Owen **Williams** consultants			
	Client:	EAST SUSSEX COUNTY COUNCIL	Sheet No. of
	Project:	**BEXHILL TO HASTINGS LINK ROAD**	Job No : 262701
			Date: May 2006
	Subject:	Preliminary Drainage Design	Calc by: C. Pemberton
			Check by B D Burgess

Source/Ref

1 Global Variables

Region: England & Wales
Return Periods (yrs): 1,5 and 100
M5-60: 19 From Wallingford
Ratio (r): 0.35 Procedure Volume 3 Maps

2 Cactchment Characteristics

SAAR; 737 Estimate SAAR from Average Annual Rainfall Maps (1941 to 1970)
Soil Type: 0.45 taken as equivalent to Wallingford Procedure Volume 3 Maps W.R.A.P Class 4

CATCHMENT	A	B	C	D	E	Comments
Outfall Description	Egerton Stream	Combe Haven	Watermill Stream	Powder Mill Sream	Decoy Pond Stream	
Infiltration rates (m/h)	NA	Practically Impermeable	3.65E-06 to 1.61E-04m/s	3.76E-06 to 3.63E-04m/s	NA	From Test Results provided by Nigel
Area (ha)	2.371	1.720	1.354	1.599	1.319	(Positively Drained Catchment)

Note: Testing was carried out for catchments B,C,&D. Catchment B is practically impermeable. Cachments C&D infiltration is above the minim allowed in section 9.8.5 of Ciria however for the proposed cathcments the half drain is much greater than 24 hours therefore unacceptable. We have therefore ignored infiltration in the following calculations.

3 Rainfall Intensity Duration Tables

Table 1 - 1year storm intensities for various durations

Storm Duration (min)	M5-60	Z1 (ratio)	M5-D(mm)	Z2 (ratio)	M1-D (mm)	Intensity (mm/hr)
5	19	0.35	7	0.62	4.12	49.5
10	19	0.5	10	0.61	5.80	34.8
15	19	0.61	12	0.61	7.07	28.3
30	19	0.8	15	0.62	9.42	18.8
60	19	1	19	0.64	12.16	12.2
120	19	1.1	21	0.64	13.38	6.7
240	19	1.5	29	0.68	19.38	4.8
360	19	1.7	32	0.68	21.96	3.7
600	19	1.9	36	0.68	24.55	2.5
1440	19	2.5	48	0.72	34.20	1.4
2880	19	3.2	61	0.74	44.99	0.9

Table 2 - 5year storm intensities for various durations

Storm Duration (min)	M5-60	Z1 (ratio)	M5-D(mm)	Z2 (ratio)	M5-D (mm)	Intensity (mm/hr)
5	19	0.35	7	1.02	6.78	81.4
10	19	0.5	10	1.03	9.79	58.7
15	19	0.61	12	1.03	11.94	47.8
30	19	0.8	15	1.03	15.66	31.3
60	19	1	19	1.03	19.57	19.6
120	19	1.1	21	1.03	21.53	10.8
240	19	1.5	29	1.03	29.36	7.3
360	19	1.7	32	1.03	33.27	5.5
600	19	1.9	36	1.03	37.18	3.7
1440	19	2.5	48	1.02	48.45	2.0
2880	19	3.2	61	1.02	62.02	1.3

Table 2 - 100year storm intensities for various durations

Storm Duration (min)	M5-60	Z1 (ratio)	M5-D(mm)	Z2 (ratio)	M100-D (mm)	Intensity (mm/hr)
5	19	0.35	7	1.84	12.24	146.8
10	19	0.5	10	1.91	18.15	108.9
15	19	0.61	12	1.94	22.48	89.9
30	19	0.8	15	1.99	30.25	60.5
60	19	1	19	2.03	38.57	38.6
120	19	1.1	21	2.03	42.43	21.2
240	19	1.5	29	1.97	56.15	14.0
360	19	1.7	32	1.97	63.63	10.6
600	19	1.9	36	1.89	68.23	6.8
1440	19	2.5	48	1.81	85.98	3.6
2880	19	3.2	61	1.73	105.18	2.2

4 Volume 11 Section 3 Part 10

Previous Calculations - Paul Jones

Conclusions No additional pollution control devices required for copper and zinc concentrations
No spill containment required.

Assumption made 95% flow estimated as no data available

Calculations following re check 11.3.10 requirements

Water Quality Prediction - Discharge to Surface Waters

Assessment of 95percentile flows

The following link has flow data for the Combe Haven at Crowhurst in the absence of any other data estimate Q95 based this information

http://www.nwl.ac.uk/ih/nrfa/station_summaries/041/017.html

Catchment Area	30.74	km2
95% exceedance (Q95)	0.02	m3/s
Estimate of (Q95) flow per km2	0.00065	m3/s/km2

	Name	Area (ha) (1)	Q95 (m3/s)	Q95 (m3/day)	Start CH	End CH	Road Width (m)	Area (m2)	Runoff coeficient	Rainfall depth (mm/day) (2)	Runoff Volume (m3/day)
A	Egerton Stream	420	0.0027	236.10	0	1460	12	17520	0.85	9	134.028
B	Combe Haven	582	0.0038	327.16	1460	2700	12	14880	0.85	9	113.832
C	Watermill Stream	1390.00	0.0090	781.37	2700	3850	12	13800	0.85	9	105.57
D	Powder Mill Stream	1750	0.0114	983.73	3850	4400	12	6600	0.85	9	50.49
E	Decoy Pond Stream	353	0.0023	198.43	4400	5500	12	13200	0.85	9	100.98

(1) Taken from Bullen Allen Report where Combe Haven is total Combe Haven 1-4
(2) Figure 3.1 11.3.10

	AADT (3)	Copper Total (kg/ha/a) (4)	Coper Soluble (kg/ha/a) (4)	5 day Dissolved Copper build up M (kg)	Copper EQSmax (mg/l) (5)	Take Cb=0.5 EQSmax (mg/l) (6)	Resulting copper Concentration Cr (mg/l) (7)	<EQSmax	Additional pollution control devices required ?
A	28800	1	0.4	0.0096	0.112	0.06	0.062	yes	no
B	28800	1	0.4	0.0082	0.112	0.06	0.060	yes	no
C	28800	1	0.4	0.0076	0.112	0.06	0.058	yes	no
D	28800	1	0.4	0.0036	0.112	0.06	0.057	yes	no
E	28800	1	0.4	0.0072	0.112	0.06	0.061	yes	no

(3) Given by Dougs email 17/3/6
(4) Table 3.1 11.3.10
(5) Taken from table 2 11.3.10
(6) See Vol 11 Sec 3 Pt 10 A3.2 No3
(7) Cr=[(CbxQ95)+(1000*M)]/(Q95+V)

	AADT (3)	Zinc Total (kg/ha/a) (4)	Zinc Soluble (kg/ha/a) (4)	5 day Dissolved Zinc build up M (kg)	Zinc EQSmax (mg/l) (5)	Take Cb=0.5 EQSmax (mg/l) (6)	Resulting zinc Concentration Cr (mg/l) (7)	<EQSmax	Additional pollution control devices
A	28800	2	1	0.0240	0.5	0.25	0.224	yes	no
B	28800	2	1	0.0204	0.5	0.25	0.232	yes	no
C	28800	2	1	0.0189	0.5	0.25	0.242	yes	no
D	28800	2	1	0.0090	0.5	0.25	0.247	yes	no
E	28800	2	1	0.0181	0.5	0.25	0.226	yes	no

Additional Pollution Control Devices Required **NO**

Method for Predicting Accidental Spilliage

	All Purpose Urban/Rural	Road Length (km)	Section	Length	SS (8)	HGV's (%)	Probabilty of serious accident spilliage	Total Probabilty	Risk Reduction Factor (9)	Return Period is 1 in (yrs)	Containment required if less than 1 in100 yr
A	Urban	1.46	No Junction	1.16	0.0039	1.4	0.000666				
			Cross Road	0.3	0.0159	1.4	0.000702				
			Side Road	0.3	0.0106	1.4	0.000468	0.0018	0.45	1211	no
B	Rural	1.24	No Junction	1.04	0.0017	1.4	0.000260				
			Side Road	0.3	0.0042	1.4	0.000185	0.0004	0.75	2992	no
C	Rural	1.15	No Junction	1.15	0.0017	1.4	0.000288	0.0003	0.75	4634	no
D	Rural	0.55	No Junction	0.55	0.0017	1.4	0.000138	0.0001	0.75	9690	no
E	Rural	1.10	No Junction	1.00	0.0017	1.4	0.000250				
				0.30	0.0042	1.4	0.000185	0.0004	0.75	3061	no

(8) Taken from table 3.2
(9) Tablee 3.3 11.3.10

Containment Required **NO**

5 Grass Swales Design -Catchments B-E

Disscussed soil type/information with Nigel as to the suitability of Swales. The soils are likely to have permeabilities less than 10-6 m/s therefore treat as impermeable (in terms of swale design). The groundwater table is likely to be more than 1m deep in most locations therefore a liner is not likely to be required.
Note that in the drainage report it is stated that all slopes and cuttings will be intercepted therefore swale catchments include the road and the swale width only

Hydralic Requirements
No surcharge in 1 in 1 year event
No flood in 1 in 5 year event

Design Criteria (Using Ciria 609)

Mannings n value	0.3		Table 9.7.6 Ciria 609 for base		
Mannings n value	0.035		Channel Walls high grass		
Mannings n value	0.021		Unsealed verge		
Max Velocity	0.91	m/s	Table 9.7.7 Ciria 609 for Clay, clay loam, sandy clay, silty clay (Seeded)		
Max Velocity	1.5	m/s	Table 9.7.7 Ciria 609 for Clay, clay loam, sandy clay, silty clay (Turfed)		
Min Residence Time	10	min	Box 9.7.1 Ciria 609		
Min Base Width	600	mm	Box 9.7.1 Ciria 609		
Max Base Width	2.5-3	m			
Max side slope	1 in 4		Box 9.7.1 Ciria 610	HA37 recommends for trapazoidal channels a max side slope of 1in 4.5	
USE	1 in 4.5			with 1in4 only used in exeptional cases	
Max hieght for water quality treatment volume	100	mm			
Max Depth of Flow	150	mm	HA37 recommends the depth of flow does not exceed 150mm		
Min Grade	1 in 100	or	1%		
Absolute Min Grade	For grades less than 1% underdrains can be used to keep base from becoming bogged				
Max Grade	1 in 50	or	2%		
Absolute Max Grade	1 in 25	or	4%	**USE underdrains for grades flatter than**	**1 in 100**

Note: Where steeper than 1 in 25 then use concrete channels. **USE Max Grade for swales** **1 in25**

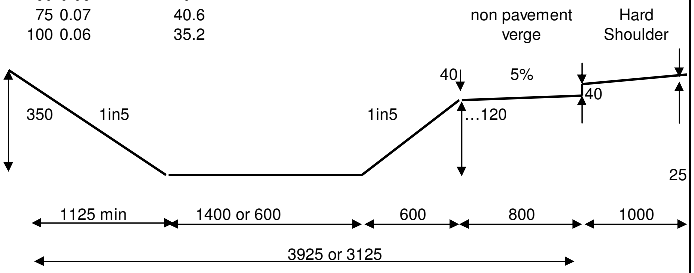
Carriageway Width	10	m
Hard Shoulder	1	m
Total Width	12	m

Treatment Volume Calculation
Use fixed depth method from table 4.3 Ciria 609
Depth of rainfall 15 mm From CIRIA 609 Table 4.3 (Taken Conservative Value)
Use 1 in 5 slopes as

For mono camber	Width of Road	12	m		
	Depth of Water	100	mm	ie flow depth below hieght of vegetation	
	Treatment Volume	0.18	m3/m	Assuming 100% runoff from the carriageway	
	Base Width	1350	m		
For dual camber	Width of Road	6	m	**USE Min base width of swale for mono camber**	**1350mm**
	Treatment Volume	0.09	m3/m		
	Base Width	450	m	Is less than 600 therefore use 600mm as minimum base width	
				USE Min base width of swale for dual camber	**600mm**

Check for min channel lenghs for residence time

Base Width	Top Width	Area	Wetted Perime	Slope 1in	Velocity	Min Length
1.35	2.25	0.180	2.175	25	0.13	76.0
1.35	2.25	0.180	2.175	50	0.09	53.7
1.35	2.25	0.180	2.175	75	0.07	43.9
1.35	2.25	0.180	2.175	100	0.06	38.0
0.6	1.5	0.105	1.425	25	0.12	70.3
0.6	1.5	0.105	1.425	50	0.08	49.7
0.6	1.5	0.105	1.425	75	0.07	40.6
0.6	1.5	0.105	1.425	100	0.06	35.2



Averaged mannings n based on
3.925m total width for input into MD 0.13
Where base n=.3, slope n=0.035, non pavement verge n=0.021
Note in certain areas this way need to be reduced to fit the profile of the land
This could include
Reducing the main channel to but not less than 100mm
Steepen the banks up to 1 in 4
Therefore minimum overall width
Mono Camber =4*180+1350+4*100+800=3270
Dual Camber =4*180+600+4*100+800=2520

USE typical section for swale as per diagram above **see diag**
Use averaged Mannings n for swale of **0.13**

Outlet Design
Max flow in the channel is during a 1 in 5 year event where the flow depth is at or less than 150mm and at max grade ie 1 in 25
Qd is the design flow at 100mm deep Qs is the design flow at 150mm deep
The maximum flow approaching the outlet is where the road slope is 1 in 25 (ie max slope)

	Base Width	slope 1in		n de slope 1in	Depth	B	A	P	Discharge Q	F
Channel Full	1.4	25	0.13	5	0.100	2.4	0.190	2.420	0.054	0.179
Surcharge	1.4	25	0.13	5	0.150	2.9	0.323	2.930	0.114	0.203

Therfore from Figures B19 and B20 two gratings will be adequate.
For in-line outlet Trapezoidal channels the width of Grating G is determined by
G/y1=3.0 y1=0.1 which gives min G=0.3m <--- This is small **For outlet use HCD Detail similar to** **F23**

6 **Catchment E - Decoy Pond Stream**

Assume that from approx chainage 5300 that kerb and gully will be used instead of swales. This allows that if the trainline is shallow methods such as beaney blocks could be used in this area to minimise depth over the trainline.
Concrete channel is proposed where the camber changes over at approx chainage 5000 to the proposed outfall. This is to allow for the relatively steep grade ie steeper than 1 in 25
All other areas allow the use of swales 1400 wide at the base and overall width 3925 width

Design of Concrete Channel
Use averaged grade of 1 in 18 for establishing outfalls and channel dimensions
Estimate Length of channel to be drained prior to outfall

b1	5	y1	0.083	S	0.056	N	1	2minM5	4.000
b2	5	y3	0.117	n	0.013	We	12.000	From Fig 3 HA 37	

r	0.981	From Eqn 7 HA37
B	0.83	=b1y1+b2y1
Boverall	1	=b1y1+b2y3
A	0.034	=0.5*By1
m	1	From Eqn 11 HA37
Gm	4.79E+06	From Eqn 13 HA37
L	158.071	m

Therefore have a outfall max dist 158 m apart or 1 at every manhole when 90 to 100m apart. Use 1m wide channel

USE concrete channel	**1 m wide**
Use mannings n for concrete channel of	**0.013**
For outlet use HCD Detail similar to	**F22**

Design of Petrol Interceptor

Catchment Area 1.319 ha OR 13190 m2

Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
13880	25	375	2500	325	C1	SC	4420	1875	700
Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1						
1450	1350	450/600	2*600						

See table for Petrol Interceptor for requirements	**see table**

From Bullen Consultants Limited Report

For Decoy Pond Crossing 100yr Flood plus 20% increased inflow

Cross section	Model Chainage (m)	Existing condition	Design condition	Design Condition (Crowhurst Weir	Comments
D5	3451	5.166	5.182	5.181	Road Crossing (u/s)
D5R	3486		5.014	5.013	Road Crossing (d/s)

Assume pond is going to be located on upstream side of road. Existing ground min ground level is 5.0m therefore water level in main channel during flooding is not likely to effect discharge from pond if constructed above gound. Assume that there is no infiltration therefore discharge from pond is controled by a hydrobrake with discharge at greenfield rate

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)
Q1	7.800
Q5	11.800
Q30	20.800
Q100	29.300

Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6

Time Area Diagram

Time from (mins)	Time to (mins)	Area (ha)
0	4	0.2264327
4	8	0.5443564
8	12	0.4113605
12	16	0.1039325
16	20	3.26E-02
	Total Area (ha)	1.319

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate		
Return Period	100.000	
M5-60(mm)	19.000	
Ratio R	0.350	
Cv (Summer)	0.750	
Cv (Winter)	0.840	
Imperm Area (ha)	1.319	
Max Allow Discharge	10.000	
Infiltration (m/hr)	0.000	
Safety Factor	2.000	
Climate Change	10%	
Assume Pond Dimensions		
Base Width	9.000	m
Base Length	27	m
Side slope 1in	3	
Depth of Storage	1.500	m

\>>>>>>> **Estimated Range of Storage Required 490-710m3**

Depth vs Storage>>>>>

	Depth	Width	Length	Area	Volume
	0	9	27	243	0
	0.2	10.2	28.2	287.64	53.064
	0.4	11.4	29.4	335.16	115.632
	0.6	12.6	30.6	385.56	188.568
	0.8	13.8	31.8	438.84	272.736
	1	15	33	495	369
	1.2	16.2	34.2	554.04	478.224
	1.4	17.4	35.4	615.96	601.272
	1.6	18.6	36.6	680.76	739.008
Design 100 year depth with	1.8	19.8	37.8	748.44	892.296
site runoff>>>	**1.510**	**18.059**	**36.059**	**651.171**	**675.00**

Source Control Results

Return Period	Duration	Depth	Vol
100	480.0	1.442	611.3

Add Runoff from Pond Area

Area of Ponds	900	m2		
Rain	8.44	mm/hr		
Runoff	67.52	mm	60.77	
Total Volume required			**672.1**	say 675m3

Note Windes Allows for Climate Control

Required Storage for Pond E	**675 m3**
Using pond dimensions	
Base Width	**9 m**
Base Length	**27 m**
Side Slope 1in	**3**
Assumed Base Level R.L. (m)	**5.000**
100 year design level	**6.510**
Freeboard	**0.300**
Min top of pond level	**6.810**

7 **Catchment D2 - Powder Mill Stream**

All other areas allow the use of swales 1400 wide at the base and overall width 3925 width

Design of Petrol Interceptor

Catchment Area	1.019	ha	OR	10190 m2

Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
11110	20	300	2000	320	C1	SC	3535	1875	700

Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1
1450	1350	450/600	2*600

See table for Petrol Interceptor for requirements **see table**

From Bullen Consultants Limited Report

For Powder Mill Stream Crossing 100yr Flood plus 20% increased inflow

Cross section	Model Chainage (m)	Existing condition	Design condition	Design Condition (Crowhurst Weir Removed)	Comments	
P4	5404	4.398	4.672	4.672	Road Crossing (u/s)	
P4R	5439		4.434	4.434	Road Crossing (d/s)	
P4 FPR	710	3.179	3.2	4.706	Road Crossing (u/s)	<-- Right Flood Plain
P4R FPR	745		2.83	2.811	Road Crossing (d/s)	<-- Right Flood Plain

Time Area Diagram

Time from (mins)	Time to (mins)	Area (ha)
0	4	0.08990677
4	8	0.01334433
8	12	0
12	16	0
16	20	0.08233286
20	24	0.05802532
24	28	0.05587892
28	32	0.06253641
32	36	0.07167145
36	40	0.0752231
40	44	0.04812275
44	48	0.05610741
48	52	0.05751631
52	56	0.07405981
56	60	0.02595302
60	64	9.64E-02
64	68	0.1356955
68	72	0.01622579
	Total Area (ha)	1.019

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)
Q1	6.200
Q5	9.300
Q30	16.500
Q100	23.300

Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate	
Return Period	100.000
M5-60(mm)	19.000
Ratio R	0.350
Cv (Summer)	0.750
Cv (Winter)	0.840
Imperm Area (ha)	1.019
Max Allow Discharge	10.000
Infiltration (m/hr)	0.000
Safety Factor	2.000
Climate Change	10%

>>>>>>> Estimated Range of Storage Required 349-510m3

Assume Pond Dimensions		
Base Width	15.0	m
Base Length	60	m
Side slope 1in	3	
Depth of Storage	0.500	m

Depth vs Storage>>>>>	Depth	Width	Length	Area	Volume
	0	15	60	900	0
	0.2	16.2	61.2	991.44	123.444
	0.4	17.4	62.4	1085.76	265.752
	0.6	18.6	63.6	1182.96	427.788
	0.8	19.8	64.8	1283.04	610.416
	1	21	66	1386	814.5
	1.2	22.2	67.2	1491.84	1040.904
Design 100 year depth with	1.4	23.4	68.4	1600.56	1290.492
site runoff>>>	**0.47**	**17.85**	**62.85**	**1121.79**	**480.00**

Return Period	Duration	Depth	Vol	
100	360.0	0.441	441.4	
Add Runoff from Pond Area				
Area of Ponds	610	m2		
Rain	8.44	mm/hr		
Runoff	50.64	mm	30.89	
Total Volume required			**472.3**	say 480m3

Required Storage for Pond D2	**480 m3**
Using pond dimensions	
Base Width	**15 m**
Base Length	**60 m**
Side Slope 1in	**3**
Assumed Base Level R.L. (m)	**2.000**
100 year design level	**2.475**
Freeboard	**0.300**
Min top of pond level	**2.775**
Hydrobrake Design Head	**0.500**
Hydrobrake Design Flow	**10l/s**
Hydrobrake	**MD6**
Hydrobrake Dia	**138mm**

8 **Catchment D1 - Powder Mill Stream**

All other areas allow the use of swales 1400 wide at the base and overall width 3925 width

Design of Petrol Interceptor

Catchment Area	0.580	ha	OR	5800	m2

Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
7200	13	195	1300	213	C1	SC	4400	1225	510/650

Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1
1400	1300	300	1*600/750

See table for Petrol Interceptor for requirements **see table**

From Bullen Consultants Limited Report

For Powder Mill Stream Crossing 100yr Flood plus 20% increased inflow

Cross section	Model Chainage (m)	Existing condition	Design condition	Design Condition (Crowhurst Weir Removed)	Comments	
P4	5404	4.398	4.672	4.672	Road Crossing (u/s)	
P4R	5439		4.434	4.434	Road Crossing (d/s)	
P4 FPR	710	3.179	3.2	4.706	Road Crossing (u/s)	<-- Right Flood Plain
P4R FPR	745		2.83	2.811	Road Crossing (d/s)	<-- Right Flood Plain

Assume pond is going to be located on downstream side of road in flood plain. Existing ground min ground level is 2.0m therefore water level in floodplain is likely to effect discharge from pond if constructed with base at existing gound level. Assume that there is no infiltration therefore discharge from pond is controled by a hydrobrake with discharge at greenfield rate

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)
Q1	3.800
Q5	5.700
Q30	10.000
Q100	14.100

Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6

Time Area Diagram

Time from (mins)	Time to (mins)	Area (ha)
0	4	0
4	8	0.01197687
8	12	0.06982661
12	16	0.08996098
16	20	0.06672771
20	24	0.08006895
24	28	0.09328491
28	32	0.07308805
32	36	7.61E-02
36	40	0.01891053
	Total Area (ha)	0.580

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate		
Return Period	100.000	
M5-60(mm)	19.000	
Ratio R	0.350	
Cv (Summer)	0.750	
Cv (Winter)	0.580	
Imperm Area (ha)	0.580	
Max Allow Discharge	10.000	
Infiltration (m/hr)	0.000	
Safety Factor	2.000	
Climate Change	10%	
Assume Pond Dimensions		
Base Width	15.0	m
Base Length	30.0	m
Side slope 1in	3	
Depth of Storage	0.500	m

Estimated Range of Storage Required 162-245m3

Depth vs Storage>>>>>

Depth	Width	Length	Area	Volume
0	15	30	450	0
0.2	16.2	31.2	505.44	95.544
0.4	17.4	32.4	563.76	202.752
0.6	18.6	33.6	624.96	322.488
0.8	19.8	34.8	689.04	455.616
1	21	36	756	603
1.2	22.2	37.2	825.84	765.504
1.4	23.4	38.4	898.56	943.992
0.46	**17.74**	**32.74**	**580.62**	**235.000**

Design 100 year depth with site runoff>>>

Return Period	Duration	Depth	Vol
100	180.0	0.413	209.6

Add Runoff from Pond Area

Area of Ponds	460	m2		
Rain	17.74	mm/hr		
Runoff	53.22	mm	24.48	
Total Volume required			**234.1**	say 235m3

Required Storage for Pond D1	**235 m3**
Using pond dimensions	
Base Width	**15.0 m**
Base Length	**30.0 m**
Side Slope 1in	**3**
Assumed Base Level R.L. (m)	**2.000**
100 year design level	**2.456**
Freeboard	**0.300**
Hydrobrake Design Head	**0.500**
Hydrobrake Design Flow	**10l/s**
Hydrobrake	**MD6**
Hydrobrake Dia	**138mm**

9 **Catchment C2 - Watermill Stream**

All other areas allow the use of swales 1400 wide at the base and overall width 3925 width

Design of Petrol Interceptor

Catchment Area	0.750	ha	OR	7500	m2

Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
8330	15	225	1500	315	C1	SC	2755	1875	700
Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1						
1450	1350	450	2*600						

See table for Petrol Interceptor for requirements **see table**

From Bullen Consultants Limited Report

For Water Mill Stream Crossing 100yr Flood plus 20% increased inflow

Cross section	Model Chainage (m)	Existing condition	Design condition	Design Condition (Crowhurst Weir Removed)	Comments	
W6R	6546		3.381	3.375	Road Crossing (u/s)	
W6	6581	3.290	3.335	3.328	Road Crossing (d/s)	
W6R FPR	755		3.49	3.49	Road Crossing (u/s)	<-- Right Flood Plain
W6 FPR	790	3.327	3.152	3.11	Road Crossing (d/s)	<-- Right Flood Plain
W6R FPL	740		3.22	3.22	Road Crossing (u/s)	<-- Left Flood Plain
W6 FPL	775	3.184	2.83	2.811	Road Crossing (d/s)	<-- Left Flood Plain

The gound level on the true left is approximately 2.5m therefore flooding on the flood plain is likely to have minimal effect on the outfall of the proposed pond. If constructed above existing ground levels.

Time Area Diagram

Time from (mins)	Time to (mins)	Area (ha)
0	4	0
4	8	0.02599807
8	12	1.46E-02
12	16	1.81E-02
16	20	6.14E-02
20	24	1.14E-01
24	28	0.1594187
28	32	3.55E-02
32	36	1.14E-01
36	40	1.69E-02
40	44	0.06323069
44	48	1.27E-01
	Total Area (ha)	0.750

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)	
Q1	4.700	Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6
Q5	7.100	
Q30	12.600	
Q100	17.700	

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate	
Return Period	100.000
M5-60(mm)	19.000
Ratio R	0.350
Cv (Summer)	0.750
Cv (Winter)	0.840
Imperm Area (ha)	0.750
Max Allow Discharge	10.000
Infiltration (m/hr)	0.000
Safety Factor	2.000
Climate Change	10%

\>>>>>>> **Estimated Range of Storage Required 231-342m3**

Assume Pond Dimensions		
Base Width	12.0	m
Base Length	48.0	m
Side slope 1in	3	
Depth of Storage	0.500	m

Depth vs Storage>>>>>

	Depth	Width	Length	Area	Volume
	0	12	48	576	0
	0.2	13.2	49.2	649.44	122.544
	0.4	14.4	50.4	725.76	260.352
	0.6	15.6	51.6	804.96	414.288
	0.8	16.8	52.8	887.04	585.216
	1	18	54	972	774
	1.2	19.2	55.2	1059.84	981.504
Design 100 year depth with	1.4	20.4	56.4	1150.56	1208.592
site runoff>>>	**0.49**	**14.96**	**50.96**	**762.29**	**330.00**

Return Period	Duration	Depth	Vol
100	240.0	0.447	294.6

Add Runoff from Pond Area

Area of Ponds	580	m2		
Rain	14.29	mm/hr		
Runoff	57.16	mm	33.15	
Total Volume required			**327.8**	say 330m3

Required Storage for Pond C2	**330 m3**
Using pond dimensions	
Base Width	**12.0m**
Base Length	**48.0m**
Side Slope 1in	**3**
Assumed Base Level R.L. (m)	**2.500**
100 year design level	**2.993**
Freeboard	**0.300**
Min top of pond level	**3.293**
Hydrobrake Design Head	**0.500**
Hydrobrake Design Flow	**10l/s**
Hydrobrake	**MD6**
Hydrobrake Dia	**138mm**

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		Check by B D Burgess

10 **Catchment C1 - Watermill Stream**

All other areas allow the use of swales 1400 wide at the base and overall width 3925 width

Design of Petrol Interceptor

Catchment Area	0.604	ha	OR	6040	m2

Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
7200	13	195	1300	213	C1	SC	4400	1225	510/650

Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1
1400	1300	300	1*600/750

See table for Petrol Interceptor for requirements **see table**

From Bullen Consultants Limited Report

For Water Mill Stream Crossing 100yr Flood plus 20% increased inflow

Cross section	Model Chainage (m)	Existing condition	Design condition	Design Condition (Crowhurst Weir Removed)	Comments	
W6R	6546		3.381	3.375	Road Crossing (u/s)	
W6	6581	3.290	3.335	3.328	Road Crossing (d/s)	
W6R FPR	755		3.49	3.49	Road Crossing (u/s)	<-- Right Flood Plain
W6 FPR	790	3.327	3.152	3.11	Road Crossing (d/s)	<-- Right Flood Plain
W6R FPL	740		3.22	3.22	Road Crossing (u/s)	<-- Left Flood Plain
W6 FPL	775	3.184	2.83	2.811	Road Crossing (d/s)	<-- Left Flood Plain

The gound level on the true right is approximately 3.0m therefore flooding on the flood plain is likely to have minimal effect on the outfall of the proposed pond. If constructed above existing ground levels.

Time Area Diagram		
Time from (mins)	Time to (mins)	Area (ha)
0	4	0
4	8	2.66E-02
8	12	7.70E-02
12	16	0.1348184
16	20	0.1198213
20	24	7.99E-02
24	28	9.22E-02
28	32	7.35E-02
	Total Area (ha)	0.604

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)
Q1	3.900
Q5	5.900
Q30	10.400
Q100	14.600

Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate	
Return Period	100.000
M5-60(mm)	19.000
Ratio R	0.350
Cv (Summer)	0.750
Cv (Winter)	0.840
Imperm Area (ha)	0.604
Max Allow Discharge	10.000
Infiltration (m/hr)	0.000
Safety Factor	2.000
Climate Change	10%

\>>>>>>> **Estimated Range of Storage Required 171-258m3**

Assume Pond Dimensions		
Base Width	12.0	m
Base Length	36.0	m
Side slope 1in	3	
Depth of Storage	0.500	m

Depth vs Storage>>>>>

	Depth	Width	Length	Area	Volume
	0	12	36	432	0
	0.2	13.2	37.2	491.04	92.304
	0.4	14.4	38.4	552.96	196.992
	0.6	15.6	39.6	617.76	314.928
	0.8	16.8	40.8	685.44	446.976
	1	18	42	756	594
	1.2	19.2	43.2	829.44	756.864
	1.4	20.4	44.4	905.76	936.432
Design 100 year depth with site runoff>>>	**0.49**	**14.96**	**38.96**	**582.66**	**250.00**

Return Period	Duration	Depth	Vol
100	180.0	0.446	222.1

Add Runoff from Pond Area

Area of Ponds	450	m2		
Rain	17.74	mm/hr		
Runoff	53.22	mm	23.95	
Total Volume required			**246.0**	say 250m3

Required Storage for Pond C1	**250 m3**
Using pond dimensions	
Base Width	**12.0 m**
Base Length	**36.0m**
Side Slope 1in	**3**
Assumed Base Level R.L. (m)	**3.000**
100 year design level	**3.493**
Freeboard	**0.300**
Min top of pond level	**3.793**
Hydrobrake Design Head	**0.500**
Hydrobrake Design Flow	**10l/s**
Hydrobrake	**MD6**
Hydrobrake Dia	**138mm**

11 **Catchment B2 - Combe Haven**

All other areas allow the use of swales 1400 wide at the base and overall width 3925 width

Design of Petrol Interceptor

Catchment Area	0.706	ha	OR	7060	m2

Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
7200	13	195	1300	213	C1	SC	4400	1225	510/650

Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1
1400	1300	300	1*600/750

See table for Petrol Interceptor for requirements **see table**

From Bullen Consultants Limited Report

For Combe Haven Crossing 100yr Flood plus 20% increased inflow

Cross section	Model Chainage (m)	Existing condition	Design condition	Design Condition (Crowhurst Weir Removed)	Comments	
CH24R	2175		3.908	3.907	Road Crossing (u/s)	
CH23R	2210		3.768	3.767	Road Crossing (d/s)	
W24R FPR	50		4	4	Road Crossing (u/s)	<-- Right Flood Plain
W23R FPR	85		3.053	3.054	Road Crossing (d/s)	<-- Right Flood Plain
W24R FPL3	50		4.25	4.25	Road Crossing (u/s)	<-- Left Flood Plain
W23R FPL3	85		3.011	3.008	Road Crossing (d/s)	<-- Left Flood Plain

The gound level on the true left is 4.5 falling quickly to 4.0m therefore flooding on the flood plain is likely to have minimal effect on the outfall of the proposed pond. If constructed above existing ground levels.

Time Area Diagram		
Time from (mins)	Time to (mins)	Area (ha)
0	4	0
4	8	3.07E-02
8	12	1.64E-01
12	16	0.1239842
16	20	0.09851091
20	24	5.23E-02
24	28	9.53E-02
28	32	4.67E-02
32	36	8.81E-02
36	40	6.33E-03
	Total Area (ha)	0.706

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)
Q1	4.500
Q5	6.700
Q30	11.900
Q100	16.800

Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate	
Return Period	100.000
M5-60(mm)	19.000
Ratio R	0.350
Cv (Summer)	0.750
Cv (Winter)	0.840
Imperm Area (ha)	0.706
Max Allow Discharge	10.000
Infiltration (m/hr)	0.000
Safety Factor	2.000
Climate Change	10%

\>>>>>>> **Estimated Range of Storage Required 211-316m3**

Assume Pond Dimensions		
Base Width	14.0	m
Base Length	42.0	m
Side slope 1in	3	
Depth of Storage	0.500	m

Depth vs Storage>>>>>	Depth	Width	Length	Area	Volume
	0	14	42	588	0
	0.2	15.2	43.2	656.64	124.464
	0.4	16.4	44.4	728.16	263.232
	0.6	17.6	45.6	802.56	417.168
	0.8	18.8	46.8	879.84	587.136
	1	20	48	960	774
	1.2	21.2	49.2	1043.04	978.624
Design 100 year depth with	1.4	22.4	50.4	1128.96	1201.872
site runoff>>>	**0.46**	**16.78**	**44.78**	**751.26**	**310.00**

Return Period	Duration	Depth	Vol
100	240.0	0.415	274.3

Add Runoff from Pond Area				
Area of Ponds	590	m2		
Rain	14.29	mm/hr		
Runoff	57.16	mm	33.72	
Total Volume required			**308.0**	say 310m3

Required Storage for Pond B2	**310 m3**
Using pond dimensions	
Base Width	**14.0m**
Base Length	**42.0m**
Side Slope 1in	**3**
Assumed Base Level R.L. (m)	**4.000**
100 year design level	**4.463**
Freeboard	**0.300**
Min top of pond level	**4.763**
Hydrobrake Design Head	**0.500**
Hydrobrake Design Flow	**10l/s**
Hydrobrake	**MD6**
Hydrobrake Dia	**138mm**

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	Subject: Preliminary Drainage Design	Calc by: C. Pemberton
		Check by B D Burgess

12 Catchment B1 - Combe Haven

Have assumed piped system from the crest of the hill (approx ch 1500) until the chamber changes (approx ch 1900)
All other areas allow the use of swales 1400 wide at the base and overall width 3925 width

Design of Petrol Interceptor

Catchment Area 1.014 ha OR 10140 m2
Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
11110	20	300	2000	320	C1	SC	3535	1875	700
Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1						
1450	1350	450/600	2*600						

See table for Petrol Interceptor for requirements **see table**

From Bullen Consultants Limited Report

For Combe Haven Crossing 100yr Flood plus 20% increased inflow

Cross section	Model Chainage (m)	Existing condition	Design condition	Design Condition (Crowhurst Weir Removed)	Comments	
CH24R	2175		3.908	3.907	Road Crossing (u/s)	
CH23R	2210		3.768	3.767	Road Crossing (d/s)	
W24R FPR	50		4	4	Road Crossing (u/s)	<-- Right Flood Plain
W23R FPR	85		3.053	3.054	Road Crossing (d/s)	<-- Right Flood Plain
W24R FPL3	50		4.25	4.25	Road Crossing (u/s)	<-- Left Flood Plain
W23R FPL3	85		3.011	3.008	Road Crossing (d/s)	<-- Left Flood Plain

The gound level on the true right is 4.0m therefore flooding on the flood plain is likely to have minimal effect on the outfall of the proposed pond. If constructed above existing ground levels.

Time Area Diagram		
Time from (mins)	Time to (mins)	Area (ha)
0	4	3.68E-03
4	8	1.84E-01
8	12	0.3002219
12	16	0.1393496
16	20	0.1487742
20	24	0.1334207
24	28	0.1044165
	Total Area (ha)	1.014

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)
Q1	6.200
Q5	9.300
Q30	16.500
Q100	23.200

Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate	
Return Period	100.000
M5-60(mm)	19.000
Ratio R	0.350
Cv (Summer)	0.750
Cv (Winter)	0.840
Imperm Area (ha)	1.014
Max Allow Discharge	10.000
Infiltration (m/hr)	0.000
Safety Factor	2.000
Climate Change	10%

>>>>>>> **Estimated Range of Storage Required 347-509m3**

Assume Pond Dimensions		
Base Width	18.0	m
Base Length	54.0	m
Side slope 1in	3	
Depth of Storage	0.500	m

	Depth	Width	Length	Area	Volume
Depth vs Storage>>>>>					
	0	18	54	972	0
	0.2	19.2	55.2	1059.84	203.184
	0.4	20.4	56.4	1150.56	424.512
	0.6	21.6	57.6	1244.16	664.848
	0.8	22.8	58.8	1340.64	925.056
	1	24	60	1440	1206
	1.2	25.2	61.2	1542.24	1508.544
Design 100 year depth with	1.4	26.4	62.4	1647.36	1833.552
site runoff>>>	**0.47**	**20.84**	**56.84**	**1184.40**	**510.00**

Return Period	Duration	Depth	Vol
100	360.0	0.417	443.4

Add Runoff from Pond Area

Area of Ponds	925	m2	
Rain	10.5	mm/hr	
Runoff	63.00	mm	58.28
Total Volume required			**501.7** say 510m3

Required Storage for Pond B1	**510 m3**
Using pond dimensions	
Base Width	**18.0m**
Base Length	**54.0m**
Side Slope 1in	**3**
Assumed Base Level R.L. (m)	**4.000**
100 year design level	**4.473**
Freeboard	**0.300**
Min top of pond level	**4.773**
Hydrobrake Design Head	**0.500**
Hydrobrake Design Flow	**10l/s**
Hydrobrake	**MD6**
Hydrobrake Dia	**138mm**

13 **Catchment A2 - Egerton Stream outfall approx chainage 700**

Have assumed piped system from the crest of the hill (approx ch 1500)
Assume that all embankments/cuttings will be drained into piped system including subsoil drainage. The model includes areas however does not include any pipework from the embankment drainage.

Design of Petrol Interceptor
Catchment Area 1.521 ha OR 15213 m2
Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
16660	30	450	3000	330	C1	SC	5755	1875	700

Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1
1450	1350	450/600	2*600

See table for Petrol Interceptor for requirements **see table**

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)
Q1	8.900
Q5	13.300
Q30	23.600
Q100	33.200

Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6

Time Area Diagram		
Time from (mins)	Time to (mins)	Area (ha)
0	4	7.53E-02
4	8	6.78E-01
8	12	0.6920562
12	16	0.07552569
Total Area (ha)		1.521

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate	
Return Period	100.000
M5-60(mm)	19.000
Ratio R	0.350
Cv (Summer)	0.750
Cv (Winter)	0.840
Imperm Area (ha)	1.521
Max Allow Discharge	10.000
Infiltration (m/hr)	0.000
Safety Factor	2.000
Propose Using Pipe Storage	

\>>>>>>> **Estimated Range of Storage Required 594-855m3**

Pipe Input to Source Control	Pipe 1	Pipe 2
Storage Pipe Diameter	1.8	1.8
Strorage Pipe Slope	200.0	267.0
Strorage Pipe Length	108	163
Downstream Invert Level	12.685	12.685
Upstream Invert Level	13.225	13.295
Downstream Ground Level	15.45	
Climate Change %	10	

<--Assume Design GL lifted to 15.45 at DS Manhole to provide 900 cover though road
<--- Take 10% additional rainfall as equivalent to 20% increase in runoff for larger events (Ciria 609 section 4.6)

Output from Source Control

Return Period	Duration	Depth	Vol
100	360.0	2.248	691.7

See Pipe Input for Storage **see table**
Assumed Road Level **15.45**

14 **Catchment A1 - Egerton Stream outfall approx chainage 150**

Includes section parralel to storage pipes in catchment A2
Assume that all embankments/cuttings will be drained into piped system including subsoil drainage. The model includes areas however does not include any pipework from the embankment drainage.

Design of Petrol Interceptor
Catchment Area 0.850 ha OR 8500 m2
Therefore from SPEL Stormceptor by-pass separators size as follows

Catchment Drainage Area m2 (A)	NSB reuired 0.0018x(A)	Oil Storage Litres NSBx15	Silt storage litres NSB x 100	Model	Class	Silt Capacity	Overall Length (mm) L	Overall Width (mm) W	Inlet Invert (mm) A
10000	18	270	1800	318	C1	SC	3200	1875	700

Base to Inlet (mm) B	Base to outlet (mm) C	Max pipe orientation A-I/D-I	No of access shafts x dia (mm) class 1
1450	1350	450/600	2*600

See table for Petrol Interceptor for requirements **see table**

Calculate Greenfield Runoff using Micro Drainage Source Control IH 124 Method

Return Period	Flow (l/s)	
Q1	5.300	Use 10 l/s as minimum discharge recommended in HR Wallingford Working with Water. See table 10.1 and section 10.6
Q5	7.900	
Q30	14.100	
Q100	19.800	

Time Area Diagram		
Time from (mins)	Time to (mins)	Area (ha)
0	4	7.53E-02
4	8	6.78E-01
8	12	0.6920562
12	16	0.07552569
Total Area (ha)		1.521

Calculate Storage Requirement using Windes Source Control

Use quick storage estimate	
Return Period	100.000
M5-60(mm)	19.000
Ratio R	0.350
Cv (Summer)	0.750
Cv (Winter)	0.840
Imperm Area (ha)	0.850
Max Allow Discharge	10.000
Infiltration (m/hr)	0.000
Safety Factor	2.000
Propose Using Pipe Storage	

\>>>>>>> **Estimated Range of Storage Required 274-403m3**

Pipe Input to Source Control	Pipe 1	Pipe 2
Storage Pipe Diameter	1.5	1.5
Strorage Pipe Slope	425.0	386.0
Strorage Pipe Length	97.7	88.5
Downstream Invert Level	7.464	7.464
Upstream Invert Level	7.694	7.693
Downstream Ground Level	9.9	
Climate Change %	10	

<--Assume Design GL lifted to 9.95 from proposed contours
<--- Take 10% additional rainfall as equivalent to 20% increase in runoff for larger events (Ciria 609 section 4.6)

Output from Source Control

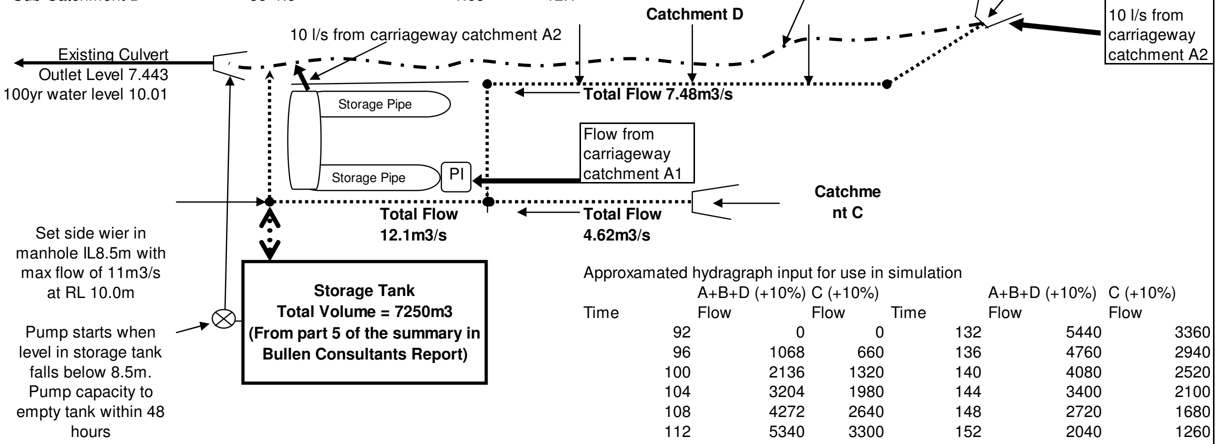
Return Period	Duration	Depth	Vol
100	360.0	2.248	691.7

See Pipe Input for Storage **see table**
Assumed Road Level **15.45**

15 Proposed Egerton Stream Diversion

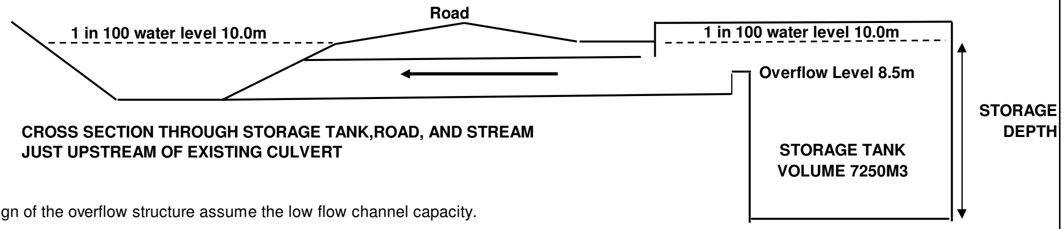
Bullen Consultants Report
From Figure 1.2 subcatchments A, B,C, and D contribute to the flow above culvert at Bexhill High School
Figure 2.2 Shows the Inflow Hydrographs for the 100 year return period. The peak flows are interpolated as follows

Catchment	Catchment Area (ha)	Peak Flow (m3/s)	Say 10% for climate change	Cum Peak Flow (m3/s)
Sub-Catchment A	47	2.6	2.86	2.86
Sub-Catchment B	48	2.7	2.97	5.83
Sub-Catchment C	50	4.2	4.62	10.45
Sub-Catchment D	35	1.5	1.65	12.1



Approxamated hydragraph input for use in simulation

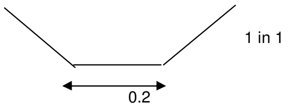
Time	A+B+D (+10%) Flow	C (+10%) Flow	Time	A+B+D (+10%) Flow	C (+10%) Flow
92	0	0	132	5440	3360
96	1068	660	136	4760	2940
100	2136	1320	140	4080	2520
104	3204	1980	144	3400	2100
108	4272	2640	148	2720	1680
112	5340	3300	152	2040	1260
116	6408	3960	156	1360	840
120	7480	4620	160	680	420
124	6800	4200	164	0	0
128	6120	3780			



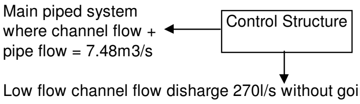
CROSS SECTION THROUGH STORAGE TANK,ROAD, AND STREAM JUST UPSTREAM OF EXISTING CULVERT

For preliminary design of the overflow structure assume the low flow channel capacity.

Low flow channel (assumed, flow needs confirmation from ESCC)

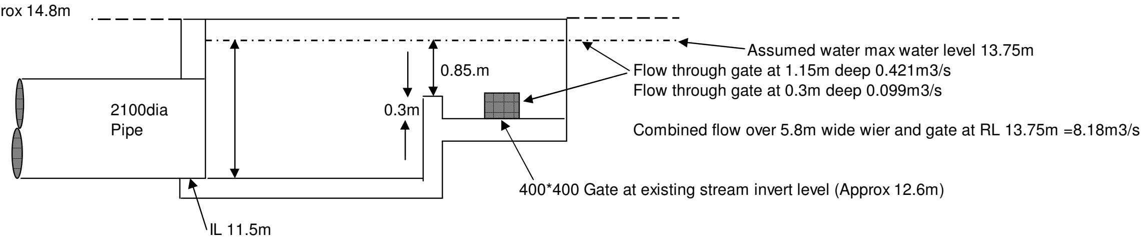


	Low flow	1 in 100 year flow	
n	0.033	0.033	
slope 1in	200	200	
Base Width	0.2	0.2	
Depth	0.320	0.606	m
Side slope 1in	1	1	
A	0.166	0.489	m2
P	1.105	1.915	m
R	0.151	0.255	
Velocity	0.606	0.862	m/s
Discharge Q	0.101	0.421	m3/s
Freeboard		0.3	m
Overal Width		2.01	m



Low flow channel flow disharge 270l/s without going down piped system
Channel will need to be designed for slighly larger flow during 100 year design events.

Proposed Control Structure (Inlet for Egerton Stream
GL approx 14.8m



Calculated using complex controls in source control

INPUT		COMBINED RESULTS			
Gate Control		Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
Coef of Contraction	0.61	0.02	1.1	0.60	1899.9
Height (m)	0.4	0.09	16.0	0.70	2811.5
Width (m)	0.4	0.15	34.5	0.80	3832.4
Level (m)	12.6	0.20	51.1	0.90	4956.7
Weir / Flume Control		0.30	97.6	1.00	6175.3
Discharge Coef	0.544	0.40	462.8	1.10	7481.5
Width (m)	5.8	0.50	1093.9	1.20	8869.4
Crest Level (m)	12.9				

Owen Williams consultants	Client: EAST SUSSEX COUNTY COUNCIL	Sheet No. of
	Project: **BEXHILL TO HASTINGS LINK ROAD**	Job No : 262701 Date: May 2006
	Subject: Preliminary Drainage Design	Calc by: C. Pemberton Check by B D Burgess

15 **Checking Flotation of Pipes/Box Culvert**

Pipe Calculations			Box Culvert Calculations			
Inside Diameter	1.800	m	Inside Width	3.000	m	
Thickness	0.100	m	Inside Hieght	1.800	m	
Outside Diamter	2.000	m	Wall Thicknes	0.200	m	
Density of Concrete	2400	kg/m3	Outside Width	3.400	m	
Wieght of Pipe	1433	kg/m	Outside Hieght	2.200	m	
			Density of Con	2400.000	kg/m3	
			Wieght of BC	4992.000	kg/m	
Density of Water	1000			1000	kg/m3	
Wieght of Water	3142			7480	kg/m	Wieght of water displaced (ie upward force)
w	1760			1760	kg/m3	Average Unit wieght of surface dry backfill
SG	2.65			2.65		Specific gravity of backfill
w1	1096			1096	kg/m3	Average Unit wieght of inundated backfill
H1	0.565			0.668	m	Depth of inundated backfill above top of pipe
H	0.565			0.668	m	Depth from top of pipe to surface of backfill
W1	1709			2488	kg/m	Wieght of inundated backfill directly over the pipe
WD	0			0	kg/m	Wieght of dry backfill directly over the pipe
WB	1709			2488	kg/m	Total wieght of backfill over the pipe
Total Upward Force	3142			7480	kg/m	
Total Down Force	3142			7480	kg/m	

Note the worst case is where the water table is at ground level. Therefore have set H1=H and reduced H1 until the Total Downward force equals the total upward force. This conservative as have not considered friction on the walls of the pipes

Therefore if the depth of cover over the pipes exceeds 0.6m for the 1800dia pipe and 0.7m the pipes will not float. It is unlikely that the water table will be this close to the surface and the pipes will be this shallow therefore flotation is unlikely to cause a problem