



**Surface Water Drainage Strategy**  
**Compound Area**  
**Nyn Park, Northaw, Hertfordshire**

**1.0 Introduction**

- 1.1 Amazi Consulting Ltd has been instructed by Bessington Investments Ltd to prepare this Surface Water Drainage Strategy associated with the proposed compound area at Nyn Park, Well Road, Northaw, Hertfordshire EN6 4BT.
- 1.2 This report has been prepared as part of the planning application documentation for development of Engineering works comprising ground works and shaping of land to create a golf course (used only in conjunction with the Nyn Park Estate dwelling house) and erection of an associated single storey maintenance building (Welwyn Hatfield Borough Council planning ref: 6/2020/0311/MAJ). This report focuses upon the surface water strategy for the 'single storey maintenance building' and its associated hard surfacing. This report is intended: to advise the developer of suitable surface water strategy, to comply with current local and national guidance, and for review by the Lead Local Flood Authority as consultees to the planning application.
- 1.3 This report has been prepared for the sole use of Bessington Investments Ltd and its contents cannot be copied or relied upon by others except as noted above, without the written authority of Amazi Consulting Ltd.

## 2 The site

- 2.1 The compound area is located within the Nyn Park estate as indicated on the attached drawing APL 18-007-01 P4.
- 2.2 The most recent survey data available is 2014 lidar data flown by BlueSky. More recently a site specific drone survey has been undertaken. Output from this survey is available as 3D AutoCAD contours which we have converted into an ASCII grid to produce a ground model of Nyn Park. The ground levels
- 2.3 The pre-development condition of the compound area is an unpaved yard, surfaced with permeable crushed stone, as evident on aerial mapping.
- 2.4 The proposed layout of the compound area is shown on attached drawing APL 18-007-17 P6. Further background information is available within the Agellus Projects Design and Access Statement ref: APL 18-007.
- 2.5 Figure 01 shows that the compound area is not at risk of flooding from surface water. Figure 02 shows the exiting area's ground levels which vary from 118.6 mAOD to 116.2 mAOD. Figure 03 shows that it is very near to the edge of a local topographical watershed, so there can be no notable surface runoff towards the compound area.



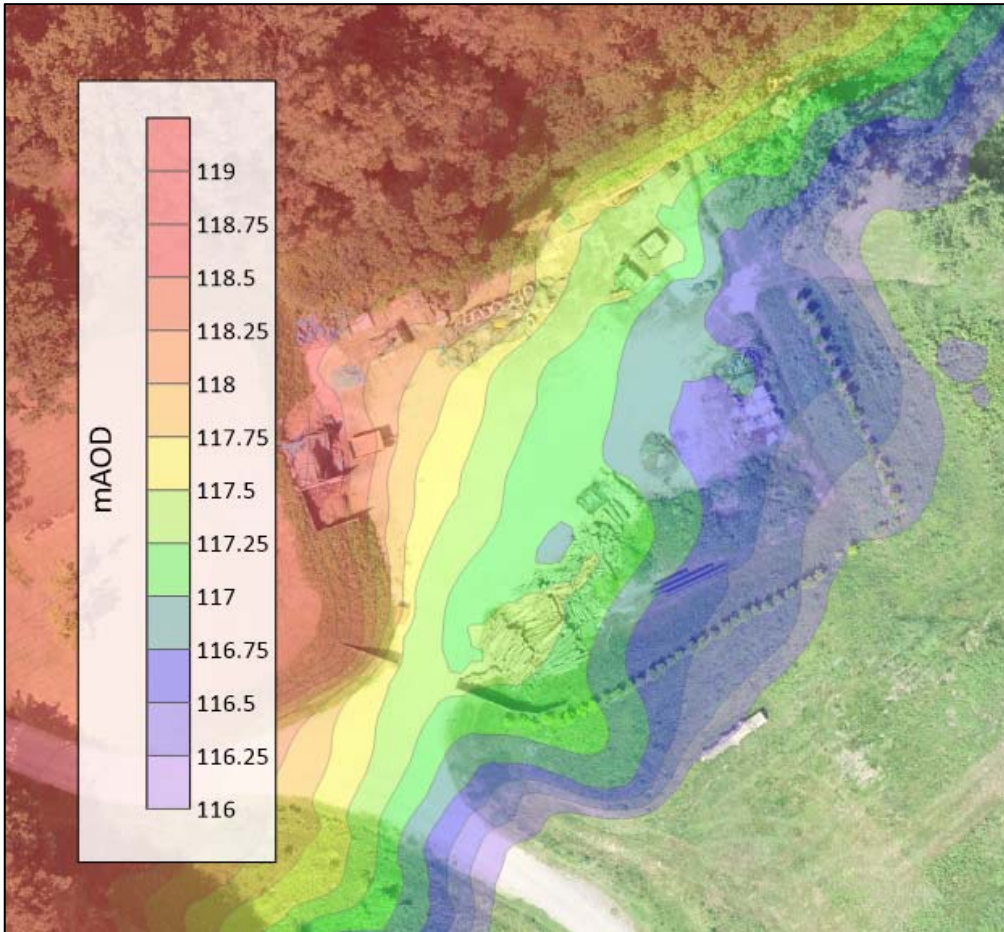
**Figure 01 - Risk of flooding form surface water – Compound Area**

**High** ⇒ 1:30 year return period

**Medium** ⇒ 1:100 year return period

**Low** ⇒ 1:1,000 year return period





**Figure 02 - Surveyed contours across existing compound area**



**Figure 03 - Watersheds**

Contours 2m c-c

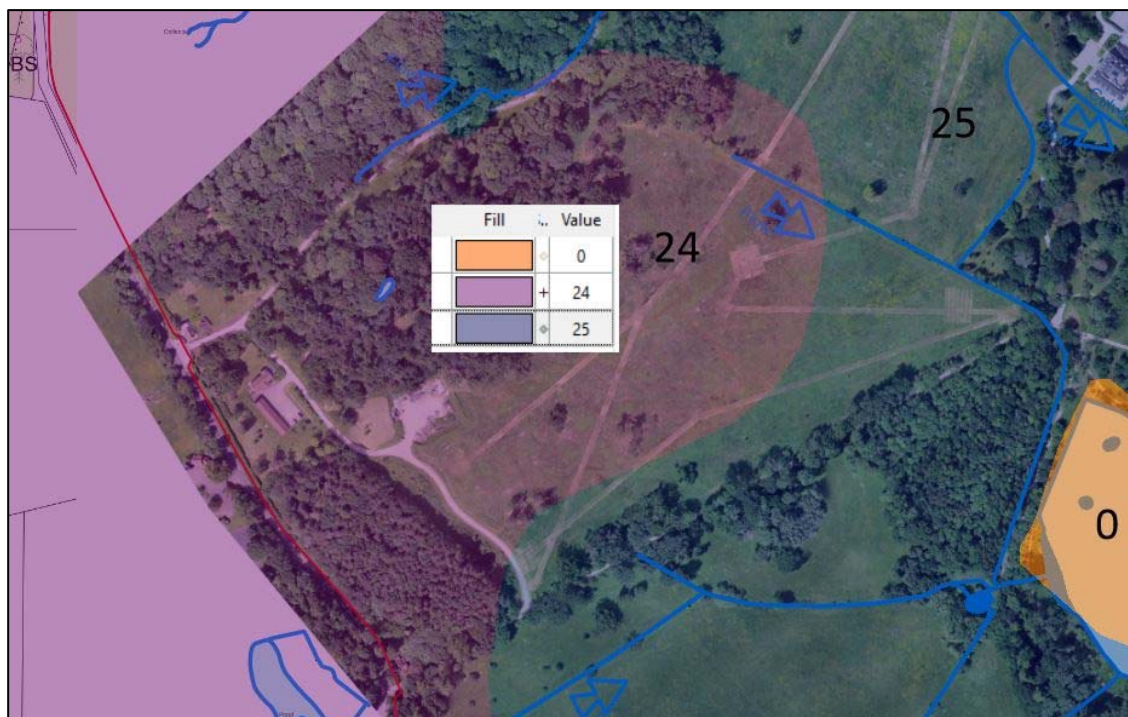
### 3 Existing Surface Water Drainage

3.1 The existing informal yard area is surfaced with permeable stone.

3.2 The existing site greenfield runoff rates have been calculated in accordance with the methodology in the Environment Agency/DEFRA report SC030219, *Rainfall runoff management for development*, 2013. Attached are calculations for the runoff rates per unit area. Soil conditions are known to be clayey. In order to be specific about the likely soil (SPR) value, we have prepared Figure 0. This confirms the soil HOST value to be class 24, i.e. an SPR value of 0.4. The Standard Average Annual Rainfall (SAAR) of 687 mm has been taken from the attached Flood Estimation Handbook (FEH) rainfall data.

**Table 01 – Existing Site Peak Runoff rates**

Area (ha)	0.207
Q 1 year (l/s)	0.6
Q bar (l/s)	0.7
Q 30 year (l/s)	1.6
Q 100 year (l/s)	2.2



**Figure 04 - HOST soil types**



#### 4 Proposed Surface Water Drainage

- 4.1 The design of the compound area drainage system has been undertaken by others. It comprises interception from hard surfaces, a petrol interceptor and an outfall pipe across to an existing watercourse system. The following sets out proposed surface water outfall design to ensure that the compound development does not increase flooding elsewhere.
- 4.2 The size of the site is fairly small and hence the 1:1 year return period existing greenfield runoff rate is only 0.6 l/s. This is too small to sensible restrict back to in the proposed scenario without a very small diameter orifice at eh outfall. This would run a risk flooding as a consequence of an impractically small diameter outfall. So it is proposed to use a peak outflow rate of 2.2 l/s to limit the risk of blockage.
- 4.3 A 40% allowance for future climate change has been applied in accordance with the Government's *Flood risk assessment: climate change allowances*, July 2020.
- 4.4 Infiltration drainage systems have not been utilised since there is evidence that the soils are clayey and infiltration rates will therefore not be adequate. Refer to section 3.2.4 of the accompanying Flood Risk Assessment report. The British Geological Survey's website indicates that the bedrock geology at the site is clay:



- 4.5 Calculations for the required attenuation system are attached and are summarised in Table 02.

**Table 02 - Proposed basin calculation summary**

1:100 + CC peak outflow (l/s)	2.2
1:100 + CC max storage volume (m <sup>3</sup> )	139
1:100 + CC peak depth (m)	0.71
1:2 year peak outflow (l/s)	2.0
1:2 max storage Volume (m <sup>3</sup> )	23.4
1:2 peak depth (m)	0.15

Storage type/ flow control"	Open attenuation basin Lined/no infiltration Orifice outflow control into adjacent watercourse
Minimum invert level (mAOD)	94.58 (crest 95.58)
Invert at flow control (mAOD)	94.57
Plan area (m <sup>2</sup> )	300 (crest) 144 (invert) (1:3 side slope)
Contributing impermeable area (ha)	0.207
Temporary above ground storage (m <sup>3</sup> )	

Subject to survey including: watercourse levels and trees.

- 4.6 The compound, its outfall pipe and attenuation system are all within the private land of Nyn Park with the same land owner. The responsibility for maintaining these systems will be with the land owner and the work will be undertaken by the Nyn Park site maintenance team. Refer to the attached Surface Water Maintenance Plan.
- 4.7 Surface water treatment is proposed in accordance with the simple index method outlined in Ciria report C753: The SuDS Manual, 2015. It is understood that there will be some plant/vehicles stored in the compound area for use in general maintenance of Nyn Pak and the golf course.
- 4.8 It is understood that the materials to be stored in the compound will be sand (which is used to dress the golf course grass) and there will be no rainfall runoff from any composing areas that enters the surface water drainage system. Waste grass material will enter skips and be deposited off site. Fuel storage is to be bunded and spill kits kept on site in case of spillage.
- 4.9 Table 7.2 summarises the proposed treatment for the site which complies with the CIRIA report C753, *The SuDS Manual*, Simple Index Approach. Table 03 summarises how this criterion may be met for the compound area.

**Table 03 Proposed runoff treatment – Roads and hardstandings**

Yard		Treatment Required <sup>1&amp;3</sup>	Proposed Treatment individual indices <sup>2</sup>			
Pollution Hazard <sup>1</sup>	Medium		Interceptor	Swale	Basin	Total
	Total suspended solids indices	<b>0.7</b>	Benefit not accountable	0.5	0.5	<b>0.75</b>
	Metals indices	<b>0.6</b>	Benefit not accountable	0.6	0.5	<b>0.85</b>
	Hydrocarbons indices	<b>0.7</b>	Benefit not accountable	0.6	0.6	<b>0.9</b>

Notes:

1 - C753 table 26.2

2 - C753 table 26.3

3 – Confirmation should be sought on the exact type of vehicles and use of the compound area so that the required indices can be confirmed.

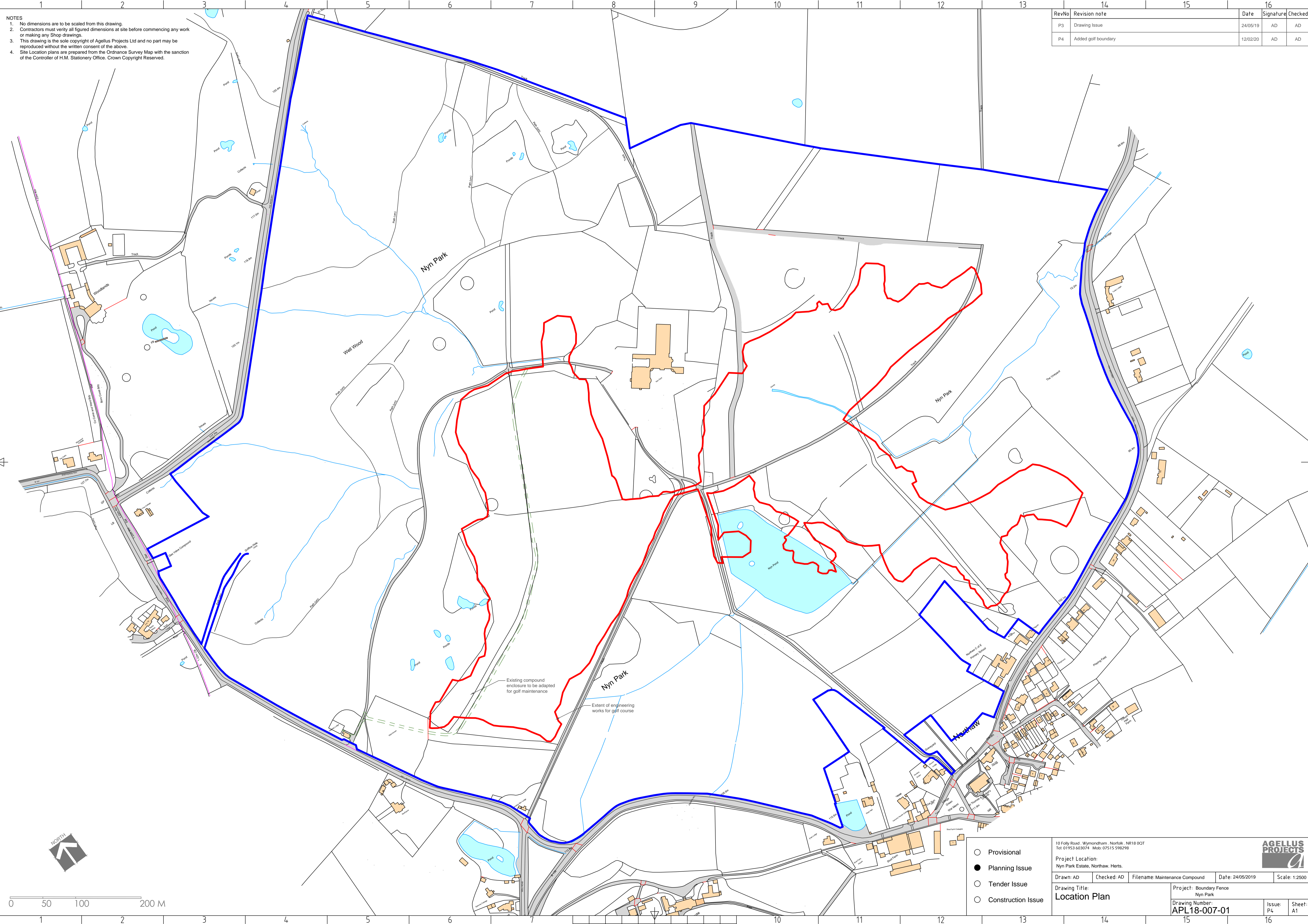
- 4.10 The lower, south end of the compound will be bounded by a concrete wall and a raised earth bund. Therefore any exceedance runoff within the compound will remain in the compound area and make its way into the gulley/interception systems rather than flow overland in an uncontrolled manner.

Prepared by Leigh Parratt  
BEng (Hons) CEng MICE CWEM MCIWEM PCHEP FHEA

#### **Attachments**

- APL 18-007-01 P4 Location Plan
- APL 18-007-17 P6 Proposed Site Plan
- FEH data
- Greenfield runoff rates
- Attenuation calculations : AMA809\_Compound\_01.iddx
- Surface Water Maintenance Plan





NOTES  
 1. No dimensions are to be scaled from this drawing.  
 2. Contractors must verify all figured dimensions at site before commencing any work or making any Shop drawings.  
 3. This drawing is the sole copyright of Agellus Projects Ltd and no part may be reproduced without the written consent of the above.  
 4. Site Location plans are prepared from the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown Copyright Reserved.

RevNo	Revision note	Date	Signature	Checked
P3	Drawing Issue	24/05/19	AD	AD
P4	Added golf boundary	12/02/20	AD	AD

- Provisional
- Planning Issue
- Tender Issue
- Construction Issue

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**AGELLUS PROJECTS**

Project Location:  
 Nyn Park Estate, Northaw, Herts.

Drawn: AD	Checked: AD	Filename: Maintenance Compound	Date: 24/05/2019	Scale: 1:2500
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Drawing Title:  
**Location Plan**

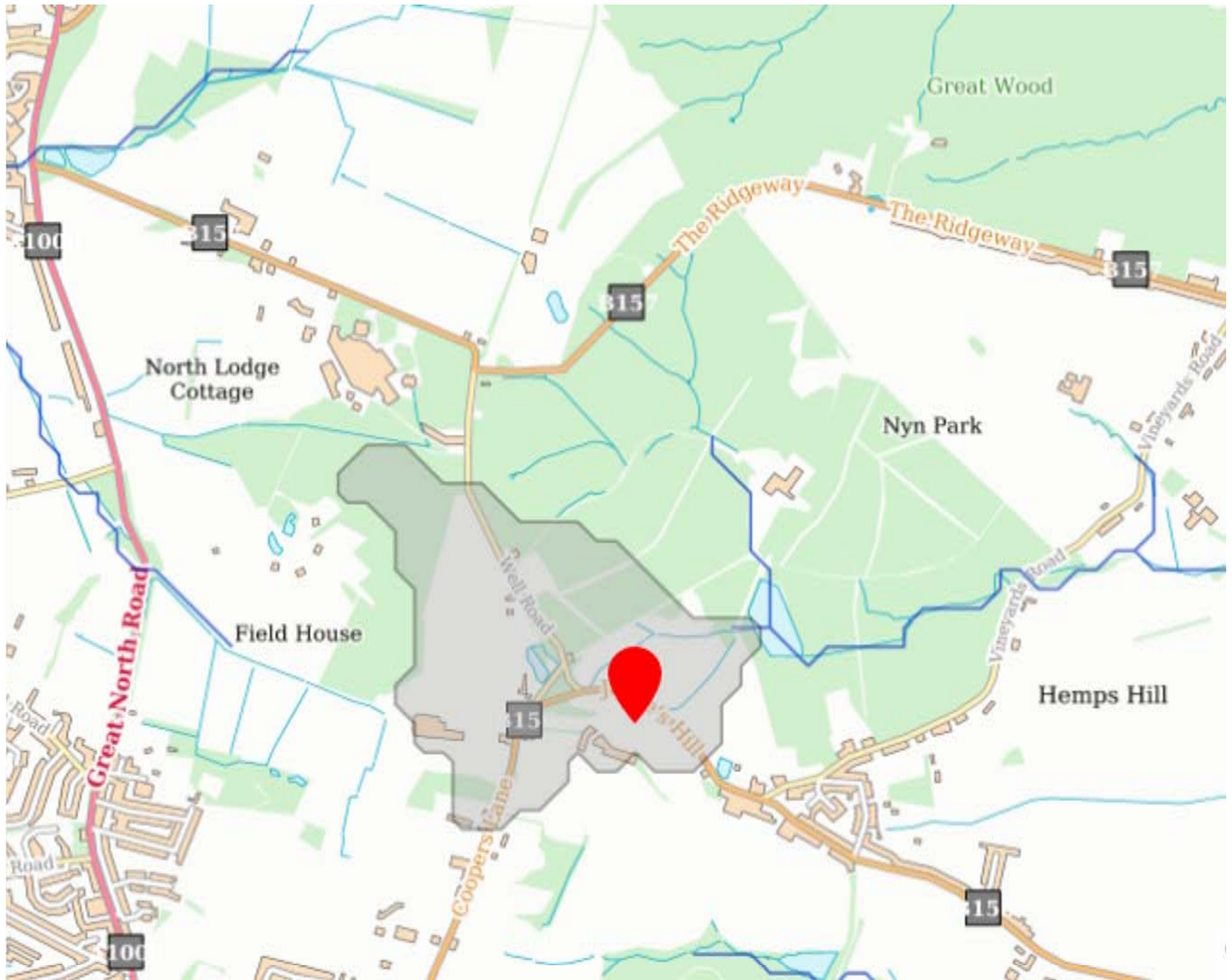
Project: Boundary Fence Nyn Park	Drawing Number: <b>APL18-007-01</b>	Issue: P4	Sheet: A1
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VERSION	"FEH CD-ROM"	Version	2.0.1	exported a	09:51:18 GMT	Mon	17-Aug-20
CATCHMENT	GB	527750	202750	TL 27750	02750		
CENTROID	GB	527247	202705	TL 27247	02705		
AREA		0.57					
ALTBAR		115					
ASPBAR		89					
ASPVAR		0.49					
BFIHOST		0.238					
DPLBAR		0.68					
DPSBAR		42.3					
FARL		1					
FPEXT		0.0833					
FPDBAR		0.469					
FPLOC		1.07					
LDP		1.29					
PROPWET		0.3					
RMED-1H		11					
RMED-1D		29.7					
RMED-2D		39.1					
SAAR		687					
SAAR4170		676					
SPRHOST		47.46					
URBCONC1990		-999999					
URBEXT1990		0.0022					
URBLOC1990		-999999					
URBCONC2000		0.333					
URBEXT2000		0.0066					
URBLOC2000		0.682					
C		-0.02546					
D1		0.2734					
D2		0.29143					
D3		0.28787					
E		0.32289					
F		2.49356					
C(1 km)		-0.025					
D1(1 km)		0.274					
D2(1 km)		0.29					
D3(1 km)		0.294					
E(1 km)		0.324					
F(1 km)		2.483					





Great Wood

100

15

15

15

North Lodge Cottage

Nyn Park

Field House

Hemp Hill

15

15

100



Date 11/02/2015

Designed by LeighP

File

Checked by

InfoDrainage 2020.1

**ICP SUDS Mean Annual Flood**

**Input**

Return Period(years)	100
Area (ha)	1.000
SAAR (mm)	687.000
Soil	0.400
Urban	0.000
Region	Region 6

**Results**

QBAR Rural (L/s)	3.3285
QBAR Urban (L/s)	3.3285
Q 100 (years)	10.6179
Q 1 (years)	2.8292
Q 30 (years)	7.5434
Q 100 (years)	10.6179



AMA809 - Nyn Oark: Compound Surface Water	Date: 09/10/2020		
	Designed by: LSP	Checked by:	Approved By: LSP
Report Details: Type: Inflows Phase: Phase	Company Address:		



**Catchment Area**

Type : Catchment Area


Area (ha)	0.207
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**Dynamic Sizing**

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	100

**Pollutant Concentrations**

Name	Concentration (mg/L)
TSS	0.0
TP	0.0
TN	0.0

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Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)
Manhole	Manhole	527361.511	202863.571	116.55	1.00

Name	Invert Level (m)	Chamber Shape	Diameter (m)	Manhole Locked
Manhole	115.552	Circular	1.20	<input type="checkbox"/>

**Inlets**

Junction	Inlet Name	Incoming Item(s)	Bypass Destination	Capacity Type
Manhole	Inlet	Catchment Area	(None)	No Restriction

**Outlets**

Junction	Outlet Name	Outgoing Connection	Outlet Type
Manhole	Outlet	Pipe	Orifice
	Diameter (m)	0.30	
	Coefficient of Discharge	0.600	
	Invert Level (m)	115.55	



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Report Details: Type: Stormwater Controls Phase: Phase	Company Address:		



**Pond**

Type : Pond

**Dimensions**

Exceedence Level (m)	95.57
Depth (m)	1.00
Base Level (m)	94.57
Freeboard (mm)	0
Initial Depth (m)	0.00
Porosity (%)	100
Average Slope (1:x)	3.00
Total Volume (m³)	217.325

Depth (m)	Area (m²)	Volume (m³)
0.00	144.08	0.000
1.00	300.00	217.325

**Inlets**

**Inlet (1)**

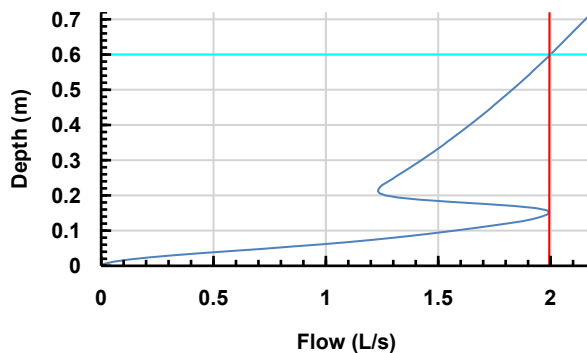
Inlet Type	Point Inflow
Incoming Item(s)	No Delay
Bypass Destination	(None)
Capacity Type	No Restriction

**Outlets**

**Outlet**

Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	94.57
Design Depth (m)	0.60
Design Flow (L/s)	2.0
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	<input type="checkbox"/>


Unit Reference CHE-0071-2000-0600-2000



**Advanced**

Perimeter	Circular
Length (m)	24.18

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<b>Pollutant Removals</b>
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Name	Background Concentration (mg/L)	Method	Percentage Removal (%)	$\tau$ (mins)
TSS	0.0	Percentage Removal	0	
TP	0.0	Percentage Removal	0	
TN	0.0	Percentage Removal	0	

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Report Details: Type: Stormwater Controls Phase: Phase	Company Address:		



**Swale**

Type : Swale

**Swale**

Exceedence Level (m)	97.39
Depth (m)	0.60
Base Level (m)	96.79
Top Width (m)	4.60
Side Slope (1:x)	3.00
Base Width (m)	1.00
Freeboard (mm)	0
Length (m)	30.12
Long. Slope (1:x)	15.00
Filtration Rate (m/hr)	0.0
Friction Scheme	Manning's n
n	0.025
Total Volume (m³)	50.599

**Inlets**

**Inlet**

Inlet Type	Point Inflow
Incoming Item(s)	Pipe
Bypass Destination	(None)
Inlet Destination	Ponding Area
Capacity Type	No Restriction

**Outlets**

**Outlet**

Outgoing Connection	No Delay
Outlet Type	Weir
Width (m)	3.00
Coefficient of Discharge	0.544
Crest Level (m)	96.79

**Advanced**

**Swale**

Porosity (%)	100
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Report Details: Type: Stormwater Controls Phase: Phase	Company Address:		



**Pollutant Removals**

Name	Aspect	Background Concentration (mg/L)	Method	Percentage Removal (%)	$\tau$ (mins)
TSS	Swale Pollution Removals	0.0	Percentage Removal	0	
TP	Swale Pollution Removals	0.0	Percentage Removal	0	
TN	Swale Pollution Removals	0.0	Percentage Removal	0	
TSS	Trench Pollution Removals	0.0	Percentage Removal	0	
TP	Trench Pollution Removals	0.0	Percentage Removal	0	
TN	Trench Pollution Removals	0.0	Percentage Removal	0	

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Name	Length (m)	Connection Type	Slope (1:x)	Manning's n	Colebrook-White Roughness (mm)	Diameter / Base Width (mm)	Upstream Cover Level (m)	Upstream Invert Level (m)
No Delay	1.00	No Delay						
Pipe	170.14	Pipe	10.218		0.6	300	116.55	115.55

Name	Downstream Cover Level (m)	Downstream Invert Level (m)	Flow Restriction (L/s)
No Delay			
Pipe	99.61	98.90	173.2

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Runoff Type	Dynamic
Output Interval (mins)	1
Time Step	Reduced
Urban Creep (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	<input type="checkbox"/>

**Rainfall**

**AMA809 - FEH rainfall**

Type: FEH

Site Location	GB 527750 202750 TL 27750 02750	
Rainfall Version	1999	
C (1km)	-0.025	
D1 (1km)	0.274	
D2 (1km)	0.290	
D3 (1km)	0.294	
E (1km)	0.324	
F (1km)	2.483	
Summer	<input checked="" type="checkbox"/>	
Winter	<input checked="" type="checkbox"/>	

**Return Period**

Return Period (years)	Increase Rainfall (%)
100.0	40
2.0	0

**Storm Durations**

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920



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**Critical Storm**

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
Manhole	FEH: 100 years: Increase Rainfall (%): +40: 15 mins: Winter	116.5 5	115.5 5	116.56	1.01	224.2	8.812	7.681	174.0	103.602	Flood

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Report Details: Type: Stormwater Controls Summary Phase: Phase	Company Address:		



**Critical Storm**

Stormwater Control	Storm Event	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Pond	FEH: 100 years: Increase Rainfall (%): +40: 240 mins: Winter	95.29	0.71	28.2	138.521	0.000	0.000	2.2	52.116	606	36	OK
Swale	FEH: 100 years: Increase Rainfall (%): +40: 15 mins: Winter	96.88	0.09	174.0	3.289	0.000	0.000	174.0	103.582	0	94	OK

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### Manhole

Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
FEH: 100 years: Increase Rainfall (%) +40: 15 mins: Summer	116.5 5	115.5 5	116.56	1.01	213.4	6.832	5.701	173.8	92.468	Flood
FEH: 100 years: Increase Rainfall (%) +40: 15 mins: Winter	116.5 5	115.5 5	116.56	1.01	224.2	8.812	7.681	174.0	103.602	Flood
FEH: 100 years: Increase Rainfall (%) +40: 30 mins: Summer	116.5 5	115.5 5	116.46	0.91	163.7	1.028	0.000	163.7	103.385	Surcharged
FEH: 100 years: Increase Rainfall (%) +40: 30 mins: Winter	116.5 5	115.5 5	116.32	0.77	148.1	0.872	0.000	148.1	115.795	Surcharged
FEH: 100 years: Increase Rainfall (%) +40: 60 mins: Summer	116.5 5	115.5 5	116.04	0.49	108.9	0.550	0.000	108.9	115.442	Surcharged
FEH: 100 years: Increase Rainfall (%) +40: 60 mins: Winter	116.5 5	115.5 5	115.92	0.37	88.1	0.418	0.000	88.1	129.297	Surcharged
FEH: 100 years: Increase Rainfall (%) +40: 120 mins: Summer	116.5 5	115.5 5	115.84	0.29	66.4	0.330	0.000	66.4	128.913	OK
FEH: 100 years: Increase Rainfall (%) +40: 120 mins: Winter	116.5 5	115.5 5	115.79	0.24	50.2	0.274	0.000	50.2	144.372	OK
FEH: 100 years: Increase Rainfall (%) +40: 180 mins: Summer	116.5 5	115.5 5	115.79	0.24	48.7	0.269	0.000	48.7	137.492	OK
FEH: 100 years: Increase Rainfall (%) +40: 180 mins: Winter	116.5 5	115.5 5	115.75	0.19	35.9	0.220	0.000	35.9	153.993	OK
FEH: 100 years: Increase Rainfall (%) +40: 240 mins: Summer	116.5 5	115.5 5	115.76	0.20	38.8	0.231	0.000	38.8	143.940	OK
FEH: 100 years: Increase Rainfall (%) +40: 240 mins: Winter	116.5 5	115.5 5	115.72	0.17	28.3	0.188	0.000	28.3	161.212	OK
FEH: 100 years: Increase Rainfall (%) +40: 360 mins: Summer	116.5 5	115.5 5	115.72	0.16	27.9	0.186	0.000	27.9	153.540	OK
FEH: 100 years: Increase Rainfall (%) +40: 360 mins: Winter	116.5 5	115.5 5	115.68	0.13	20.1	0.151	0.000	20.1	171.949	OK
FEH: 100 years: Increase Rainfall (%) +40: 480 mins: Summer	116.5 5	115.5 5	115.69	0.14	21.9	0.159	0.000	21.9	160.730	OK

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FEH: 100 years: Increase Rainfall (%): +40: 480 mins: Winter	116.5 5	115.5 5	115.67	0.11	15.8	0.129	0.000	15.8	180.012	OK
FEH: 100 years: Increase Rainfall (%): +40: 600 mins: Summer	116.5 5	115.5 5	115.68	0.12	18.1	0.141	0.000	18.1	166.534	OK
FEH: 100 years: Increase Rainfall (%): +40: 600 mins: Winter	116.5 5	115.5 5	115.65	0.10	13.1	0.114	0.000	13.1	186.514	OK
FEH: 100 years: Increase Rainfall (%): +40: 720 mins: Summer	116.5 5	115.5 5	115.66	0.11	15.5	0.127	0.000	15.5	171.451	OK
FEH: 100 years: Increase Rainfall (%): +40: 720 mins: Winter	116.5 5	115.5 5	115.64	0.09	11.2	0.103	0.000	11.2	192.024	OK
FEH: 100 years: Increase Rainfall (%): +40: 960 mins: Summer	116.5 5	115.5 5	115.65	0.10	12.3	0.109	0.000	12.3	180.328	OK
FEH: 100 years: Increase Rainfall (%): +40: 960 mins: Winter	116.5 5	115.5 5	115.63	0.08	8.9	0.088	0.000	8.9	201.940	OK
FEH: 2 years: Increase Rainfall (%): +0: 15 mins: Summer	116.5 5	115.5 5	115.75	0.20	37.5	0.226	0.000	37.4	16.282	OK
FEH: 2 years: Increase Rainfall (%): +0: 15 mins: Winter	116.5 5	115.5 5	115.76	0.21	39.4	0.233	0.000	39.3	18.237	OK
FEH: 2 years: Increase Rainfall (%): +0: 30 mins: Summer	116.5 5	115.5 5	115.73	0.18	30.8	0.199	0.000	30.8	19.461	OK
FEH: 2 years: Increase Rainfall (%): +0: 30 mins: Winter	116.5 5	115.5 5	115.72	0.16	27.9	0.186	0.000	27.9	21.797	OK
FEH: 2 years: Increase Rainfall (%): +0: 60 mins: Summer	116.5 5	115.5 5	115.69	0.14	21.9	0.159	0.000	21.9	23.256	OK
FEH: 2 years: Increase Rainfall (%): +0: 60 mins: Winter	116.5 5	115.5 5	115.67	0.12	17.8	0.139	0.000	17.7	26.048	OK
FEH: 2 years: Increase Rainfall (%): +0: 120 mins: Summer	116.5 5	115.5 5	115.66	0.11	14.3	0.120	0.000	14.3	27.793	OK
FEH: 2 years: Increase Rainfall (%): +0: 120 mins: Winter	116.5 5	115.5 5	115.64	0.09	10.8	0.100	0.000	10.8	31.120	OK
FEH: 2 years: Increase Rainfall (%): +0: 180 mins: Summer	116.5 5	115.5 5	115.64	0.09	10.9	0.101	0.000	10.9	30.838	OK
FEH: 2 years: Increase Rainfall (%): +0: 180 mins: Winter	116.5 5	115.5 5	115.62	0.07	8.1	0.083	0.000	8.0	34.542	OK



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FEH: 2 years: Increase Rainfall (%): +0: 240 mins: Summer	116.5 5	115.5 5	115.63	0.08	8.9	0.089	0.000	8.9	33.217	OK
FEH: 2 years: Increase Rainfall (%): +0: 240 mins: Winter	116.5 5	115.5 5	115.62	0.06	6.5	0.072	0.000	6.5	37.200	OK
FEH: 2 years: Increase Rainfall (%): +0: 360 mins: Summer	116.5 5	115.5 5	115.62	0.06	6.7	0.073	0.000	6.7	36.870	OK
FEH: 2 years: Increase Rainfall (%): +0: 360 mins: Winter	116.5 5	115.5 5	115.60	0.05	4.8	0.060	0.000	4.8	41.281	OK
FEH: 2 years: Increase Rainfall (%): +0: 480 mins: Summer	116.5 5	115.5 5	115.61	0.06	5.4	0.064	0.000	5.4	39.693	OK
FEH: 2 years: Increase Rainfall (%): +0: 480 mins: Winter	116.5 5	115.5 5	115.60	0.05	3.9	0.052	0.000	3.9	44.462	OK
FEH: 2 years: Increase Rainfall (%): +0: 600 mins: Summer	116.5 5	115.5 5	115.60	0.05	4.6	0.057	0.000	4.6	42.038	OK
FEH: 2 years: Increase Rainfall (%): +0: 600 mins: Winter	116.5 5	115.5 5	115.59	0.04	3.3	0.047	0.000	3.3	47.076	OK
FEH: 2 years: Increase Rainfall (%): +0: 720 mins: Summer	116.5 5	115.5 5	115.60	0.05	4.0	0.053	0.000	4.0	44.100	OK
FEH: 2 years: Increase Rainfall (%): +0: 720 mins: Winter	116.5 5	115.5 5	115.59	0.04	2.9	0.043	0.000	2.9	49.372	OK
FEH: 2 years: Increase Rainfall (%): +0: 960 mins: Summer	116.5 5	115.5 5	115.59	0.04	3.2	0.046	0.000	3.2	47.670	OK
FEH: 2 years: Increase Rainfall (%): +0: 960 mins: Winter	116.5 5	115.5 5	115.58	0.03	2.3	0.037	0.000	2.3	53.377	OK

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**Pond**

Storm Event	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
FEH: 100 years: Increase Rainfall (%): +40: 15 mins: Summer	95.08	0.51	173.8	90.616	0.000	0.000	2.0	2.427	486	58	OK
FEH: 100 years: Increase Rainfall (%): +40: 15 mins: Winter	95.13	0.56	174.0	101.683	0.000	0.000	1.9	2.548	548	53	OK
FEH: 100 years: Increase Rainfall (%): +40: 30 mins: Summer	95.13	0.55	162.0	100.218	0.000	0.000	2.0	5.459	548	54	OK
FEH: 100 years: Increase Rainfall (%): +40: 30 mins: Winter	95.18	0.60	147.2	112.520	0.000	0.000	2.0	5.714	583	48	OK
FEH: 100 years: Increase Rainfall (%): +40: 60 mins: Summer	95.17	0.59	108.4	109.655	0.000	0.000	2.0	11.752	561	50	OK
FEH: 100 years: Increase Rainfall (%): +40: 60 mins: Winter	95.23	0.65	88.0	123.382	0.000	0.000	2.1	12.268	593	43	OK
FEH: 100 years: Increase Rainfall (%): +40: 120 mins: Summer	95.20	0.63	66.2	117.662	0.000	0.000	2.0	24.571	562	46	OK
FEH: 100 years: Increase Rainfall (%): +40: 120 mins: Winter	95.26	0.69	50.2	132.940	0.000	0.000	2.1	25.622	600	39	OK
FEH: 100 years: Increase Rainfall (%): +40: 180 mins: Summer	95.21	0.64	48.5	120.694	0.000	0.000	2.1	37.311	559	44	OK
FEH: 100 years: Increase Rainfall (%): +40: 180 mins: Winter	95.28	0.71	35.9	136.942	0.000	0.000	2.2	38.970	618	37	OK
FEH: 100 years: Increase Rainfall (%): +40: 240 mins: Summer	95.22	0.64	38.7	121.584	0.000	0.000	2.1	49.810	573	44	OK

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FEH: 100 years: Increase Rainfall (%): +40: 240 mins: Winter	95.29	0.71	28.2	138.521	0.000	0.000	2.2	52.116	606	36	OK
FEH: 100 years: Increase Rainfall (%): +40: 360 mins: Summer	95.21	0.64	27.8	120.167	0.000	0.000	2.1	73.760	556	45	OK
FEH: 100 years: Increase Rainfall (%): +40: 360 mins: Winter	95.29	0.71	20.1	138.116	0.000	0.000	2.2	77.489	603	36	OK
FEH: 100 years: Increase Rainfall (%): +40: 480 mins: Summer	95.20	0.62	21.9	116.871	0.000	0.000	2.0	96.000	546	46	OK
FEH: 100 years: Increase Rainfall (%): +40: 480 mins: Winter	95.27	0.70	15.8	135.371	0.000	0.000	2.2	101.334	596	38	OK
FEH: 100 years: Increase Rainfall (%): +40: 600 mins: Summer	95.18	0.61	18.1	113.811	0.000	0.000	2.0	116.299	539	48	OK
FEH: 100 years: Increase Rainfall (%): +40: 600 mins: Winter	95.26	0.68	13.1	131.530	0.000	0.000	2.1	123.400	590	39	OK
FEH: 100 years: Increase Rainfall (%): +40: 720 mins: Summer	95.17	0.60	15.5	110.923	0.000	0.000	2.0	134.466	532	49	OK
FEH: 100 years: Increase Rainfall (%): +40: 720 mins: Winter	95.24	0.67	11.2	127.786	0.000	0.000	2.1	143.523	578	41	OK
FEH: 100 years: Increase Rainfall (%): +40: 960 mins: Summer	95.15	0.58	12.3	106.152	0.000	0.000	2.0	172.334	514	51	OK
FEH: 100 years: Increase Rainfall (%): +40: 960 mins: Winter	95.22	0.64	8.9	121.907	0.000	0.000	2.1	182.081	562	44	OK
FEH: 2 years: Increase Rainfall (%): +0: 15 mins: Summer	94.67	0.10	36.6	15.032	0.000	0.000	1.6	1.713	127	93	OK
FEH: 2 years: Increase Rainfall (%): +0: 15 mins: Winter	94.69	0.11	38.4	16.885	0.000	0.000	1.7	1.881	126	92	OK
FEH: 2 years: Increase Rainfall (%): +0: 30 mins: Summer	94.69	0.11	30.3	17.391	0.000	0.000	1.7	4.193	135	92	OK

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FEH: 2 years: Increase Rainfall (%): +0: 30 mins: Winter	94.70	0.13	27.6	19.584	0.000	0.000	1.9	4.581	131	91 OK
FEH: 2 years: Increase Rainfall (%): +0: 60 mins: Summer	94.70	0.13	21.7	19.350	0.000	0.000	1.9	9.231	114	91 OK
FEH: 2 years: Increase Rainfall (%): +0: 60 mins: Winter	94.72	0.14	17.7	21.923	0.000	0.000	2.0	10.022	116	90 OK
FEH: 2 years: Increase Rainfall (%): +0: 120 mins: Summer	94.71	0.13	14.2	20.507	0.000	0.000	1.9	18.077	115	91 OK
FEH: 2 years: Increase Rainfall (%): +0: 120 mins: Winter	94.72	0.15	10.8	23.121	0.000	0.000	2.0	19.783	120	89 OK
FEH: 2 years: Increase Rainfall (%): +0: 180 mins: Summer	94.71	0.14	10.8	20.964	0.000	0.000	1.9	24.505	119	90 OK
FEH: 2 years: Increase Rainfall (%): +0: 180 mins: Winter	94.73	0.15	8.0	23.425	0.000	0.000	2.0	27.225	122	89 OK
FEH: 2 years: Increase Rainfall (%): +0: 240 mins: Summer	94.71	0.14	8.9	21.067	0.000	0.000	2.0	28.839	113	90 OK
FEH: 2 years: Increase Rainfall (%): +0: 240 mins: Winter	94.73	0.15	6.5	23.240	0.000	0.000	2.0	32.313	119	89 OK
FEH: 2 years: Increase Rainfall (%): +0: 360 mins: Summer	94.71	0.14	6.7	20.709	0.000	0.000	1.9	34.286	115	90 OK
FEH: 2 years: Increase Rainfall (%): +0: 360 mins: Winter	94.72	0.14	4.8	22.202	0.000	0.000	2.0	38.531	117	90 OK
FEH: 2 years: Increase Rainfall (%): +0: 480 mins: Summer	94.71	0.13	5.4	20.020	0.000	0.000	1.9	37.905	112	91 OK
FEH: 2 years: Increase Rainfall (%): +0: 480 mins: Winter	94.71	0.14	3.9	20.900	0.000	0.000	1.9	42.595	114	90 OK
FEH: 2 years: Increase Rainfall (%): +0: 600 mins: Summer	94.70	0.13	4.6	19.240	0.000	0.000	1.9	40.678	111	91 OK



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FEH: 2 years: Increase Rainfall (%): +0: 600 mins: Winter	94.70	0.13	3.3	19.590	0.000	0.000	1.9	45.676	110	91	OK
FEH: 2 years: Increase Rainfall (%): +0: 720 mins: Summer	94.70	0.12	4.0	18.461	0.000	0.000	1.8	42.979	109	92	OK
FEH: 2 years: Increase Rainfall (%): +0: 720 mins: Winter	94.70	0.12	2.9	18.403	0.000	0.000	1.8	48.230	109	92	OK
FEH: 2 years: Increase Rainfall (%): +0: 960 mins: Summer	94.69	0.11	3.2	17.055	0.000	0.000	1.7	46.762	108	92	OK
FEH: 2 years: Increase Rainfall (%): +0: 960 mins: Winter	94.68	0.11	2.3	16.381	0.000	0.000	1.7	52.462	107	92	OK

AMA809 - Nyn Oark: Compound Surface Water	Date: 09/10/2020		
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Report Details: Type: Stormwater Controls Summary Phase: Phase	Company Address:		




**Swale**


Storm Event	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
FEH: 100 years: Increase Rainfall (%): +40: 15 mins: Summer	96.88	0.09	173.8	3.286	0.000	0.000	173.8	92.440	0	94	OK
FEH: 100 years: Increase Rainfall (%): +40: 15 mins: Winter	96.88	0.09	174.0	3.289	0.000	0.000	174.0	103.582	0	94	OK
FEH: 100 years: Increase Rainfall (%): +40: 30 mins: Summer	96.87	0.08	162.9	3.131	0.000	0.000	162.2	103.335	0	94	OK
FEH: 100 years: Increase Rainfall (%): +40: 30 mins: Winter	96.87	0.08	147.7	2.922	0.000	0.000	147.3	115.734	0	94	OK
FEH: 100 years: Increase Rainfall (%): +40: 60 mins: Summer	96.86	0.07	108.7	2.358	0.000	0.000	108.5	115.404	0	95	OK
FEH: 100 years: Increase Rainfall (%): +40: 60 mins: Winter	96.85	0.06	88.1	2.040	0.000	0.000	88.0	129.248	0	96	OK
FEH: 100 years: Increase Rainfall (%): +40: 120 mins: Summer	96.84	0.05	66.3	1.679	0.000	0.000	66.2	128.862	0	97	OK
FEH: 100 years: Increase Rainfall (%): +40: 120 mins: Winter	96.83	0.04	50.2	1.393	0.000	0.000	50.2	144.320	0	97	OK
FEH: 100 years: Increase Rainfall (%): +40: 180 mins: Summer	96.83	0.04	48.6	1.362	0.000	0.000	48.5	137.438	0	97	OK
FEH: 100 years: Increase Rainfall (%): +40: 180 mins: Winter	96.82	0.03	35.9	1.115	0.000	0.000	35.9	153.947	0	98	OK
FEH: 100 years: Increase Rainfall (%): +40: 240 mins: Summer	96.83	0.04	38.7	1.170	0.000	0.000	38.6	143.886	0	98	OK

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FEH: 100 years: Increase Rainfall (%): +40: 240 mins: Winter	96.82	0.03	28.2	0.952	0.000	0.000	28.2	161.169	0	98 OK
FEH: 100 years: Increase Rainfall (%): +40: 360 mins: Summer	96.82	0.03	27.8	0.943	0.000	0.000	27.8	153.482	0	98 OK
FEH: 100 years: Increase Rainfall (%): +40: 360 mins: Winter	96.81	0.02	20.1	0.764	0.000	0.000	20.1	171.904	0	98 OK
FEH: 100 years: Increase Rainfall (%): +40: 480 mins: Summer	96.82	0.02	21.9	0.806	0.000	0.000	21.9	160.666	0	98 OK
FEH: 100 years: Increase Rainfall (%): +40: 480 mins: Winter	96.81	0.02	15.8	0.653	0.000	0.000	15.8	179.960	0	99 OK
FEH: 100 years: Increase Rainfall (%): +40: 600 mins: Summer	96.81	0.02	18.1	0.714	0.000	0.000	18.1	166.463	0	99 OK
FEH: 100 years: Increase Rainfall (%): +40: 600 mins: Winter	96.81	0.02	13.1	0.579	0.000	0.000	13.1	186.453	0	99 OK
FEH: 100 years: Increase Rainfall (%): +40: 720 mins: Summer	96.81	0.02	15.5	0.646	0.000	0.000	15.5	171.372	0	99 OK
FEH: 100 years: Increase Rainfall (%): +40: 720 mins: Winter	96.81	0.02	11.2	0.525	0.000	0.000	11.2	191.955	0	99 OK
FEH: 100 years: Increase Rainfall (%): +40: 960 mins: Summer	96.81	0.02	12.3	0.555	0.000	0.000	12.3	180.230	0	99 OK
FEH: 100 years: Increase Rainfall (%): +40: 960 mins: Winter	96.80	0.01	8.9	0.451	0.000	0.000	8.9	201.851	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 15 mins: Summer	96.82	0.03	36.6	1.130	0.000	0.000	36.7	16.169	0	98 OK
FEH: 2 years: Increase Rainfall (%): +0: 15 mins: Winter	96.83	0.03	38.2	1.166	0.000	0.000	38.4	18.122	0	98 OK
FEH: 2 years: Increase Rainfall (%): +0: 30 mins: Summer	96.82	0.03	30.3	0.993	0.000	0.000	30.2	19.403	0	98 OK

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FEH: 2 years: Increase Rainfall (%): +0: 30 mins: Winter	96.82	0.03	27.6	0.936	0.000	0.000	27.6	21.740	0	98 OK
FEH: 2 years: Increase Rainfall (%): +0: 60 mins: Summer	96.82	0.02	21.6	0.801	0.000	0.000	21.7	23.218	0	98 OK
FEH: 2 years: Increase Rainfall (%): +0: 60 mins: Winter	96.81	0.02	17.6	0.702	0.000	0.000	17.7	26.012	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 120 mins: Summer	96.81	0.02	14.2	0.610	0.000	0.000	14.2	27.762	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 120 mins: Winter	96.81	0.02	10.8	0.512	0.000	0.000	10.8	31.092	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 180 mins: Summer	96.81	0.02	10.8	0.513	0.000	0.000	10.8	30.806	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 180 mins: Winter	96.80	0.01	8.0	0.424	0.000	0.000	8.0	34.515	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 240 mins: Summer	96.80	0.01	8.9	0.452	0.000	0.000	8.9	33.183	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 240 mins: Winter	96.80	0.01	6.5	0.372	0.000	0.000	6.5	37.170	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 360 mins: Summer	96.80	0.01	6.7	0.377	0.000	0.000	6.7	36.829	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 360 mins: Winter	96.80	0.01	4.8	0.308	0.000	0.000	4.8	41.243	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 480 mins: Summer	96.80	0.01	5.4	0.330	0.000	0.000	5.4	39.643	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 480 mins: Winter	96.80	0.01	3.9	0.270	0.000	0.000	3.9	44.415	0	99 OK
FEH: 2 years: Increase Rainfall (%): +0: 600 mins: Summer	96.80	0.01	4.6	0.298	0.000	0.000	4.6	41.979	0	99 OK

AMA809 - Nyn Oark: Compound Surface Water	Date: 09/10/2020			
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FEH: 2 years: Increase Rainfall (%): +0: 600 mins: Winter	96.80	0.01	3.3	0.243	0.000	0.000	3.3	47.021	0	100	OK
FEH: 2 years: Increase Rainfall (%): +0: 720 mins: Summer	96.80	0.01	4.0	0.273	0.000	0.000	4.0	44.031	0	99	OK
FEH: 2 years: Increase Rainfall (%): +0: 720 mins: Winter	96.80	0.01	2.9	0.224	0.000	0.000	2.9	49.306	0	100	OK
FEH: 2 years: Increase Rainfall (%): +0: 960 mins: Summer	96.80	0.01	3.2	0.240	0.000	0.000	3.2	47.581	0	100	OK
FEH: 2 years: Increase Rainfall (%): +0: 960 mins: Winter	96.80	0.01	2.3	0.196	0.000	0.000	2.3	53.290	1	100	OK





Catchment Area

Manhole

Pipe

Swale

No Delay

Pond

## **Nyn Park, Maintenance Compound**

### **Draft Surface Water Drainage Management & Maintenance Plan**

#### **The Management**

The responsibility for maintenance of all elements of the drainage systems will be with the private Nyn Park maintenance team.

On completion of construction and testing, the building contractor will hand over the constructed works along with as built drawings and details of any drainage components installed as part of the site Operation and Maintenance Manual. This Surface Water Drainage Management and Maintenance Plan should be updated in due course to include these as built plans.

#### **System Overview**

Rainwater will be intercepted by gulleys/channels, flow through an oil separator and enter an outfall pipe that is routed to a watercourse south of the compound. Prior to the outflow to the watercourse flows are attenuated within an open basin and outflow restricted with a vortex flow control device.

#### **General Piped Systems**

Maintenance to be undertaken to ensure the longevity of the surface water drainage system;

##### **Quarterly**

- i) Inspect the performance of the chambers by lifting the cover of the chamber(s) and check that the outlet pipe is free of obstruction and visible (ie not submerged). If the outlet pipe is submerged then remedial action may be required. Remedial advice to be sought from a suitably qualified contractor or consulting engineer.

##### **Every 6 months**

- i) Remove silt build up from chambers.

##### **Annually**

- i) Inspect chambers for blockages / silt build up. Remove silt and debris.

Every c5-10 years (depending on outcome of aforementioned inspections)

- i) Commission a CCTV survey and report on condition of the surface water piped drainage system upstream of the attenuation to check for structural integrity and hydraulic fluidity. Carry out promptly any remedial work as advised by CCTV company.

## Attenuation Basin

Refer to section 22.12 of *The SuDS Manual* (2015). Extract:

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – 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)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

## Swale

Refer to section 17.12 of *The SuDS Manual* (2015).Extract:

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	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 vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required 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 reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	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

## Other

All necessary safety precautions should be taken when undertaking maintenance and it should be undertaken by an experienced contractor. There may be hazards such as falls into chambers, water, handling contaminated materials, or heavy lifting.

Any waste material generated from drainage maintenance or repairs shall be disposed of in accordance with current legislative requirements and best practice.

A final copy of this Plan should be included with other site operation and maintenance documentation in the site Health and Safety File (as part of the requirements under the CDM Regulations, 2015).

Consideration should be given to using the maintenance checklist in table B.25 of *The SuDS Manual*, 2015.

It is important that this Plan is revisited/reviewed once final site drainage designs are prepared for construction and as built drawings are available.

If there are any concerns or queries about the site drainage systems, then advice should be sought from a Chartered Civil Engineer who specialises in drainage systems.



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