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Existing Surface Water Drainage Analysis

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2579 Western Gateway Development Access Road

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Existing Surface Water Drainage Analysis

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2579 Western Gateway Development Access Road



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1.0 Introduction

Burroughs are engaged on a design-and-build basis by Alun Griffiths (Contractors) Ltd to deliver a highway scheme, referred to as Western Gateway Access Road, Wrexham.

These works have been commissioned by Wrexham County Borough Council to provide suitable access to an identified development site, which is located in the West of Wrexham bound between the A483 and A525.

Planning permission has been granted with reference P/2014/0598.

The purpose of this report is to provide an overview of the storm water analysis carried out on the existing surface water system, adjacent to the proposed Western Gateway access road and its capacity to accommodate additional flows from a section of the proposed road.

2.0 Modelling Approach

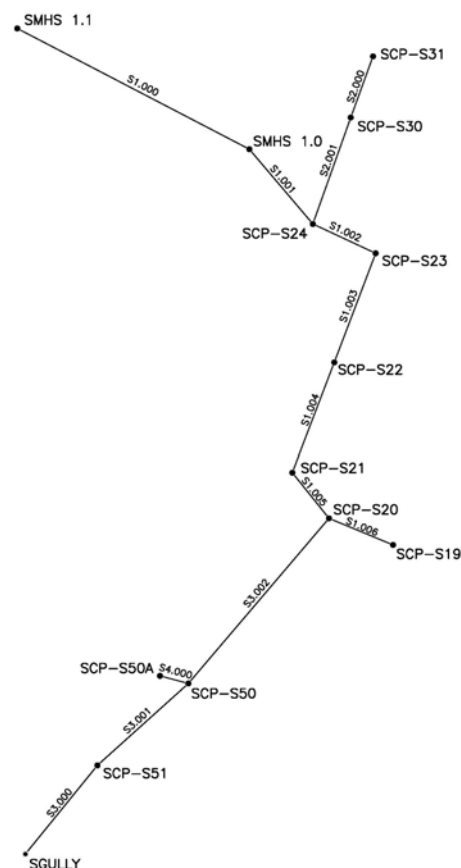
The analysis was carried out with the use of MicroDrainage WinDes.

The geometry for the analysis was determined using the existing and proposed surface water drainage layouts as shown on drawings; 07701_D_503_B, 07701_D_500_E_Working and 2579-C-0500.

Design coordinates and levels for each manhole were input into the model ensuring the correct pipe sizes, and gradients were accurately represented.

Manhole sizes were determined based on standard sizes from the Manual of Contract Documents for Highway Works, Volume 3 – Highway Construction Details – Series F Drainage.

A schematic diagram of the model is as represented below (please note the annotation of pipe numbers will be different to that shown in the drawings listed above but will relate to the model outputs).



The existing system is inclusive of a flow control and attenuation pond that have been suitably modelled and included within the drainage model, details of which are as follows:

- Flow control to limit forward flows from storm water design
Existing flow control has been simulated as a Hydrobrake limited to 5l/s design forward flow with a design head of 1.250m at SCP-S20, which represents the constraint on permitted discharge from the attenuation pond and is consistent

with expected top of water level of 92.572m AOD – 0.128m below the top of pond level (refer to Appendix A);

- **Attenuation Pond Storage**
The existing attenuation pond is modelled as a Pond Storage Structure located at SCP-S20.

The pond plan area has been taken from drawing 07701_D_500_E_Working as 707m² and extrapolated upwards with a 1:3 batter slopes. The potential depth of the pond has been capped to yield a volume not exceeding 705m³ as described on the design plans, this gives a potential depth of 0.845m

General design criteria input to the drainage model has been included in Appendix D for reference, which includes geometrical information.

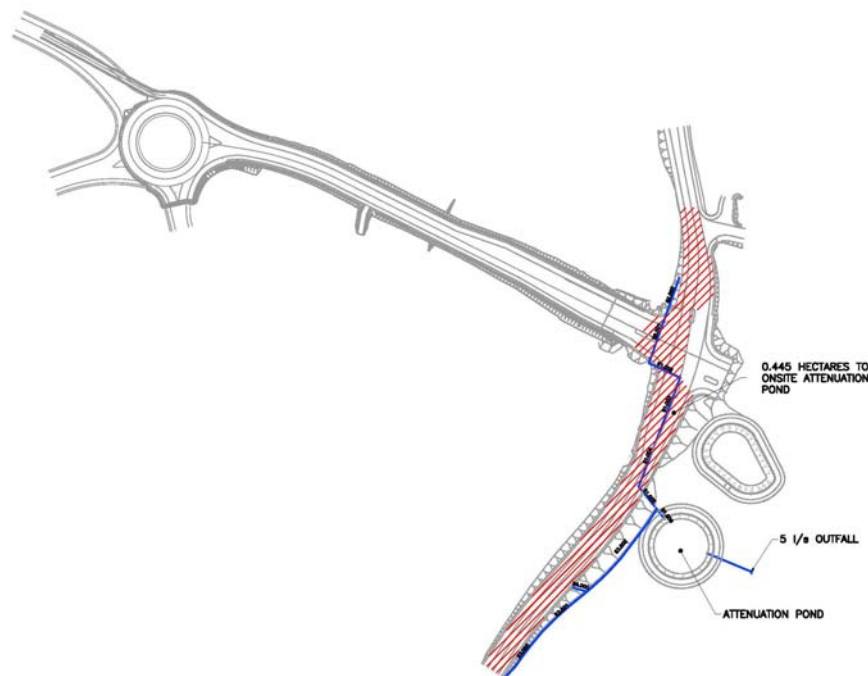
3.0 Storm Water Analysis

To carry out the analysis, the model was placed under various scenarios to determine how the system would react, where the scenarios of interest are as follows:

1. Scenario 1 – The existing drainage system; and
2. Scenario 2 – as Scenario 1 with additional flows from the new section of highway that is to be connected into this existing system.

3.1 Scenario 1 – Existing Drainage System

The contributing area that currently discharges into the existing attenuation pond is 0.455ha (4550m²), shown in the sketch diagram below:



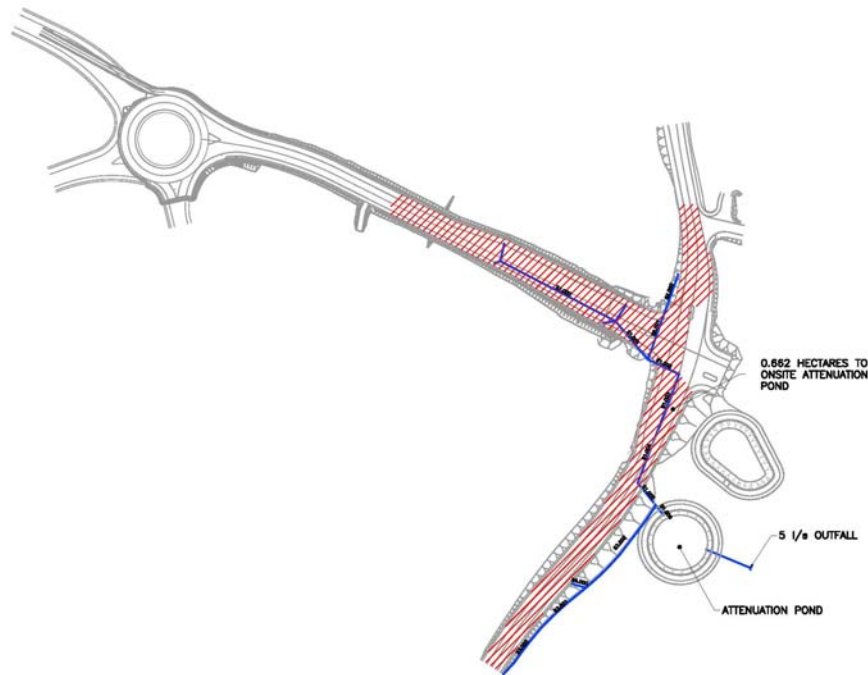
For this scenario, all surface water runoff flows from the highway (as hatched) are directed to the pond for attenuation and will be subjected to the 5l/s forward flow control. In this scenario the pond does not completely fill, where:

- the maximum top water level for the 100yr + 20% climate change event = 92.062mAOD. This is assessed as 0.638m below the top of the pond;
- there are no flooding or exceedance of flow limits from the model; and
- a max forward flow of 5.0l/s is recorded at CP-S20.

Full model results for this scenario can be found in Appendix D.

3.2 Scenario 2 – Addition of New Highway Drainage

The contributing area that would discharge into the existing attenuation pond including the additional section of new highway is 0.662ha (6620m²), shown in the sketch diagram below:



For this scenario, all surface water runoff flows from the existing highway and the proposed section of new highway (as hatched) are directed to the pond for attenuation and will be subjected to the 5l/s forward flow control. In this scenario the pond does not completely fill, where:

- the maximum top water level for the 100yr + 20% climate change event = 92.222mAOD. This is assessed as 0.478m below the top of the pond;
- there are no flooding or exceedance of flow limits from the model; and
- a max forward flow of 5.0l/s is recorded at CP-S20.

Full model results for this scenario can be found in Appendix E.

4.0 Summary

- The pond has sufficient capacity to attenuate run off from the proposed section of highway and limit the pass forward flow to 5l/s for the 100yr + 20% climate change without flooding.
- The modelled depth of the pond was 0.262m for the current situation and 0.422m once the new road is added, this compares to 0.845m design depth to maximise the full design storage volume of 705m³.

Appendix A

*Model Details:
Online Controls*

Burroughs		Page 1
4 Radnor Court 256 Cowbridge Road East Cardiff CF5 1GZ	Wrexham Gateway Developmen Access Road Existing Drainage and Pond	
Date 02/09/2015 06:41	Designed by RDT	
File 2579-150827-RDT-MODEL-	Checked by DDH	
Micro Drainage	Network 2015.1	

Online Controls for Storm

Hydro-Brake Optimum® Manhole: SCP-S20, DS/PN: S1.006, Volume (m³): 5.1

Unit Reference MD-SCL-0096-5000-1250-5000
Design Head (m) 1.250
Design Flow (l/s) 5.0
Flush-Flo™ Calculated
Objective Minimise blockage risk
Diameter (mm) 96
Invert Level (m) 91.322
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	4.9	Kick-Flo®	0.687	3.8
Flush-Flo™	0.296	4.9	Mean Flow over Head Range	-	4.3

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	3.4	0.800	4.0	2.000	6.1	4.000	8.5	7.000	11.1
0.200	4.8	1.000	4.5	2.200	6.4	4.500	9.0	7.500	11.4
0.300	4.9	1.200	4.9	2.400	6.7	5.000	9.4	8.000	11.8
0.400	4.9	1.400	5.2	2.600	6.9	5.500	9.9	8.500	12.1
0.500	4.7	1.600	5.5	3.000	7.4	6.000	10.3	9.000	12.5
0.600	4.3	1.800	5.9	3.500	8.0	6.500	10.7	9.500	12.8

Appendix B

Model Details: Storage

Burroughs		Page 1
4 Radnor Court 256 Cowbridge Road East Cardiff CF5 1GZ	Wrexham Gateway Developmen Access Road Existing Drainage and Pond	
Date 02/09/2015 06:42	Designed by RDT	
File 2579-150827-RDT-MODEL-	Checked by DDH	
Micro Drainage	Network 2015.1	

Storage Structures for Storm

Tank or Pond Manhole: SCP-S20, DS/PN: S1.006

Invert Level (m) 91.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	707.0	0.845	968.0	0.846	0.0

Appendix C

Design Criteria

Burroughs		Page 1
4 Radnor Court 256 Cowbridge Road East Cardiff CF5 1GZ	Wrexham Gateway Developmen Access Road Existing Drainage and Pond	
Date 02/09/2015 06:43	Designed by RDT	
File 2579-150827-RDT-MODEL-	Checked by DDH	
Micro Drainage	Network 2015.1	

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	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 Coeffiecient	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	1	Number of Storage Structures	1
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.324		

Appendix D

Scenario 1: Existing Drainage System: Results

Burroughs		Page 1
4 Radnor Court 256 Cowbridge Road East Cardiff CF5 1GZ	Wrexham Gateway Developmen Access Road Existing Drainage and Pond	
Date 02/09/2015 06:43	Designed by RDT	
File 2579-150827-RDT-MODEL-	Checked by DDH	
Micro Drainage	Network 2015.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.322 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	SMHS 1.1	60 Winter	100	+20%					94.944	-0.225
S1.001	SMHS 1.0	15 Winter	100	+20%					94.572	-0.125
S2.000	SCP-S31	15 Winter	100	+20%					95.649	-0.076
S2.001	SCP-S30	15 Winter	100	+20%					95.101	-0.054
S1.002	SCP-S24	15 Winter	100	+20%	100/15 Summer				94.585	0.015
S1.003	SCP-S23	15 Winter	100	+20%					94.463	-0.076
S1.004	SCP-S22	15 Winter	100	+20%					94.325	-0.099
S1.005	SCP-S21	15 Winter	100	+20%					92.136	-0.179
S3.000	SGULLY	60 Winter	100	+20%					93.000	-0.150
S3.001	SCP-S51	15 Winter	100	+20%	100/15 Summer				92.901	0.376
S4.000	SCP-S50A	60 Winter	100	+20%					92.900	-0.150
S3.002	SCP-S50	360 Winter	100	+20%	30/15 Summer				92.064	0.139
S1.006	SCP-S20	360 Winter	100	+20%	1/15 Summer				92.062	0.590

PN	US/MH Name	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SMHS 1.1	0.000	0.00		0.0	OK	
S1.001	SMHS 1.0	0.000	0.04		1.4	OK	
S2.000	SCP-S31	0.000	0.77		63.5	OK	
S2.001	SCP-S30	0.000	0.91		63.5	OK	
S1.002	SCP-S24	0.000	1.05		75.6	SURCHARGED	
S1.003	SCP-S23	0.000	0.97		103.2	OK	
S1.004	SCP-S22	0.000	0.89		111.1	OK	
S1.005	SCP-S21	0.000	0.52		157.1	OK	
S3.000	SGULLY	0.000	0.00		0.0	OK	
S3.001	SCP-S51	0.000	1.14		27.5	FLOOD RISK	
S4.000	SCP-S50A	0.000	0.00		0.0	OK	
S3.002	SCP-S50	0.000	0.15		5.4	SURCHARGED	
S1.006	SCP-S20	0.000	0.29		4.9	SURCHARGED	

Appendix E

*Scenario 2:
Addition of New Highway Drainage:
Results*

Burroughs		Page 1
4 Radnor Court 256 Cowbridge Road East Cardiff CF5 1GZ	Wrexham Gateway Development Access Road Additional Flows to Pond	
Date 02/09/2015 06:51	Designed by RDT	
File 2579-150819-DDH-MODEL.MDX	Checked by DDH	
Micro Drainage	Network 2015.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.322 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth
									(m)	(m)
S1.000	SMHS 1.1	15 Winter	100	+20%	30/15 Summer				95.767	0.598
S1.001	SMHS 1.0	15 Winter	100	+20%	30/15 Summer				95.666	0.969
S2.000	SCP-S31	15 Winter	100	+20%					95.711	-0.014
S2.001	SCP-S30	15 Winter	100	+20%	100/15 Summer				95.484	0.329
S1.002	SCP-S24	15 Winter	100	+20%	30/15 Summer				95.133	0.563
S1.003	SCP-S23	15 Winter	100	+20%	30/15 Summer				94.770	0.231
S1.004	SCP-S22	15 Winter	100	+20%	100/15 Summer				94.516	0.092
S1.005	SCP-S21	480 Winter	100	+20%					92.224	-0.091
S3.000	SGULLY	60 Winter	100	+20%					93.000	-0.150
S3.001	SCP-S51	15 Winter	100	+20%	30/15 Summer				92.905	0.380
S4.000	SCP-S50A	60 Winter	100	+20%					92.900	-0.150
S3.002	SCP-S50	480 Winter	100	+20%	30/15 Summer				92.224	0.299
S1.006	SCP-S20	480 Winter	100	+20%	1/15 Summer				92.222	0.750

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level
							Exceeded
S1.000	SMHS 1.1	0.000	0.78		32.2	FLOOD RISK	
S1.001	SMHS 1.0	0.000	1.71		67.2	FLOOD RISK	
S2.000	SCP-S31	0.000	0.75		61.4	OK	
S2.001	SCP-S30	0.000	0.81		56.8	SURCHARGED	
S1.002	SCP-S24	0.000	1.84		132.1	SURCHARGED	
S1.003	SCP-S23	0.000	1.45		154.5	SURCHARGED	
S1.004	SCP-S22	0.000	1.29		162.0	SURCHARGED	
S1.005	SCP-S21	0.000	0.11		34.6	OK	
S3.000	SGULLY	0.000	0.00		0.0	OK	
S3.001	SCP-S51	0.000	1.14		27.4	FLOOD RISK	
S4.000	SCP-S50A	0.000	0.00		0.0	OK	
S3.002	SCP-S50	0.000	0.12		4.3	SURCHARGED	
S1.006	SCP-S20	0.000	0.29		4.9	SURCHARGED	



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