

Surface Water Drainage Calculations

Phase 2C, Gateway 36

Dearne Valley Parkway, Barnsley

Prepared For

EOS Inc. Limited

Report: 7241-HJCE-00-XX-CA-C-3000.v1

Date: October 2024

Contents

Document Revisions.....	2
Contents	3
Appendices	3
Introduction.....	4
Drainage Strategy	4

Appendices

Appendix A Hydraulic Calculations

Document Revisions

Revision	Date	Written by	Checked by
P01	21.10.2024	AF	MH

Introduction

- 1.1. This surface water calculation pack is the property of H J Consulting Engineers (HJCE) and is produced for the exclusive use of the client, EOS Inc. Limited. The contents may not be made use of by any third party without the express written consent of HJCE. Without such consent HJCE can accept no responsibility to any third party. By receiving these calculations and acting on it, the client, or any third party relying on it, accepts that no individual is personally liable in contract, tort, or breach of statutory duty (including negligence).
- 1.2. The existing site infrastructure drainage will accept an unrestricted discharge of both domestic foul water and surface water. Surface water attenuation is provided in a downstream surface water attenuation pond constructed under and earlier phase of works.
- 1.3. These calculations support the drainage design and has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) 2021 and the associated Planning Practice Guidance.

Drainage Strategy

Surface Water Disposal

Surface water will discharge unrestricted to the infrastructure drainage tails provided to the site.

Drainage Calculation Results

The enclosed calculations produced on Causeway Flow software demonstrate there is no flooding for both the 1:30 year event and a nominal volume of flooding (11m³) for the 1:100 year plus 40% climate change storm events. The flooded volume will be stored on the yard/car park surface

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW01	0.057	5.00	145.192	1200	1.500
SW02	0.187	5.00	145.298	600	1.905
SW03	0.455	5.00	144.944	1350	1.840
INT-01	0.000	5.00	145.013	1200	1.973
SW04	5.870	8.00	146.579	1500	2.682
SW05	0.667	8.00	145.406	1800	2.400
SW06	0.038	5.00	145.282	2100	3.360
SW07	0.057	5.00	145.285	2100	3.646
SW08	1.742	5.00	145.293	2400	3.807
SW09	0.185	5.00	145.302	2100	4.016
SW10	0.392	5.00	145.270	1200	1.650
SW11	0.747	5.00	145.271	1350	2.087
SW12	0.747	5.00	145.272	1500	2.291
SW13	0.392	5.00	145.274	1500	2.423
SW14	0.685	8.00	144.844	1500	1.800
INT-02	0.000	5.00	144.844	1200	2.056
SW15	0.000		145.012	1500	2.500
SW16	0.660	8.00	145.012	2700	4.076
OUTFALL	0.000		142.767	1200	1.914
DL-01	0.187	5.00	144.800	600	1.500

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1.000	SW01	SW02	33.600	0.600	143.692	143.468	0.224	150.0	375	5.38	50.0
S1.001	SW02	SW03	24.200	0.600	143.393	143.104	0.289	83.7	450	5.56	50.0
S1.002	SW03	INT-01	3.500	0.600	143.104	143.090	0.014	250.0	450	5.61	50.0
S1.003	INT-01	SW06	16.900	0.600	143.040	142.972	0.068	248.5	450	5.83	50.0
S1.004	SW06	SW07	70.700	0.600	141.922	141.639	0.283	249.8	1500	8.60	50.0
S1.005	SW07	SW08	38.300	0.600	141.639	141.486	0.153	250.3	1500	8.84	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S1.000	1.477	163.1	10.3	1.125	1.455	0.057	0.0	63	0.837
S1.001	2.223	353.5	44.1	1.455	1.390	0.244	0.0	106	1.532
S1.002	1.281	203.7	126.3	1.390	1.473	0.699	0.0	257	1.347
S1.003	1.285	204.3	126.3	1.523	1.860	0.699	0.0	256	1.349
S1.004	2.709	4787.0	1314.4	1.860	2.146	7.274	0.0	534	2.333
S1.005	2.706	4782.2	1324.7	2.146	2.307	7.331	0.0	536	2.336

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1.006	SW08	SW09	50.000	0.600	141.486	141.286	0.200	250.0	1500	9.15	50.0
S1.007	SW09	SW16	87.600	0.600	141.286	140.936	0.350	250.3	1500	9.68	50.0
S1.008	SW16	OUTFALL	20.700	0.600	140.936	140.853	0.083	249.4	1500	9.81	50.0
S2.000	SW04	SW05	32.700	0.600	143.897	143.156	0.741	44.1	1050	8.10	50.0
S2.001	SW05	SW06	24.700	0.600	143.006	142.222	0.784	31.5	1200	8.17	50.0
S4.000	SW10	SW11	32.300	0.600	143.620	143.409	0.211	153.1	525	5.30	50.0
S4.001	SW11	SW12	31.900	0.600	143.184	143.056	0.128	249.2	750	5.60	50.0
S4.002	SW12	SW13	32.400	0.600	142.981	142.851	0.130	249.2	825	5.89	50.0
S4.003	SW13	SW15	26.000	0.600	142.851	142.512	0.339	76.7	825	6.01	50.0
S4.004	SW15	SW16	37.400	0.600	142.512	141.611	0.901	41.5	825	8.83	50.0
S5.000	SW14	INT-02	51.400	0.600	143.044	142.838	0.206	249.5	600	8.56	50.0
S5.001	INT-02	SW15	12.800	0.600	142.788	142.737	0.051	251.0	600	8.70	50.0
S6.000	DL-01	SW14	24.000	0.600	143.300	143.200	0.100	240.0	375	5.34	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S1.006	2.708	4785.3	1639.5	2.307	2.516	9.073	0.0	603	2.469
S1.007	2.706	4782.6	1672.9	2.516	2.576	9.258	0.0	610	2.480
S1.008	2.711	4791.1	2361.4	2.576	0.414	13.068	0.0	744	2.702
S2.000	5.194	4497.3	1060.7	1.632	1.200	5.870	0.0	344	4.294
S2.001	6.675	7549.4	1181.2	1.200	1.860	6.537	0.0	317	4.942
S4.000	1.808	391.3	70.8	1.125	1.337	0.392	0.0	150	1.386
S4.001	1.768	781.0	205.8	1.337	1.466	1.139	0.0	261	1.502
S4.002	1.876	1002.7	340.8	1.466	1.598	1.886	0.0	331	1.706
S4.003	3.392	1813.1	411.6	1.598	1.675	2.278	0.0	265	2.774
S4.004	4.615	2467.0	569.2	1.675	2.576	3.150	0.0	268	3.793
S5.000	1.537	434.5	157.6	1.200	1.406	0.872	0.0	249	1.419
S5.001	1.532	433.2	157.6	1.456	1.675	0.872	0.0	250	1.417
S6.000	1.165	128.7	33.8	1.125	1.269	0.187	0.0	131	0.987

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.000	33.600	150.0	375	Circular	145.192	143.692	1.125	145.298	143.468	1.455
S1.001	24.200	83.7	450	Circular	145.298	143.393	1.455	144.944	143.104	1.390
S1.002	3.500	250.0	450	Circular	144.944	143.104	1.390	145.013	143.090	1.473
S1.003	16.900	248.5	450	Circular	145.013	143.040	1.523	145.282	142.972	1.860
S1.004	70.700	249.8	1500	Circular	145.282	141.922	1.860	145.285	141.639	2.146
S1.005	38.300	250.3	1500	Circular	145.285	141.639	2.146	145.293	141.486	2.307
S1.006	50.000	250.0	1500	Circular	145.293	141.486	2.307	145.302	141.286	2.516

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.000	SW01	1200	Manhole	Adoptable	SW02	600	Manhole	Adoptable
S1.001	SW02	600	Manhole	Adoptable	SW03	1350	Manhole	Adoptable
S1.002	SW03	1350	Manhole	Adoptable	INT-01	1200	Manhole	Adoptable
S1.003	INT-01	1200	Manhole	Adoptable	SW06	2100	Manhole	Adoptable
S1.004	SW06	2100	Manhole	Adoptable	SW07	2100	Manhole	Adoptable
S1.005	SW07	2100	Manhole	Adoptable	SW08	2400	Manhole	Adoptable
S1.006	SW08	2400	Manhole	Adoptable	SW09	2100	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.007	87.600	250.3	1500	Circular	145.302	141.286	2.516	145.012	140.936	2.576
S1.008	20.700	249.4	1500	Circular	145.012	140.936	2.576	142.767	140.853	0.414
S2.000	32.700	44.1	1050	Circular	146.579	143.897	1.632	145.406	143.156	1.200
S2.001	24.700	31.5	1200	Circular	145.406	143.006	1.200	145.282	142.222	1.860
S4.000	32.300	153.1	525	Circular	145.270	143.620	1.125	145.271	143.409	1.337
S4.001	31.900	249.2	750	Circular	145.271	143.184	1.337	145.272	143.056	1.466
S4.002	32.400	249.2	825	Circular	145.272	142.981	1.466	145.274	142.851	1.598
S4.003	26.000	76.7	825	Circular	145.274	142.851	1.598	145.012	142.512	1.675
S4.004	37.400	41.5	825	Circular	145.012	142.512	1.675	145.012	141.611	2.576
S5.000	51.400	249.5	600	Circular	144.844	143.044	1.200	144.844	142.838	1.406
S5.001	12.800	251.0	600	Circular	144.844	142.788	1.456	145.012	142.737	1.675
S6.000	24.000	240.0	375	Circular	144.800	143.300	1.125	144.844	143.200	1.269

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.007	SW09	2100	Manhole	Adoptable	SW16	2700	Manhole	Adoptable
S1.008	SW16	2700	Manhole	Adoptable	OUTFALL	1200	Manhole	Adoptable
S2.000	SW04	1500	Manhole	Adoptable	SW05	1800	Manhole	Adoptable
S2.001	SW05	1800	Manhole	Adoptable	SW06	2100	Manhole	Adoptable
S4.000	SW10	1200	Manhole	Adoptable	SW11	1350	Manhole	Adoptable
S4.001	SW11	1350	Manhole	Adoptable	SW12	1500	Manhole	Adoptable
S4.002	SW12	1500	Manhole	Adoptable	SW13	1500	Manhole	Adoptable
S4.003	SW13	1500	Manhole	Adoptable	SW15	1500	Manhole	Adoptable
S4.004	SW15	1500	Manhole	Adoptable	SW16	2700	Manhole	Adoptable
S5.000	SW14	1500	Manhole	Adoptable	INT-02	1200	Manhole	Adoptable
S5.001	INT-02	1200	Manhole	Adoptable	SW15	1500	Manhole	Adoptable
S6.000	DL-01	600	Manhole	Adoptable	SW14	1500	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW01	145.192	1.500	1200	 0	S1.000	143.692	375
SW02	145.298	1.905	600		S1.000	143.468	375
SW03	144.944	1.840	1350	 0	S1.001	143.393	450
				1	S1.001	143.104	450
INT-01	145.013	1.973	1200	 0	S1.002	143.104	450
				1	S1.002	143.090	450
SW04	146.579	2.682	1500	 0	S1.003	143.040	450
				0	S2.000	143.897	1050

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW05	145.406	2.400	1800	1	S2.000	143.156	1050
				0	S2.001	143.006	1200
SW06	145.282	3.360	2100	1	S2.001	142.222	1200
				2	S1.003	142.972	450
				0	S1.004	141.922	1500
SW07	145.285	3.646	2100	1	S1.004	141.639	1500
				0	S1.005	141.639	1500
SW08	145.293	3.807	2400	1	S1.005	141.486	1500
				0	S1.006	141.486	1500
SW09	145.302	4.016	2100	1	S1.006	141.286	1500
				0	S1.007	141.286	1500
SW10	145.270	1.650	1200	0	S4.000	143.620	525
SW11	145.271	2.087	1350	1	S4.000	143.409	525
				0	S4.001	143.184	750
SW12	145.272	2.291	1500	1	S4.001	143.056	750
				0	S4.002	142.981	825
SW13	145.274	2.423	1500	1	S4.002	142.851	825
				0	S4.003	142.851	825
SW14	144.844	1.800	1500	1	S6.000	143.200	375
				0	S5.000	143.044	600
INT-02	144.844	2.056	1200	1	S5.000	142.838	600
				0	S5.001	142.788	600
SW15	145.012	2.500	1500	1	S5.001	142.737	600
				2	S4.003	142.512	825
				0	S4.004	142.512	825
SW16	145.012	4.076	2700	1	S4.004	141.611	825
				2	S1.007	140.936	1500
				0	S1.008	140.936	1500

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
OUTFALL	142.767	1.914	1200	1	S1.008	140.853	1500
DL-01	144.800	1.500	600	0	S6.000	143.300	375

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320
30	120	240	480	720	1440	2880	5760

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node DL-01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	144.275
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	0.0	0.0	0.125	513.4	0.0	0.325	1202.4	0.0	0.475	1721.0	0.0
0.025	169.4	0.0	0.225	857.7	0.0	0.425	1547.8	0.0			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	11	145.078	1.386	59.3	2.6212	0.0000	FLOOD RISK
15 minute summer	SW02	11	145.051	1.658	165.6	3.7242	0.0000	FLOOD RISK
15 minute summer	SW03	11	144.944	1.840	486.4	11.7337	4.6835	FLOOD
30 minute summer	INT-01	19	144.768	1.728	410.2	1.9542	0.0000	FLOOD RISK
30 minute summer	SW04	20	145.604	1.707	3311.7	77.7405	0.0000	SURCHARGED
30 minute summer	SW05	20	144.857	1.851	3651.9	14.9961	0.0000	SURCHARGED
30 minute summer	SW06	19	144.427	2.505	4042.8	9.2449	0.0000	SURCHARGED
30 minute summer	SW07	19	144.120	2.481	4078.7	9.3665	0.0000	SURCHARGED
30 minute summer	SW08	19	143.896	2.410	4971.0	32.9518	0.0000	SURCHARGED
30 minute summer	SW09	19	143.491	2.205	5077.5	9.6695	0.0000	SURCHARGED
15 minute summer	SW10	11	144.805	1.185	282.6	6.9696	0.0000	SURCHARGED
15 minute summer	SW11	11	144.687	1.503	788.6	12.9070	0.0000	SURCHARGED
15 minute summer	SW12	11	144.503	1.522	1253.8	12.6175	0.0000	SURCHARGED
15 minute summer	SW13	11	144.176	1.325	1502.4	6.6281	0.0000	SURCHARGED
30 minute summer	SW14	19	144.220	1.176	490.3	11.0314	0.0000	SURCHARGED
30 minute summer	INT-02	19	143.890	1.102	508.6	1.2468	0.0000	SURCHARGED
15 minute summer	SW15	11	143.760	1.248	1928.2	2.2044	0.0000	SURCHARGED
30 minute summer	SW16	19	142.912	1.976	7351.3	17.7166	0.0000	SURCHARGED
30 minute summer	OUTFALL	19	142.213	1.360	7345.9	0.0000	0.0000	OK
15 minute summer	DL-01	12	144.291	0.991	134.8	3.6317	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW01	S1.000	SW02	39.3	0.920	0.241	3.7060	
15 minute summer	SW02	S1.001	SW03	173.5	1.095	0.491	3.8343	
15 minute summer	SW03	S1.002	INT-01	415.7	2.624	2.041	0.5546	
30 minute summer	INT-01	S1.003	SW06	389.0	2.456	1.904	2.6777	
30 minute summer	SW04	S2.000	SW05	3296.2	4.711	0.733	28.2082	
30 minute summer	SW05	S2.001	SW06	3684.2	4.415	0.488	27.8297	
30 minute summer	SW06	S1.004	SW07	4058.0	2.305	0.848	124.4661	
30 minute summer	SW07	S1.005	SW08	4096.1	2.327	0.857	67.4265	
30 minute summer	SW08	S1.006	SW09	4973.8	2.826	1.039	88.0241	
30 minute summer	SW09	S1.007	SW16	5076.8	2.884	1.062	154.2183	
15 minute summer	SW10	S4.000	SW11	257.6	1.498	0.658	6.9779	
15 minute summer	SW11	S4.001	SW12	740.1	1.682	0.948	14.0399	
15 minute summer	SW12	S4.002	SW13	1232.8	2.313	1.230	17.2735	
15 minute summer	SW13	S4.003	SW15	1484.1	2.966	0.819	13.8615	
30 minute summer	SW14	S5.000	INT-02	508.6	1.806	1.170	14.4782	
30 minute summer	INT-02	S5.001	SW15	512.5	1.849	1.183	3.6055	
15 minute summer	SW15	S4.004	SW16	1921.4	4.073	0.779	19.9392	
30 minute summer	SW16	S1.008	OUTFALL	7345.9	4.175	1.533	35.5899	5620.0
15 minute summer	DL-01	S6.000	SW14	116.2	1.176	0.903	2.6471	