7.004	15 Winter	100	+30%	30/15 Summer				
7.005	30 Winter	100	+30%	30/15 Summer				
7.006	60 Winter	100	+30%	30/15 Summer				
7.007	60 Winter	100	+30%	30/15 Summer				
1.003	60 Winter	100	+30%	1/15 Summer				
1.004	360 Winter	100	+30%	1/15 Winter				
8.000	15 Winter	100	+30%	30/15 Summer				
8.001	15 Winter	100	+30%	30/15 Summer				
8.002	15 Winter	100	+30%	30/15 Summer				
8.003	15 Winter	100	+30%	30/15 Summer				
8.004	15 Winter	100	+30%					
1.005	360 Winter	100	+30%	1/15 Summer				
1.006	360 Winter	100	+30%	1/15 Summer				

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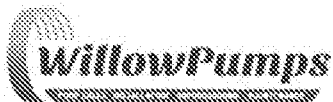
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4462-SW2A.SWS

PN	Storm	Return Period	Climate Change	First X Surge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.007	360 Winter	100	+30%	1/15 Winter				
1.008	15 Summer	100	+30%					

PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	11	10.501	1.174	0.000	1.23	0.0	50.5	FLOOD RISK
1.001	10	9.855	0.945	0.000	1.30	0.0	92.5	FLOOD RISK
2.000	14	9.983	0.674	0.000	0.25	0.0	5.4	SURCHARGED
2.001	13	9.979	0.788	0.000	0.41	0.0	9.6	SURCHARGED
3.000	16	10.182	1.058	0.000	0.89	0.0	14.5	FLOOD RISK
3.001	15	10.095	1.011	0.000	0.78	0.0	34.0	FLOOD RISK
2.002	12	9.978	1.171	0.000	1.86	0.0	53.3	FLOOD RISK
4.000	28	9.883	0.507	0.000	0.83	0.0	23.9	SURCHARGED
1.002	9	9.428	0.777	0.000	1.88	0.0	177.2	SURCHARGED
5.000	19	9.363	0.000	0.000	0.73	0.0	42.5	SURCHARGED
5.001	18	9.181	0.210	0.000	1.12	0.0	66.6	SURCHARGED
6.000	34	8.343	1.043	0.000	0.37	0.0	4.2	SURCHARGED
5.002	17	8.918	1.695	0.000	0.26	0.0	4.6	SURCHARGED
7.000	27	9.569	0.534	0.000	0.05	0.0	1.8	SURCHARGED
7.001	26	9.570	0.633	0.000	0.13	0.0	3.5	SURCHARGED
7.002	25	9.585	0.710	0.000	0.44	0.0	11.5	SURCHARGED
7.003	24	9.572	0.746	0.000	0.68	0.0	18.0	SURCHARGED
7.004	23	9.546	0.770	0.000	1.50	0.0	35.8	SURCHARGED
7.005	22	9.288	0.626	0.000	1.91	0.0	43.3	SURCHARGED
7.006	21	9.256	0.608	0.000	1.46	0.0	36.0	SURCHARGED
7.007	20	9.250	0.612	0.000	1.01	0.0	49.9	SURCHARGED
1.003	8	9.233	2.108	0.000	0.12	0.0	9.8	SURCHARGED
1.004	7	8.294	1.197	0.000	0.12	0.0	14.8	SURCHARGED
8.000	33	9.655	0.712	0.000	0.79	0.0	12.2	SURCHARGED
8.001	32	9.613	0.763	0.000	2.63	0.0	31.4	SURCHARGED
8.002	31	9.204	0.413	0.000	1.75	0.0	50.0	SURCHARGED
8.003	30	8.736	0.088	0.000	2.09	0.0	49.9	SURCHARGED
8.004	29	8.540	-0.082	0.000	0.72	0.0	49.5	OK
1.005	6	8.292	1.259	0.000	0.14	0.0	25.9	SURCHARGED
1.006	5	8.290	1.323	0.000	0.06	0.0	7.7	SURCHARGED
1.007	4	8.159	1.207	0.000	0.04	0.0	6.2	SURCHARGED
1.008	3	6.410	-0.534	0.000	0.03	0.0	6.2	OK

APPENDIX (3)

PUMP SUPPLIER – MAINTENANCE SCHEDULE



Unit 9 Lordswood Industrial Estate
Revenge Road, Lordswood, Chatham
Kent ME5 8UD

DATE:

SITE:

ENGINEER:

Pump Station Ref:

6 MONTHLY SERVICE SCHEDULE

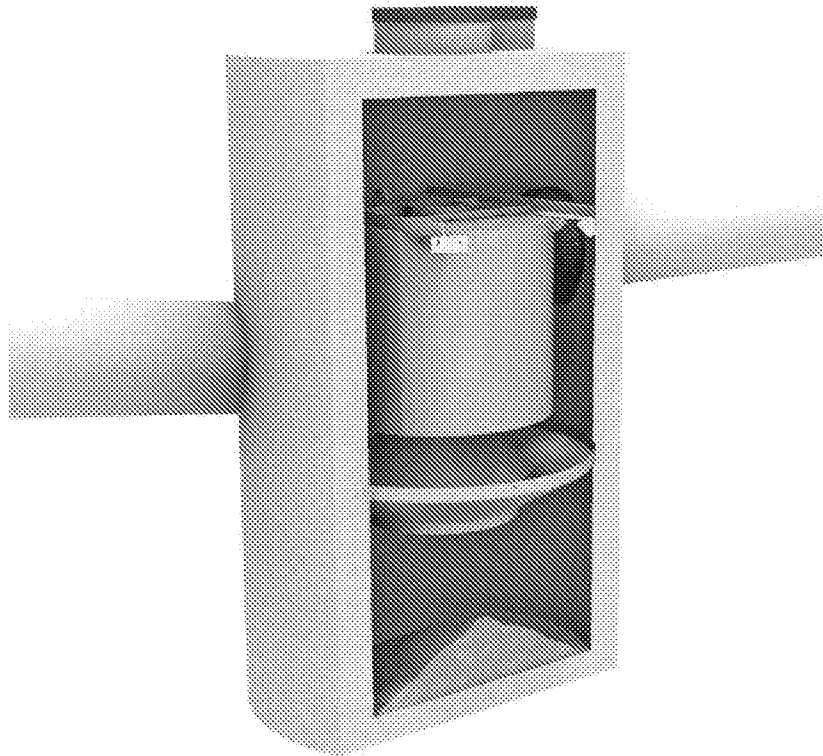
ACTION	PUMP 1		PUMP 2		PUMP 3	
	Pass	Fail	Pass	Fail	Pass	Fail
Pump Down On Manual						
Check Valve Operation						
Check Pipework For Leaks						
Check Control Panel						
Check Panel Bulbs						
Amp Meter Reading (Panel or Hand Meter)						
Hours Run						
Electricity Meter Reading						
Check Overloads & Fuses						
Check Condition of Motor Cables						
Megger Test Windings						
Condition Guide Rails/						
Check Lifting Chains/ Shackles/Lifting Gear						

	Checked	Pass	Fail	Status
Clean Floats/Ultrasonic Transducer				
Check Float/Ultrasonic Operation & Sequence				
Check High Level Alarm				
Condition of Wet Well/ Valve Chest				
Condition of Access Covers & Grease as Required				
Clean Wet Well (if water & power available)				
Advise if Tanker/ Jetter Required				
Check Heater & Lights				
Inspect Earthing System				
Condition of Kiosk				
Ensure System Reset and Left In Auto.				

PUMP DESCRIPTION	SERIAL NO.s
1	
2	
3	
4	
Notes:	
Client Signature:	Print:

APPENDIX (4)

DOWNSTREAM DEFENDER – MAINTENANCE MANUAL



Operation and Maintenance Manual

Downstream Defender®

Vortex Separator for Stormwater Treatment

Turning Water Around ...®

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Downstream Defender® by Hydro International

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- Applications

- Downstream Defender® Components

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- Pollutant Capture and Retention

- Wet Sump

- Blockage Protection

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Maintenance

- Overview

- Determining You Maintenance Schedule

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Maintenance Procedures

- Inspection

- Floatables and Sediment Cleanout

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Downstream Defender® Installation Log

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Downstream Defender® Inspection and Maintenance Log

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DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's Downstream Defender®. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc have a policy of continuous product development and reserve the right to amend specifications without notice.

Downstream Defender® by Hydro International

The Downstream Defender® is an advanced Hydrodynamic Vortex Separator designed to provide high removal efficiencies of settleable solids and their associated pollutants, oil, and floatables over a wide range of flow rates.

The Downstream Defender® has unique, flow-modifying internal components developed from extensive full-scale testing, CFD modeling and over thirty years of hydrodynamic separation experience in wastewater, combined sewer and stormwater applications. These internal components distinguish the Downstream Defender® from simple swirl-type devices and conventional oil/grit separators by minimizing turbulence and headlosses, enhancing separation, and preventing washout of previously stored pollutants.

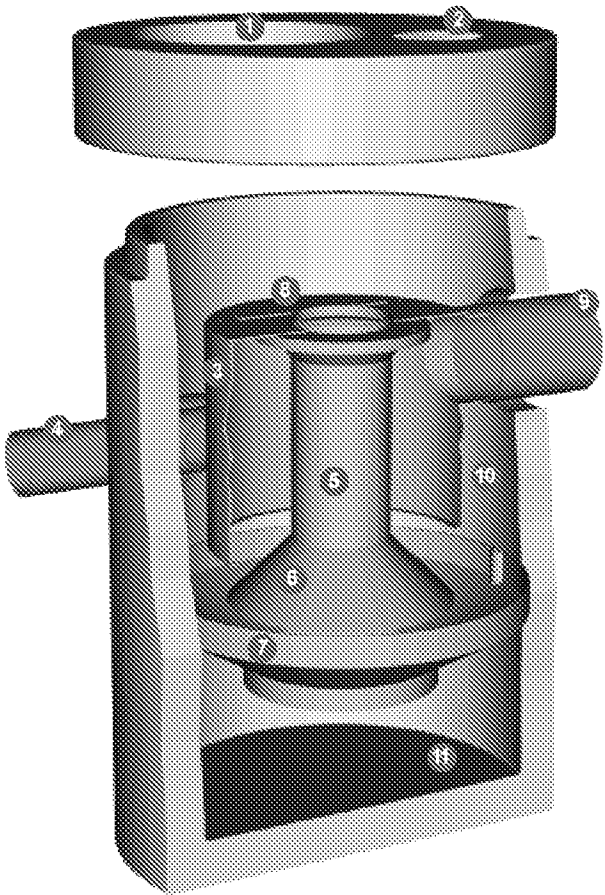
The high removal efficiencies and inherent low headlosses of the Downstream Defender® allow for a small footprint making it a compact and economical solution for the treatment of non-point source pollution.

Benefits of the Downstream Defender®

- Removes sediment, floatables, oil and grease
- No pollutant washouts
- Small footprint
- No loss of treatment capacity between clean-outs
- Low headloss
- Efficient over a wide ranges of flows
- Easy to install
- Low maintenance

Applications

- New developments and retrofits
- Utility yards
- Streets and roadways
- Parking lots
- Pre-treatment for filters, infiltration and storage
- Industrial and commercial facilities
- Wetlands protection



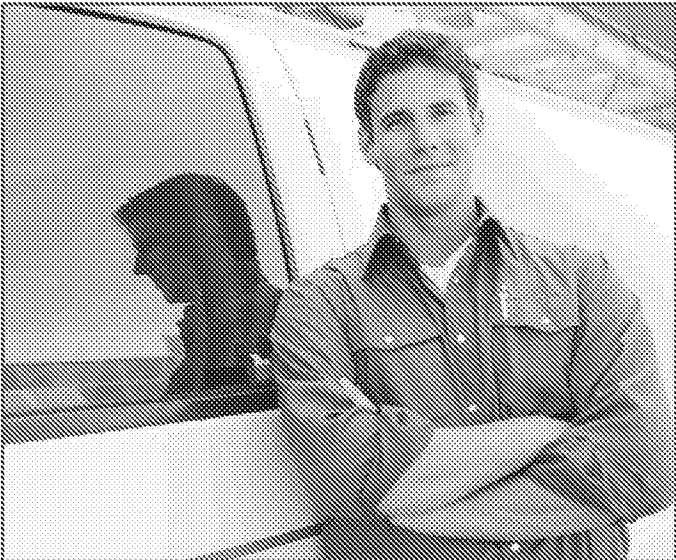
Downstream Defender® Components

1. Central Access Port
2. Floatables Access Port (6-ft., 8-ft. and 10-ft. models only)
3. Dip Plate
4. Tangential Inlet
5. Center Shaft
6. Center Cone
7. Benching Skirt
8. Floatables Lid
9. Outlet Pipe
10. Floatables Storage
11. Isolated Sediment Storage Zone

HYDRO MAINTENANCE SERVICES

Hydro International has been engineering stormwater treatment systems for over 30 years. We understand the mechanics of removing pollutants from stormwater and how to keep systems running at an optimal level.

NOBODY KNOWS OUR SYSTEMS BETTER THAN WE DO



AVOID SERVICE NEGLIGENCE

Sanitation services providers not intimately familiar with stormwater treatment systems are at risk of the following:

- Inadvertently breaking parts or failing to clean/replace system components appropriately.
- Charging you for more frequent maintenance because they lacked the tools to service your system properly in the first place.
- Billing you for replacement parts that might have been covered under your Hydro warranty plan
- Charging for maintenance that may not yet have been required.

LEAVE THE DIRTY WORK TO US

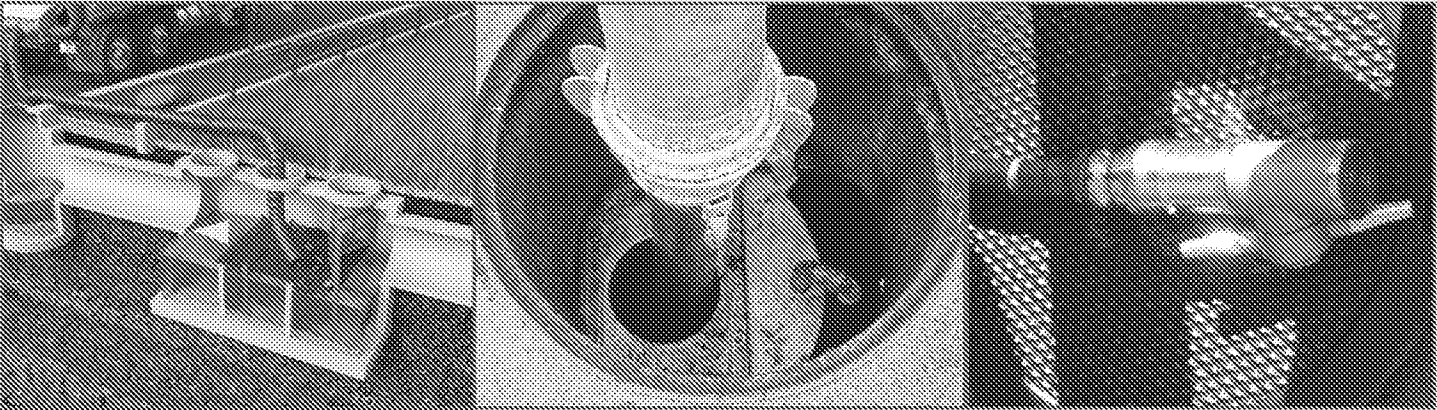
Trash, sediment and polluted water is stored inside treatment systems until they are removed by our team with a vacor truck. Sometimes teams must physically enter the system chambers in order to prepare the system for maintenance and install any replacement parts. Services include but are not limited to:

- Solids removal
- Removal of liquid pollutants
- Replacement media installation (when applicable)



BETTER TOOLS, BETTER RESULTS

Not all vacor trucks are created equal. Appropriate tools and suction power are needed to service stormwater systems appropriately. Companies who don't specialize in stormwater treatment won't have the tools to properly clean systems or install new parts.

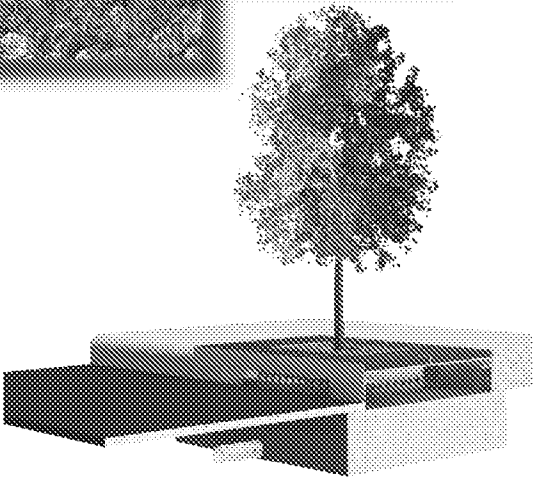
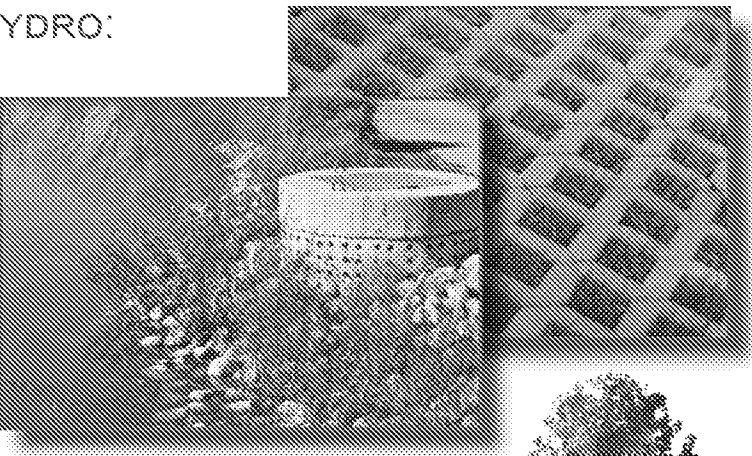
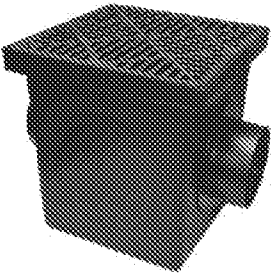


SERVICE WARRANTY

Make sure you're not paying for service that is covered under your warranty plan. Only Hydro International's service teams can identify tune-ups that should be on us, not you.

TREATMENT SYSTEMS SERVICED BY HYDRO:

- Stormwater filters
- Stormwater separators
- Baffle boxes
- Biofilters/biorention systems
- Storage structures
- Catch basins
- Stormwater ponds
- Permeable pavement



SAVE TIME & MONEY. CALL HYDRO FOR A QUOTE

1 (888) 382-7808

LEARN MORE AT HYDRO-INT.COM/SERVICE

Operation

Introduction

The Downstream Defender® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The Downstream Defender® has been designed to allow for easy and safe access for inspection/monitoring and clean-out procedures. Entry into the unit or removal of the internal components is not necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the Downstream Defender® have been designed to protect the oil, floatables and sediment storage volumes so that separator performance is not reduced as pollutants accumulate between clean-outs. Additionally, the Downstream Defender® is designed and installed into the storm drain system so that the vessel remains wet between storm events. Oil and floatables are stored on the water surface in the outer annulus separate from the sediment storage volume in the sump of the unit providing the option for separate oil disposal, and accessories such as adsorbant pads. Since the oil/floatables and sediment storage volumes are isolated from the active separation region, the potential for re-suspension and washout of stored pollutants between clean-outs is minimized.

Wet Sump

The sump of the Downstream Defender® retains a standing water level between storm events. The water in the sump prevents stored sediment from solidifying in the base of the unit. The clean-out procedure becomes more difficult and labor intensive if the system allows fine sediment to dry-out and consolidate. Dried sediment must be manually removed by maintenance crews. This is a labor intensive operation in a hazardous environment.

Blockage Protection

The Downstream Defender® has large clear openings and no internal restrictions or weirs, minimizing the risk of blockage and hydraulic losses. In addition to increasing the system headloss, orifices and internal weirs can increase the risk of blockage within the unit.

Maintenance

Overview

The Downstream Defender® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the Downstream Defender®. The Downstream Defender® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the Downstream Defender® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

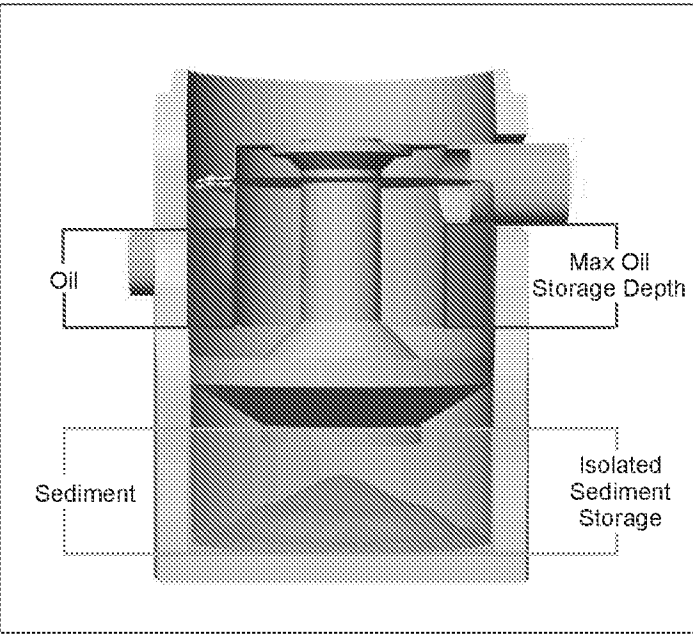


Fig.1 Pollutant storage volumes of the Downswtream Defender®.

The Downstream Defender® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole. On the 6-ft, 8-ft and 10-ft units, the floatables access port is above the outlet pipe between the concrete manhole wall and the dip plate. The sediment removal access ports for all Downstream Defender® models are located directly over the hollow center shaft.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the Downstream Defender®, nor do they require the internal components of the Downstream Defender® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Determining Your Maintenance Schedule

The frequency of cleanout is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil/floatables removal, for a 6-ft Downstream Defender® typically takes less than 30 minutes and removes a combined water/oil volume of about 500 gallons.

Inspection Procedures

Inspection is a simple process that does not involve entry into the Downstream Defender®. Maintenance crews should be familiar with the Downstream Defender® and its components prior to inspection.

Scheduling

- It is important to inspect your Downstream Defender® every six months during the first year of operation to determine your site-specific rate of pollutant accumulation
- Typically, inspection may be conducted during any season of the year
- Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1

Recommended Equipment

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge Judge®)
- Trash bag for removed floatables
- Downstream Defender® Maintenance Log

Table 1. Downstream Defender® Pollutant Storage Capacities and Max. Cleanout Depths.

Unit Diameter (feet)	Total Oil Storage (gallons)	Oil Clean-out Depth (inches)	Total Sediment Storage (gallons)	Sediment Clean-out Depth (inches)	Max. Liquid Volume Removed (gallons)
4	70	<16	141	<18	384
6	216	<23	424	<24	1,239
8	540	<33	939	<30	2,884
10	1,050	<42	1,757	<36	5,546
12	1,770	<49	2,970	<42	9,460

NOTES

1. Refer to Downstream Defender® Clean-out Detail (Fig. 1) for measurement of depths.
2. Oil accumulation is typically less than sediment, however, removal of oil and sediment during the same service is recommended.
3. Remove floatables first, then remove sediment storage volume.
4. Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.

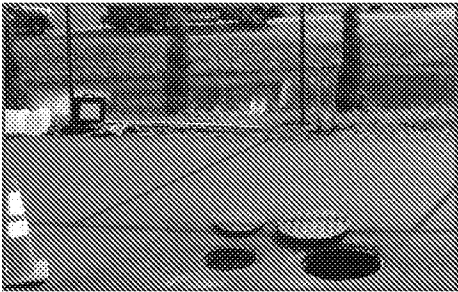


Fig. 4

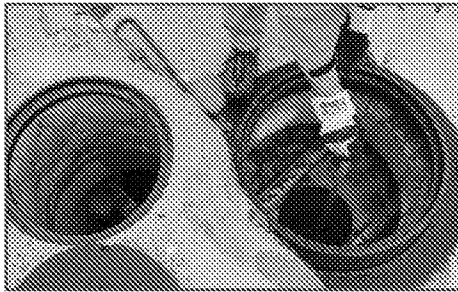


Fig. 5

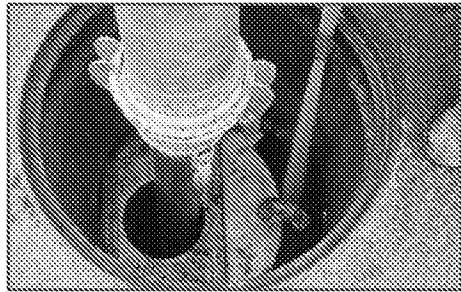


Fig. 6

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the lids to the manhole (Fig. 4). NOTE: The 4-ft Downstream Defender® will only have one lid.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. See Fig. 7 and 8 for typical inspection views.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the outer annulus of the chamber.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel (Fig. 5).
6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.



Fig. 7 View over center shaft into sediment storage zone.

7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Cleanout

Floatables cleanout is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig. 6).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump cleanout are typically conducted once a year during any season.
- If sediment depths are greater than 75% of maximum cleanout depths stated in Table 1, sediment removal is required.
- Floatables and sump cleanout should occur as soon as possible following a spill in the contributing drainage area.

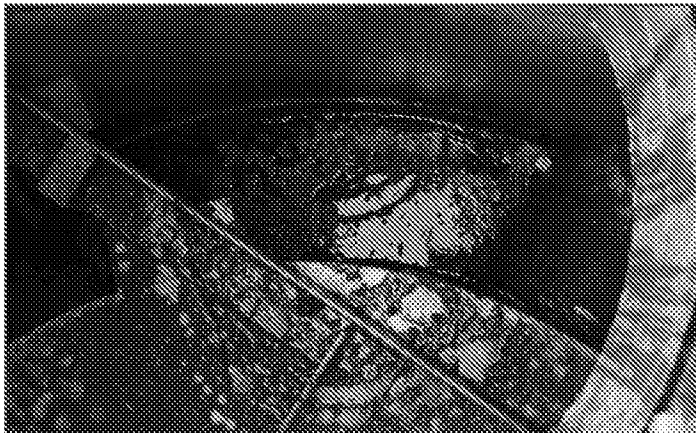


Fig. 8 View of outer annulus of floatables and oil collection zone.

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (6-inch flexible hose recommended)
- Downstream Defender® Maintenance Log

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the lids to the manhole (NOTE: The 4-ft Downstream Defender® will only have one lid).
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Using the Floatables Port for access, remove oil and floatables stored on the surface of the water with the vactor hose or the skimmer net (Fig. 9).
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (Pg. 9).
6. Once all floatables have been removed, drop the vactor hose to the base of the sump via the Central Access Port. Vactor out the sediment and gross debris off the sump floor (Fig. 6).

7. Retract the vactor hose from the vessel.
8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
9. Securely replace the grate or lid.

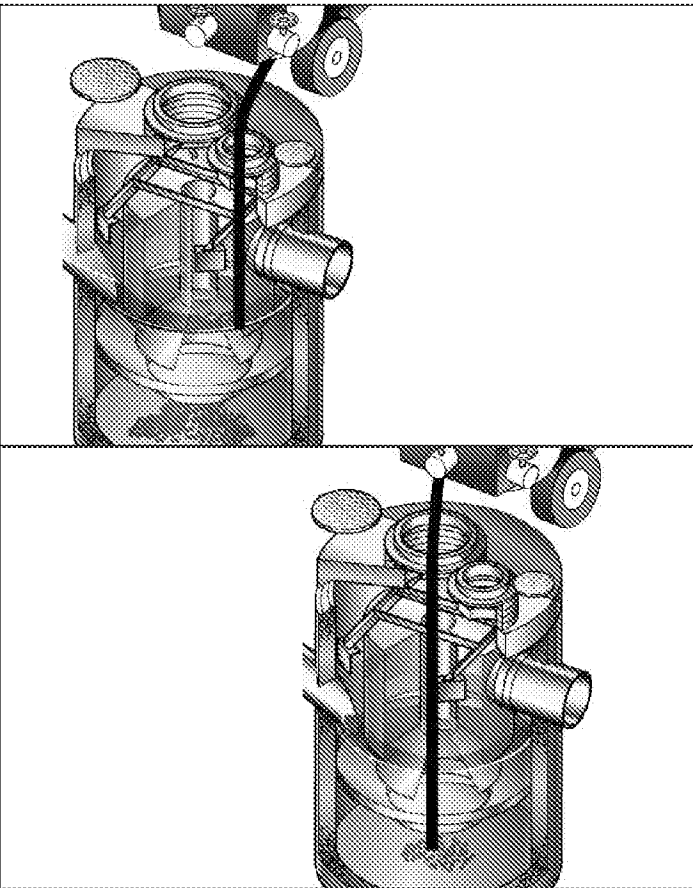


Fig. 9 Floatables and sediment are removed with a vactor hose

Maintenance at a Glance

Activity	Frequency
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most cleanouts it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils/floatables and the sediment storage volume is required.	



Downstream Defender® Inspection and Maintenance Log

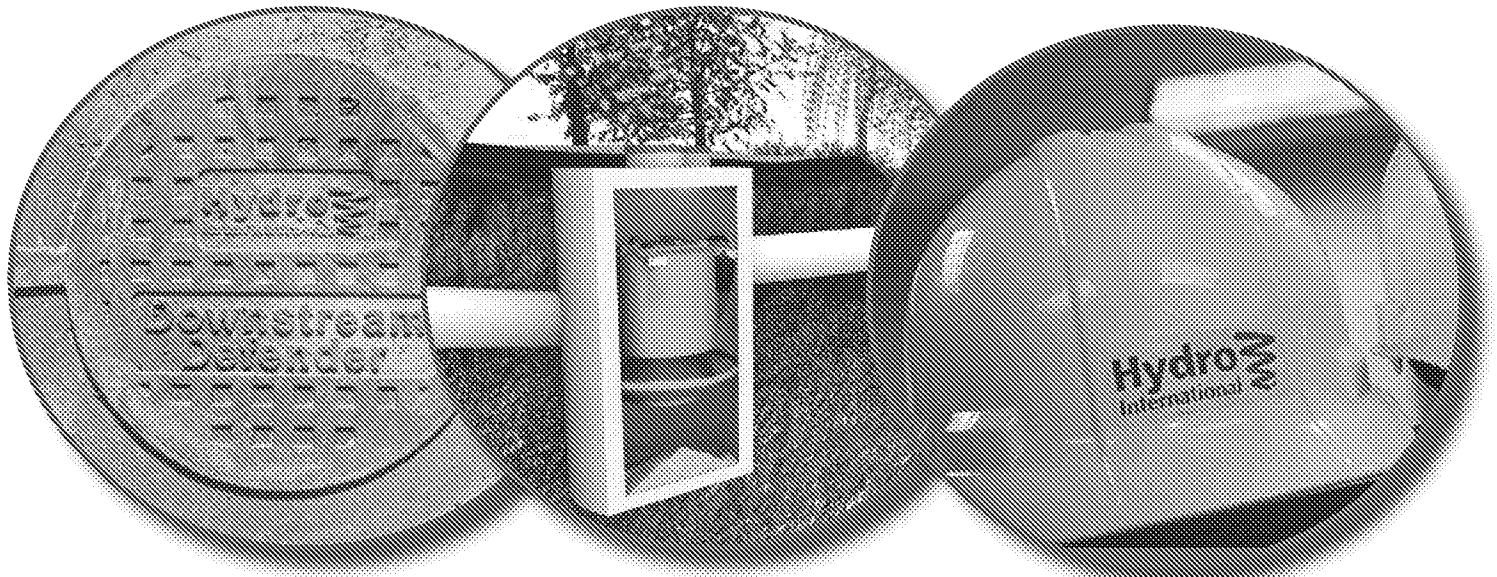
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*Note: Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.

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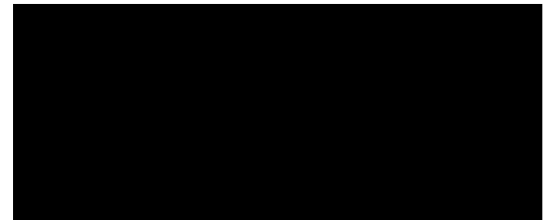
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