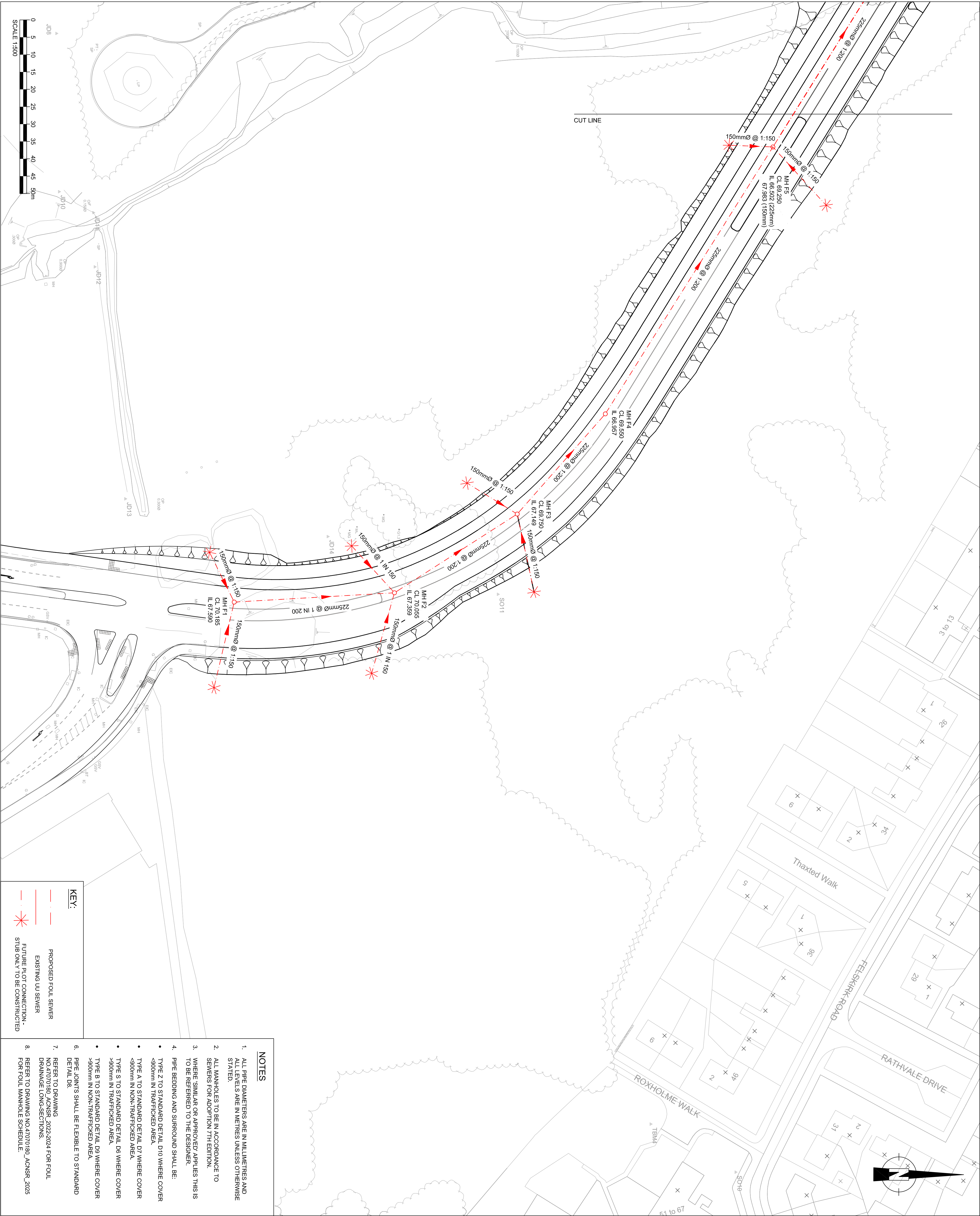


R2	01/06/16 FOR APPROVAL
R1	18/02/17 FOR PROXY
P1	12/05/21 FOR SIGNATION
1/1R	DATE DESCRIPTION



Appendix 7

Foul Sewer Loadings

Airport City North
FOUL DRAINAGE SERVICE LOADS

							AREA	OCCUPANCY		FOUL	Estimated Services Quantities Within Each Zone
Zone	Plot	Start on Site	Months to demand requirement		Category	Date Demand Required	GFA m ² Total	Persons	Minimum stack connections (mm)	FW Pipe length (Avge 150mm dia/ Zone)	
A	AA1	Mar-21	8		Office	Nov-21	4,320	432	100	150	
	AA2	Oct-20	3		MSCP	Jan-21	16,415	0	50		
	A1a	Jun-21	7		Hotel	Jan-22	3,900	186			
	A1b	Jun-21	7		Hotel	Jan-22	4,000	190			
	A2	Jan-22	4		MSCP	May-22	18,540	0	100		
B	B1	Jun-21	8		Office	Feb-22	4,320	432	100	40	
	B2	Jan-22	8		Office	Sep-22	4,320	432	100		
	B3	Mar-22	8		Office	Nov-22	4,320	432	100		
	B4	Oct-22	11		Office	Sep-23	7,600	760			
	B5	Jan-23	12		Office	Jan-24	8,650	865			
	B6	Oct-23	16		Office	Feb-25	12,240	1224			
C	C1	Jun-17	8		Office	Feb-18	4,320	432	100	360	
	C2	Jan-18	8		Office	Sep-18	4,320	432			
	C3	Oct-17	8		Office	Jun-18	4,320	432			
	C4	Jan-18	8		Office	Sep-18	4,320	432			
D	D1	Jun-18	10		Hotel	Apr-19	6,825	326		210	
	D2	Jan-17	4		MSCP	May-17	14,070	0			
	D3	Jun-15	10		Office	Apr-16	6,920	692	50		
	D4	Jun-16	10		Office	Apr-17	6,920	692	100		
E	E1	Jun-23	11		Hotel	May-24	7,210	344	100	450	
	E2	Jan-24	12		Office	Jan-25	8,650	865	100		
	E3	Oct-24	12		Office	Oct-25	8,650	865			
	E4	Jan-25	12		Office	Jan-26	8,650	865			
F	F1	Jun-25	12		Office	Jun-26	8,650	865		200	
	F2	Jan-26	14		Office	Mar-27	10,150	1015			
O	O1	Oct-16	6		Hotel	Apr-17	2,875	136		340	
	O2	Jan-18	8		Hotel	Sep-18	4,320	206			
I	I1	Oct-27	7		Office	May-28	3,600	360	50	4	
	I2	Oct-27	7		Office	May-28	3,600	360	100		
	I3	Jan-28	7		Office	Aug-28	3,600	360	50		
	I4	Jan-28	7		Office	Aug-28	3,600	360			
J	J1	Jun-28	12		Hotel	Jun-29	8,756	416	50	400	
	J2	Jun-28	4		Hotel	Oct-28	945	46	100		
	J3	Jun-29	12		Hotel	Jun-30	8,029	382	50		
K	K1	Oct-28	5		Office	Mar-29	1,882	188		350	
	K2	Oct-28	5		Office	Mar-29	1,882	188			
	K3	Jan-29	6		Office	Jul-29	2,857	286	50		
	K4	Jan-29	8		Office	Sep-29	4,458	446			
L	L1	Jan-25	9		Hotel	Oct-25	4,984	238		40	
	L2	Jun-26	5		Office	Nov-26	1,858	186			
	L3	Jun-26	5		Office	Nov-26	1,858	186	50		
	L4	Oct-26	5		Office	Mar-27	1,858	186			
	L5	Jan-27	5		Office	Jun-27	1,858	186			
	L6	Mar-27	5		Office	Aug-27	1,858	186			
M	M1	Jun-20	5		Office	Nov-20	1,725	172	50	40	
	M2	Jul-20	5		Office	Dec-20	1,725	172			
	M3	Aug-19	5		Office	Jan-20	1,725	172			
	M4	Sep-19	5		Office	Feb-20	1,725	172			
N	N1	Oct-18	5		Office	Mar-19	1,725	172			
	N2	Oct-18	5		Office	Mar-19	1,725	172			
	N3	Jan-19	5		Office	Jun-19	1,725	172			
	N4	Jan-19	5		Office	Jun-19	1,725	172			
P	P1	Jan-19	20		Hotel	Sep-20	16,808	800			
X	X1	Oct-19	7		Office	May-20	3,240	324	50	120	
	X2	Jan-20	7		Office	Aug-20	3,240	324	51		
	X3	Apr-20	7		Office	Nov-20	3,240	324	52		
	X4	Oct-20	7		Office	May-21	3,240	324	53		
Z	Z3	Jun-20	7		Office	Jan-21	3,240	324	54		
	Z4	Aug-20	5		Office	Jan-21	1,725	172	55		
	Z1	Oct-20	9		Office	Jul-21	5,190	519	56		
	Z2	Jan-21	7		Office	Aug-21	3,240	324	57		
Total							314,243			2,754	

Appendix 8

CCTV Survey Report

Airport City North Spine Road

Drainage Survey Report

REVISION SCHEDULE

Rev	Date	Details	Prepared by	Reviewed by	Approved by
01	22.09.2015	First Draft	LS	NB	JM

AECOM Infrastructure & Environment UK Limited
Bridgewater House
Whitworth Street
Manchester
M1 6LT

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1 EXECUTIVE SUMMARY

A CCTV drainage survey was conducted by Aecom with a specialist sub-contractor (Drain Alert) undertaking the survey works at the Airport City North Development site. The aim of the survey was to identify as far as practicable all incoming connections to the two tributaries of Baguley Brook which cross the site. This involved traversing the watercourses, locating and surveying existing drains to determine the source of incoming flows.

The drainage survey determined that there are 9 main discharge points into the two watercourses, 5 on the Easterly watercourse and 4 on the Westerly watercourse. It was observed during the course of the survey that the two watercourses had very low flow rates, with the easterly watercourse having more water flow than the Westerly watercourse.

As a result of the survey the existing catchment areas of the two watercourses could be approximated as shown in Figure 1.0 below. The total catchment area of the two watercourses is approximately 44 hectares. The westerly watercourse shown in blue represents 12 hectares of this catchment with approximately 60 percent hard-standing areas and 40 percent soft landscaping. The easterly watercourse shown in orange represents the remaining catchment area of 32 hectares of which 30 percent is made up of hard-standing areas, and 70 percent is soft landscaping.



Figure 1.0 – Catchment Areas for the Westerly (left) and Easterly (right) watercourses

A previous Flood Risk Assessment (FRA)¹ by Shepherd Gilmore states that the westerly watercourse catchment is approximately 52 hectares and the easterly water is 89 hectares. The associated peak flows were calculated as 1920 litres/second and 2760 litres/second respectively, for a 1 in 100 year storm event plus 20 percent climate change. These were calculated using the Flood Estimation Handbook (FEH) method. Following the drainage survey more accurate estimates of the catchment areas have been derived as indicated above, and by proportioning the previous and new catchment areas approximations of the peak flows can be made. Therefore the peak flow for the westerly watercourse is now estimated to be 443 litres/second, and for the easterly watercourse is 992 litres/second.

¹ Flood Risk Assessment for Land of Thorley Green, Off Thorley Lane, Woodhouse Park Wythenshawe for Manchester Airport Developments Ltd. Olympic House, Manchester M90 1QX by Shepherd Gilmore dated April 2009

2 INTRODUCTION

2.1 Background

The proposed site of the Airport City North development comprises an area of land to the north of Outwood Lane including the existing airport car parks, Jet Parks 1 and 2 along with areas of undeveloped, relatively flat land with some areas of woodland. Two watercourses currently pass through the site running North with an existing pond to the east. The two watercourses flow along the west and east side of Thorley Lane, Manchester (Appendix A). The watercourses are unnamed tributaries to Baguley Brook, which discharges from the pond in Painswick Park to the north of the site. Hereafter they are referred to as 'Westerly Watercourse' and 'Easterly Watercourse'.

This report outlines the findings from the CCTV drainage survey undertaken by AECOM with a specialist sub-contractor (Drain Alert) undertaking the CCTV survey works. The site location for the survey is shown below.



Figure 1.1 - Site location plan

2.2 Scope of Works

The purpose of the survey works was to identify all incoming connections to the watercourses so as to gain an understanding of the existing drainage arrangements within the site and to better inform proposals for development solutions. It involved traversing the two watercourses, locating and CCTV surveying existing drains where possible to determine the source of incoming flows. Access was made to existing manholes within the survey area including the Jet Parks 1 and 2 car parks to further determine the drainage arrangements.

During the survey works some of the sewers could not be CCTV surveyed due to heavy debris/silt, buried manholes, and the presence of drainage features such as hydro-breaks, interceptors and inverted siphons. In these cases reasonable assumptions were made with regards to the drainage arrangements by lifting manholes, inspecting gullies and dye testing to establish the orientation of flows within the drainage systems in question. In areas where the drainage arrangement could not be determined by lifting manhole covers and inspecting gullies such as in Jet Parks 1 and 2, dye testing was used to determine if the drainage outfalls.

The United Utilities foul sewer in Bailey Lane was investigated to check the depth and existing internal arrangements to enable the new connection to be designed (Appendix B). The existing manhole F9 to which the proposed foul network is to be connected was not fully surveyed as the manhole cover could not be lifted to determine the invert level due to the presence of a small wall erected on top of it. Two other manholes on the existing line were fully surveyed as shown in Appendix B.

2.3 Site description

The site is located between Manchester Airport and the Wythenshawe area of Manchester and covers an area of approximately 21.3 hectares. The existing site comprises car parking areas, existing roads and soft landscaping.

The existing ground is relatively flat and topographical surveys show that the site levels vary between 68m AOD and 71.5m AOD, although the T2 roundabout area is elevated by approximately 6.0m to allow the M56 motorway to pass underneath.

3 DRAINAGE ARRANGEMENTS

The following section outlines the findings of the CCTV drainage survey undertaken to determine what discharges into the two watercourses.

3.1 EASTERLY WATERCOURSE

The Easterly Watercourse flows along the eastern boundary of the site from South to North and drains into Painswick Park Lake to the North of the site.



Figure 1.2 – Route of Easterly Watercourse

Evidence gained from the survey indicates the following as the main discharge points into the easterly watercourse. These are number 1 to 3 as illustrated in Figure 1.3 below.



Figure 1.3 – Existing Drainage around the Aviator Way Junction

Headwall installed during Metrolink works with 300Φ and 450Φ outlets

The Easterly watercourse was found to originate at the headwall installed during the Metrolink/SEMMS works at the discharge point 1 (FIGURE 1.3), the design drawing for the Metrolink works on Ringway road is attached in Appendix C for reference. The headwall has two outlets as shown below a 300Φ and 450Φ.



Figure1.4 – Headwall installed during Metrolink works with 300Φ and 450Φ outlets

The 300Φ pipe was CCTV surveyed using a push camera via the headwall outlet, this indicated that the pipe is currently redundant. The pipe originates from a buried manhole within the carriageway with an intermediate buried manhole before the headwall outlet. This pipe was most likely left in-situ when the Aviator way T-junction was constructed and was part of the previous drainage system on the road.

Three main drainage systems drain to the watercourse through the 450Φ pipe. The first system drains surface water from the Metro-link line. The top section of this system collects surface water from the Metro-link line between Aviator way and Ringway Road West, which connects to manhole SW03. The bottom section collects surface water from the Metro-link line pumping station south of the Aviator way and also connects to manhole SW03.

The second system starts from manhole SW10 to the west of the Aviator way T-junction, and from manhole SW A to the east of the T-junction. This system is highway drainage installed during the Aviator way junction works. It drains Ringway Road West approximately 50m from the Terminal 1/3 roundabout running towards the Aviator way junction. A 225Φ pipe from manhole SW10 picks up gullies on both sides of the road and connects to manhole SW B. To the east of the junction approximately 90m of Ringway Road is drained via the same system with the head of the run at manhole SW A. A 225Φ pipe from manhole SW A picks up gullies on this section of road and connects to manhole B.

A third system drains the section of Aviator way immediately north of the Aviator way T-junction. This system starts at manhole D with a 225 Φ pipe running to manhole SW06 picking up several gullies.

Manhole SW06 then picks up the Metro-link system, and the two systems drain to manhole SW07 to which the drainage for Ringway Way Road West also connects to. Surface water from the three systems then passes through an oil interceptor (SW08) and through a hydro-break (SW09) before discharging into the watercourse via the headwall outlet.

Goodmans Headwall with 900Φ pipe outlet

The next outfall into the watercourse is via a headwall with 900Φ pipe outlet at discharge point 2; this is approximately 60m downstream from the Headwall at the Aviator way junction. Two systems discharge to the 900Φ pipe outlet. The first is a private surface water drainage system from the business park north of Aviator Way. The extents of this drainage system could not be fully determined without the land owner's permission. The second system is the highway drainage for Aviator Way which drains the full length of the road via several gullies on either side of the road, and is adopted by United Utilities (see Appendix D). The system also picks up surface water from the Goodmans building north east of the Aviator way junction before discharging to the watercourse.



Figure 1.5 – Goodmans Headwall with 900Φ pipe outlet

Ditch adjacent to public footpath

Further downstream approximately 20m from the Goodmans Headwall is a ditch channel which outfalls into the watercourse. Topological surveys indicate this ditch channel drains a pond north of the Aviator way junction via a 300Φ pipe. During the drainage survey the 300Φ pipe could not be located due to dense vegetation within the area. The ditch channel was clogged up with large debris and no water flow was detected.

Jet Parks 2 Drainage

The CCTV drainage survey within the Jet Parks 2 car park demonstrated that the existing drainage system within the car park outfalls into the Easterly watercourse. However, the exact location of the outfall could not be found due to the presence of dense vegetation within the area. The drainage system within the car park is very minimal as shown in Figure 1.6 below.

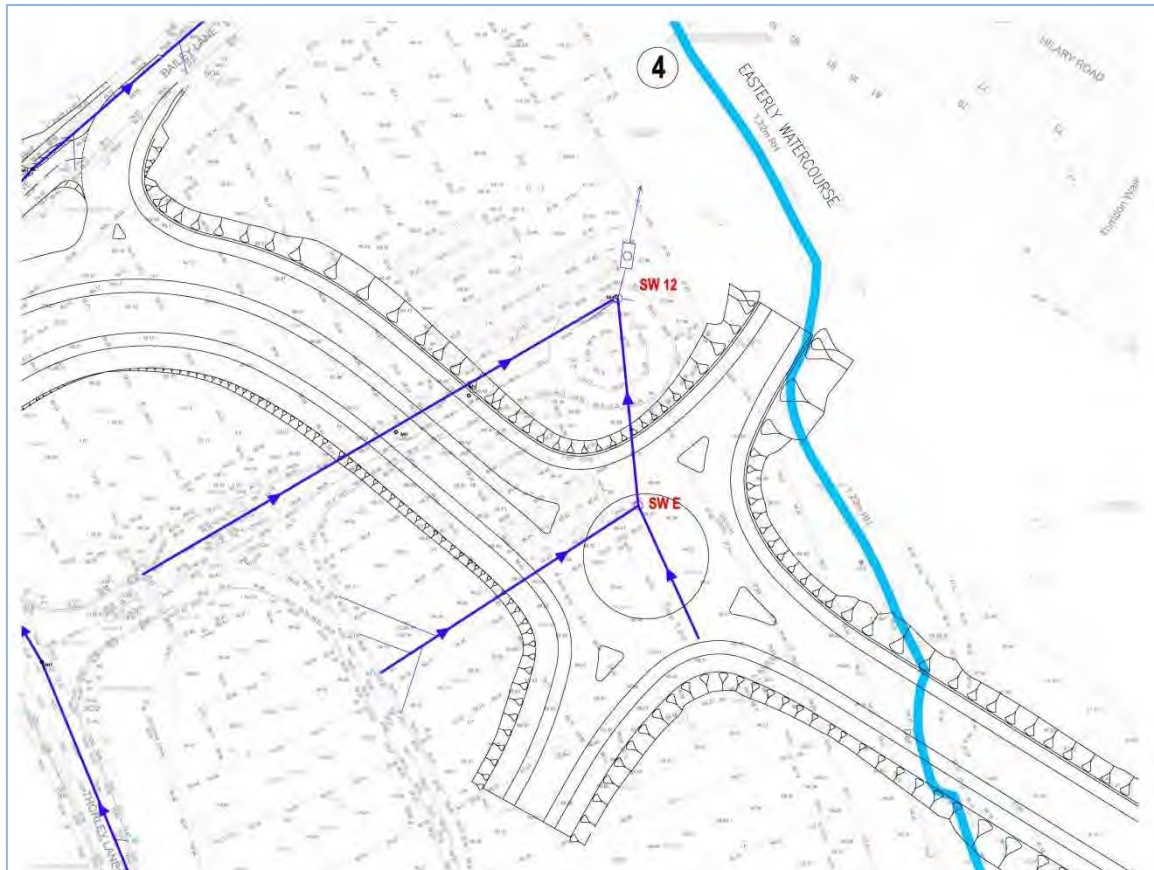


Figure 1.6 – Existing drainage identified in Jet Parks 2

The system was CCTV surveyed via manhole SW12 which revealed the following connections coming into the manhole:

- A 150Φ gully connection from the entrance of the car park to which a channel drain is also connected.
- A 150Φ connection from a gully on the roundabout.
- A 225Φ pipe which connects to a buried catch pit manhole (SW E) upstream, south of manhole SW12.

Within manhole SW E there is a connection from the west which connects four gullies on the access road that runs parallel to Thorley Lane. Dye-testing was used to try and definitively prove the connection; however this was unsuccessful due the gully connection being blocked.

There was another connection within manhole SW E coming from the south of the car park which brought a steady flow of water into the manhole, however as manhole SW E is buried it could not be CCTV surveyed and thus the origins of the connection remain unknown.

From manhole SW12, the system connects to an oil interceptor before discharging into the watercourse.

3.2 WESTERLEY WATERCOURSE

The OS grid reference for the Westerley Watercourse at the downstream limit of the site is SJ 817 859. It flows from South to North running parallel to Thorley Lane before crossing it just after the Bailey Lane Junction and drains into Painswick Park Lake to the North of the site. Evidence gained from the survey indicates various existing surface water drainage systems serving Jet Parks1 and the surrounding roads that discharge into the Westerley Watercourse.

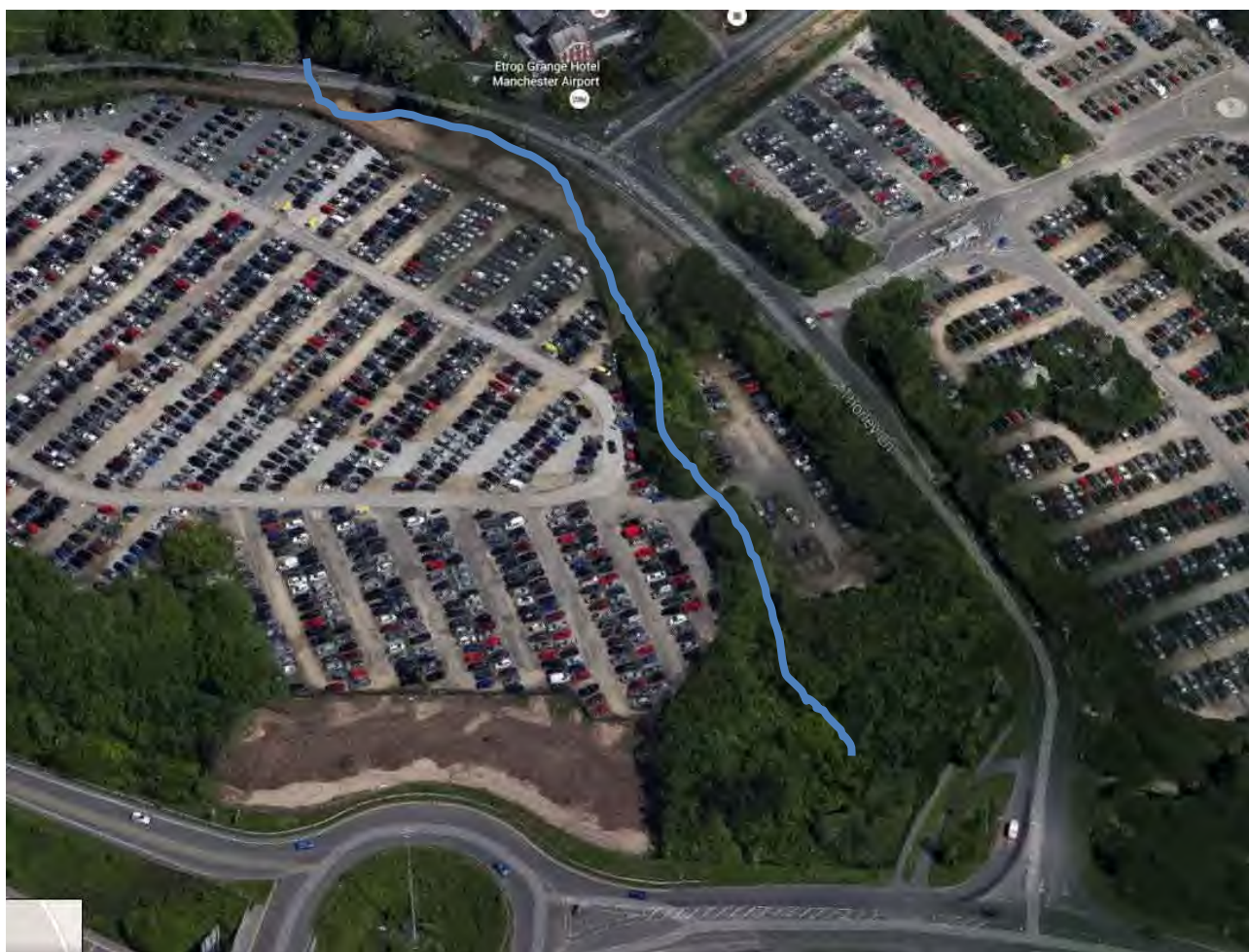


Figure1.7 – Route of Westerley Watercourse

Headwall with 900Φ and 225Φ outlets

The westerly watercourse originates at a large headwall located in dense vegetation north west of the Thorley Lane – Outwood Lane West Junction. The headwall has a 900Φ and a 225Φ outlet as shown below.



Figure 1.8 – Headwall with 900Φ and 225Φ outlets

The two outlets represent two separate drainage systems discharging into the watercourse. The first system discharges via the 900Φ outlet, and originates at the start of Outwood Lane on the roundabout north of the Manchester Airport Police station. A 1000 Φ pipe runs the full length of the road picking up connections from gullies and manholes. The pipe crosses the railway cutting via an inverted siphon before reaching the Ringway Road West roundabout where it picks up more connections from gullies on the roundabout, and a separate drainage network on the southern side of the roundabout. The 1000Φ pipe then crosses the roundabout underneath Outwood Lane West before crossing Thorley Lane and discharging into the watercourse. Where the pipe crosses Outwood Lane West there is a connection from a drainage network that serves the north of the T2 roundabout and Outwood Lane West.

An attempt was made to CCTV survey the 1000Φ on this system but this proved to be unsuccessful as the pipe was heavily silted as seen in the image below.



Figure 1.9 – Interior of the 1000 Φ pipe

The extents of this system were determined by lifting a number of accessible manholes and dye-testing. Other drainage networks may connect to the 1000 Φ pipe; however this could not be determined as a large number of manholes along the route of the pipe were inaccessible.

The second system discharges to the watercourse via the 225 Φ open pipe. Dye-testing the gullies on the road and footway immediately north of the Outwood Lane West – Thorley Lane Junction revealed that the section of Thorley Lane from the junction to approximately 130 metres up the road drains to the watercourse via this 225 Φ outlet at the headwall. Beyond the 130 metres up to the entrance of Painswick Park, there is a system of gullies and kerb drains along the carriageway that were identified as draining this section of Thorley Lane. Dye-testing and lifting the covers on the kerb drain indicated the direction flow was towards the culvert where the Westerly watercourse crosses Thorley Lane next to the entrance of Painswick Park. The system most likely drains to the watercourse via an outlet in the culvert. This could not be proven beyond reasonable doubt as the manholes that seem to be on this system were inaccessible so could not be camera surveyed.

Whilst conducting the survey on Thorley Lane a number of gullies and manholes were identified on Bailey Lane. Examining the locations of manholes and ground levels it was concluded that the drainage system on Bailey Lane drains towards the Easterly watercourse and most likely discharges via an outlet in the culvert where the watercourse crosses Bailey Lane. Again this could not be proven beyond reasonable doubt as the manholes that were identified on Bailey Lane are within the road and therefore not accessible without traffic management. Figure 2.0 shows what is believed to be the drainage arrangement on Bailey Lane.

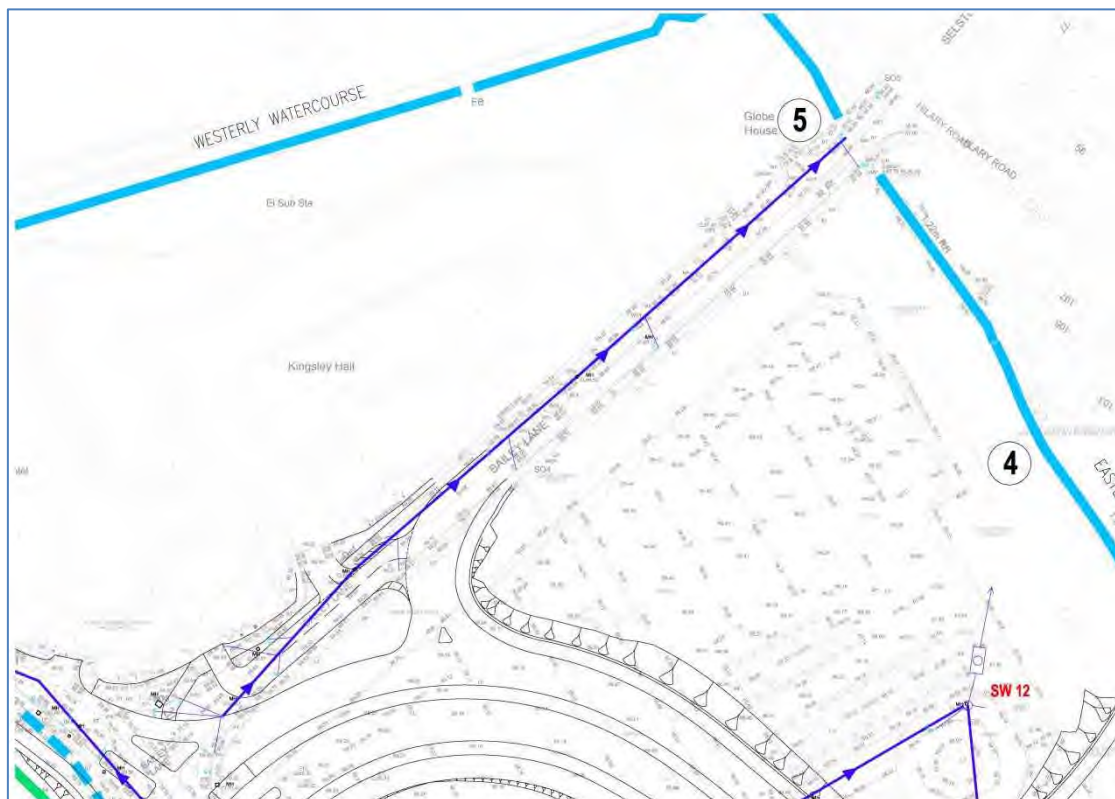


Figure 2.0 – Existing Drainage arrangement on Bailey Lane

Jet Parks 1 – Headwall with 300Φ open pipe

The drainage survey within Jet parks 1 revealed that the drainage system within the car park discharges via a 300 Φ open pipe at a headwall approximate 90 metres from the culvert in the car park

The drainage network was CCTV surveyed from manhole SW17, in which there were two connects coming in from manhole SW18 to the south and manhole SW19 to the west. The pipe from SW19 picks up two gully connections. In manhole SW18 the CCTV survey revealed two connects coming into the manhole from the west and from the south. The line from the west connects to a manhole that was under a parked car and could not be surveyed but most likely picks up connections from the west of the car park. The origins of the line to the south could not be determined as manhole SW18 was inaccessible so could not be CCTV surveyed. Figure 2.1 below shows the drainage that was identified within the car park.

Head wall within Jet Parks 1

There was headwall identified in Jet parks 1 where the watercourse crosses the entrance to the additional parking spaces at discharge point 7 (figure 2.1). After some investigation in the area an interceptor was uncovered, unfortunately no manholes or gullies could be identified as draining to the interceptor. The dye-testing conducted on Thorley Lane did not indicate any of the gullies or kerb drains connect to this interceptor either. This may have been due to the pipes being blocked; however it is more likely that this was put in to serve the additional car parking area. Any existing manholes or gullies could not be found and may be buried as was found to be the case in other areas with the car park.

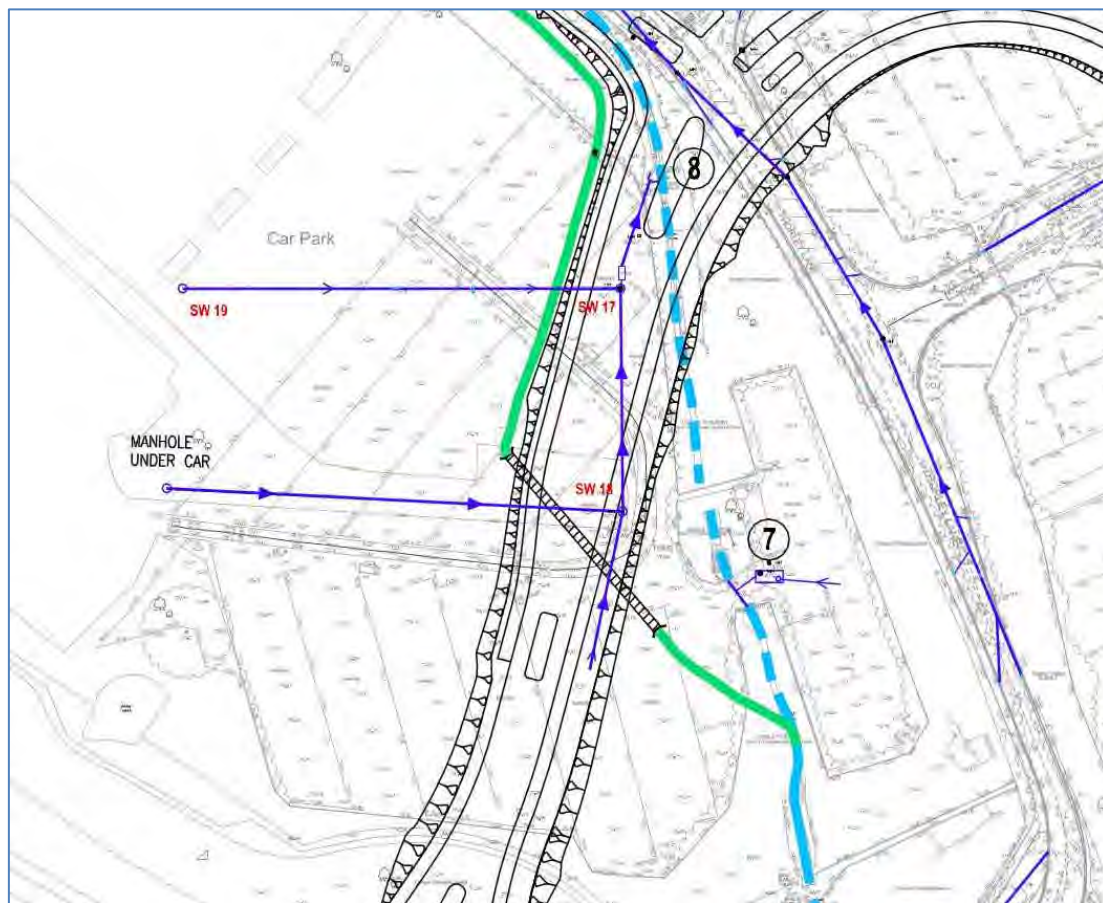


Figure 2.1 – Existing Drainage surveyed in Jet Parks 1

4 EXISTING UNITED UTILITIES SEWER ON BAILEY LANE

The United Utilities foul sewer in Bailey Lane was also investigated as part of this survey. This was to check the depth and existing internal arrangements to enable the new connection to be designed (Appendix B). The existing manhole F9 to which the proposed foul network is to be connected was not fully surveyed as the manhole cover could not be lifted to determine the invert level due to the presence of a small wall constructed on top of it (Appendix B). Two other manholes on the existing line were fully surveyed as shown in Appendix B. Manhole MH 11 was found to have a cover level of 66.477m and an invert level of 64.800m, and manhole MH12 was found to have a cover level of 67.378m and an inert level of 63.978m. This gives depths of 1.6m and 3.4m respectively and therefore proves sufficient depth for the proposed foul drainage to be connected to manhole MH F9. This manhole will need to be fully surveyed to confirm the depth before any connections are made.

5 CONCLUSION

The drainage survey determined that there are number of drainage systems within the proposed development site and the immediate surrounding areas that discharge into the two watercourses crossing the site. The survey identified 9 main discharge points into the two watercourses as shown in Appendix A.

The discharge points on the Easterly Watercourse are as follows:

- Headwall installed during Metrolink works with 300Φ and 450Φ outlets.
- Goodmans Headwall with 900Φ pipe outlet.
- Ditch Channel adjacent to public Footpath.
- Outlet for Jet Parks 2 drainage.
- Outlet for Bailey Lane Road drainage.

The Discharge points on the Westerly Watercourse are as follows:

- Headwall with 900 Φ and 225 Φ pipe outlets.
- Headwall with 300 Φ pipe outlet – Jet Parks 1 drainage.
- Culvert next to the entrance of Pranswick Park – Thorley Lane road drainage.
- Headwall within the car park.

There may be other discharge points on the two watercourses and additional drainage networks connected to the surface water systems that discharge to these watercourses. As mentioned previously these may have been missed as a number of manholes within the survey area were inaccessible for a number of reasons. In addition, some areas adjacent to the watercourses could not be reached due to presence of dense vegetation.

Throughout the duration of the survey the two watercourses were found to have little or no water flow in them, and the easterly watercourse was found to have a higher flow rate water than the westerly watercourse at the time of the survey.



Figure 2.2 – Typical water levels in the Westerly (left) and Easterly (right) watercourses

5. APPENDICES

Appendix A – Airport City North Existing Drainage Layout

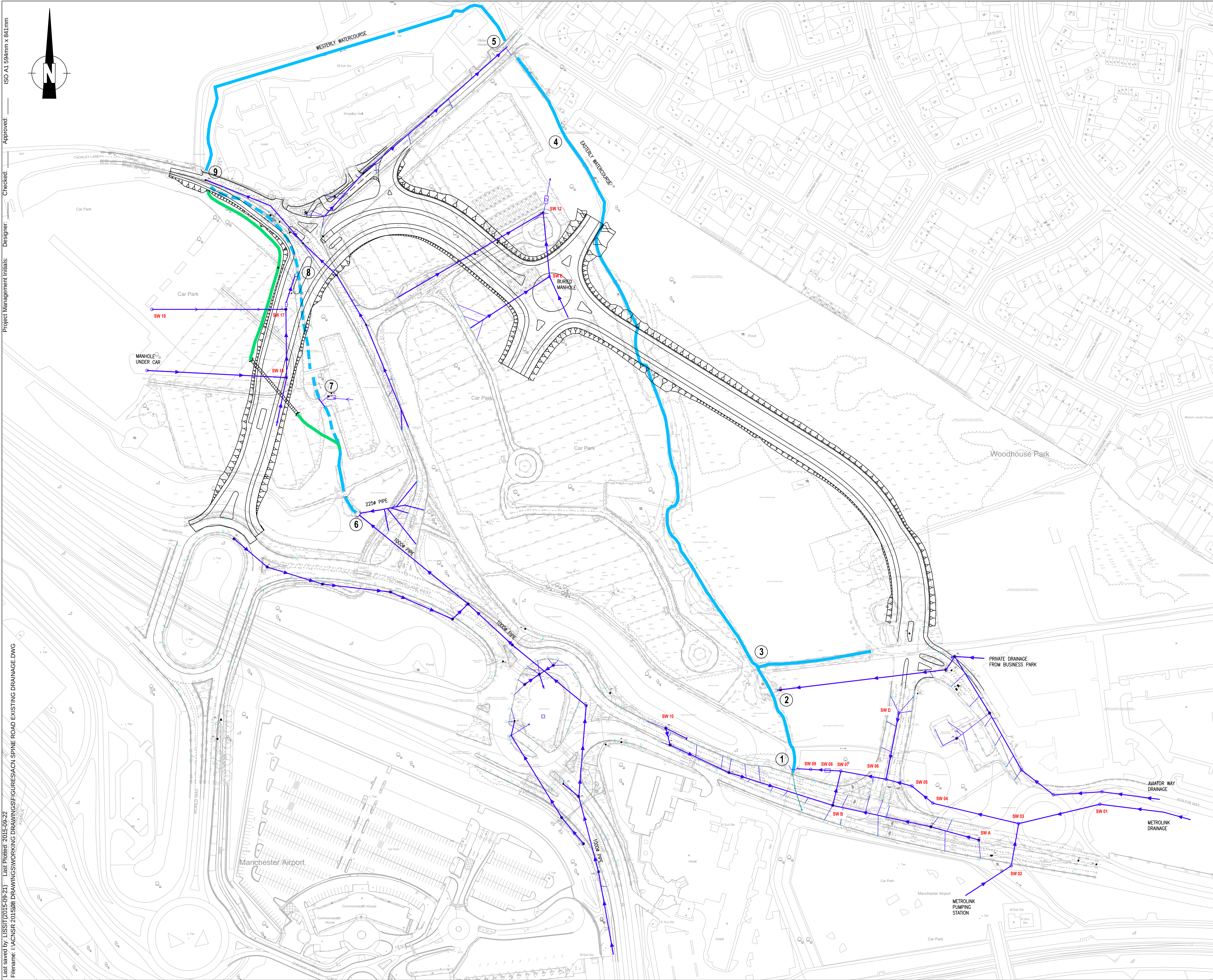
Appendix B – Existing United Utilities Sewer on Bailey Lane

Appendix C – Metrolink Design drawing for Ringway Road

Appendix D – United Utilities Surface Water Plan for Aviator Way



APPENDIX A – AIRPORT CITY NORTH EXISTING DRAINAGE LAYOUT



ISO A1 594mm x 841mm
Approved: _____
Checked: _____
Designer: _____
Project Management Initials: _____
Last saved by: LSSIT(2015-09-23) Last Plotted: 2015-09-22
Filename: I:\ACNSR 201508 DRAWINGS\WORKING DRAWINGS\FIGURES\ACN SPINE ROAD EXISTING DRAINAGE.DWG



PROJECT
Airport City North
Spine Road 2015

CLIENT
Airport City Manchester
曼彻斯特空港城

CONSULTANT
AECOM Manchester
Bridgewater House, Whitworth Street,
Manchester, M1 6LT
0161 907 3500 tel 0161 907 3599 fax
www.aecom.com

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REGISTRATION

KEY:
EXISTING WATERCOURSE
WATERCOURSE TO BE ABANDONED
PROPOSED WATERCOURSE DIVERSION

ISSUE/REVISION		
0.0	22/09/15	FOR INFORMATION
I/R	DATE	DESCRIPTION

KEY PLAN

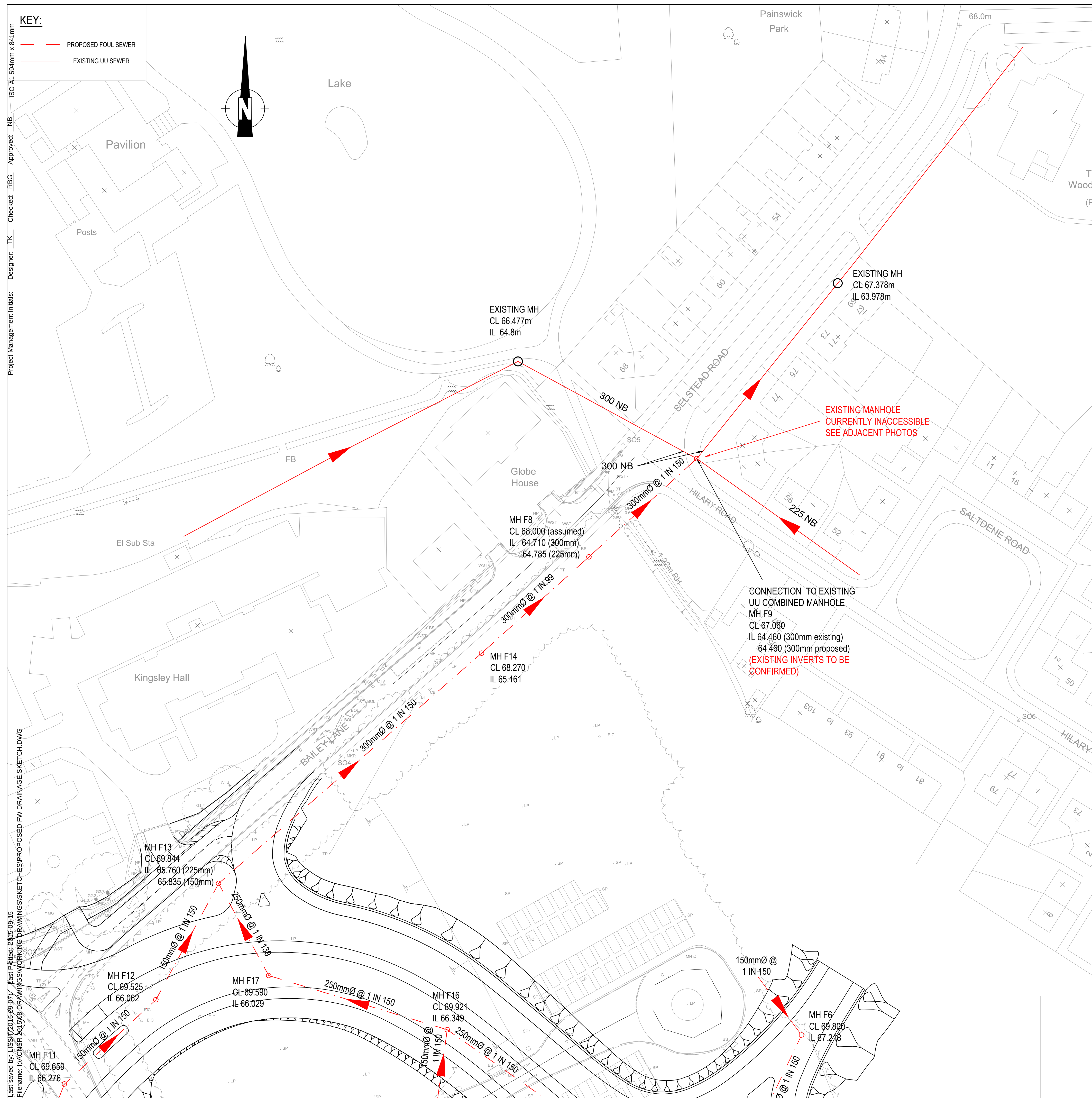
PROJECT NUMBER
47070180

SHEET TITLE
AIRPORT CITY NORTH
EXISTING DRAINAGE
LAYOUT

SHEET NUMBER
-



APPENDIX B – EXISTING UNITED UTILITIES SEWER ON BAILEY LANE

**AECOM**

PROJECT

Airport City North

Spine Road 2015

CLIENT

Airport City Manchester

曼彻斯特空港城

CONSULTANT

AECOM Manchester
Bridgewater House, Whitworth Street,
Manchester, M1 6LT
0161 907 3500 tel 0161 907 3599 fax
www.aecom.com

CONSULTANTS

Street Lighting Designer

AMEY
Factory Lane
Manchester M9 8AB
0161 277 6770 tel
www.Amey.co.uk

Design of Pedestrian Crossings and Signalised Junctions

TFGM

2 Piccadilly Place
Manchester M1 3BG
0161 224 1000 tel
www.tfgm.com

REGISTRATION

ISSUE/REVISION

P1	07/09/15	FOR INFORMATION
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

47070180

SHEET TITLE

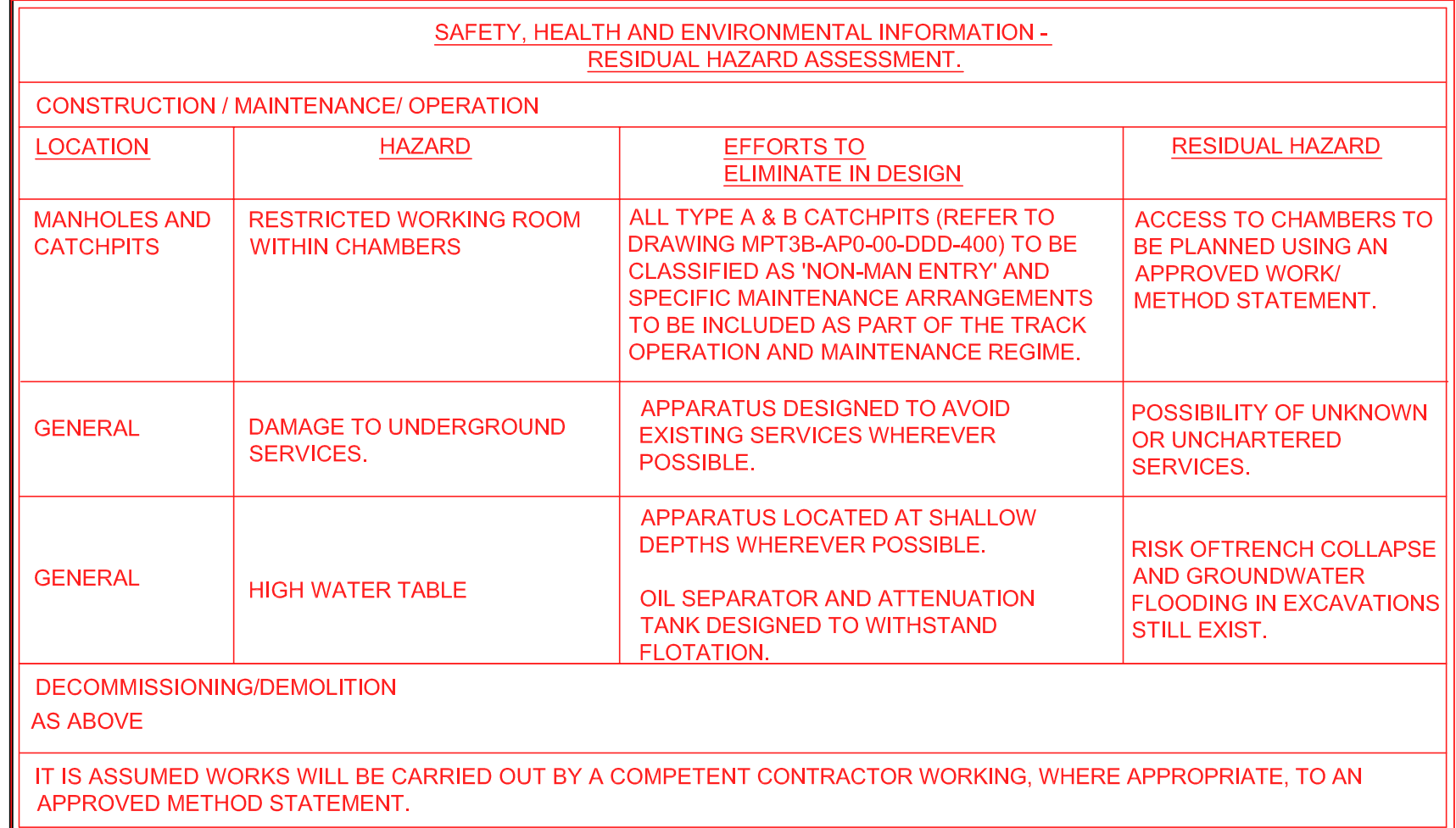
Foul Drainage Sketch

SHEET NUMBER

47070180 ACN SKETCH



APPENDIX C – METROLINK DESIGN DRAWING FOR RINGWAY ROAD



Design:	OA	MANCHESTER METROLINK PHASE 3B AIRPORT LINE - RINGWAY ROAD HIGHWAY INTERFACE WORKS	
CAD:	OA	DRAINAGE GENERAL ARRANGEMENT ROUTE SECTION - RRRHW AP SHEET 44	
Chk'd:			
FAY			
App'd:			
MH			
Scale:			
1/500 @ A1			
Date:	26 JULY 2011	Drg No' MPT3B-AP5-44-DDP-700	Rev: D04



APPENDIX D – EXISTING UNITED UTILITIES SEWER ON BAILEY LANE



tasks...

WasteWater

Woodhouse Park

250 ft
100 m
X
Y

ABOUT AECOM

In a complex and unpredictable world, where growing demands have to be met with finite resources, AECOM brings experience gained from improving quality of life in hundreds of places.

We bring together economists, planners, engineers, designers and project managers to work on projects at every scale. We engineer energy efficient buildings and we build new links between cities. We design new communities and regenerate existing ones. We are the first whole environments business, going beyond buildings and infrastructure.

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Appendix 9

Email from UU Accepting Foul Drainage Strategy - 23.06.14

Byrne, Neil

From: O'Brien, Neil <Neil.O'Brien@uuplc.co.uk>
Sent: 26 March 2014 16:17
To: Bamford, Vin
Cc: Laithwaite, Anthony
Subject: RE: Airport City North - Foul Drainage [Filed 28 Mar 2014 16:23]

Vin,

The scheme looks fine to me, if you are going to put it forward for adoption you will need to meet the requirements of SFA 6. You will need technical approval from Anthony

Regards

Neil

From: Bamford, Vin [<mailto:vin.bamford@urs.com>]
Sent: 14 March 2014 15:14
To: O'Brien, Neil
Subject: FW: Airport City North - Foul Drainage

Hi Neil

Following our meeting last week please see our attached proposal for the foul drainage of the Airport City North site. This is a gravity solution for the whole site and discharges as shown. It is not possible to discharge by gravity to the combined sewer to the east of the site (Woodhouse Road?) due to the invert levels in this sewer and the distance to far end of the site.

Hope this looks OK to you.

Regards

Vin B

From: Nelson, Brian
Sent: 14 March 2014 14:53
To: Bamford, Vin
Subject: Airport City North - Foul Drainage

Vin

Proposed outline scheme for foul drainage attached. This is a gravity scheme with the development to the north of the M56 falling to the existing combined sewer manhole on the corner of Selstead Road and Hilary Road. For the development to the south of the M56 I have assumed a connection to a foul system to the rear of the Voyager Hotel. There is approx. 4m level difference between the ground to the rear of the voyager and the proposed levels for building 1082 so a backdrop MH will be required.

Regards

Brian Nelson I.Eng AMIStructE
Senior Engineer
URS Infrastructure & Environment UK Limited

4th Floor, Bridgewater House, Whitworth Street, Manchester, M1 6LT
Direct: +44 (0)161 907 3576 (DL)
Fax: +44 (0)161 907 3559
brian.nelson@urs.com
www.ursglobal.com

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Appendix 10

Micro Drainage Calculations

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Date 16/08/2016 11:29	Designed by thokel	
File N1 23-5-16.MDX	Checked by	
XP Solutions	Network 2015.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for FROM PDS N1.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales					
Return Period (years)	100	Foul Sewage (l/s/ha)	0.000	Min Design Depth for Optimisation (m)	1.200
M5-60 (mm)	18.100	Volumetric Runoff Coeff.	0.750	Min Vel for Auto Design only (m/s)	1.00
Ratio R	0.390	Add Flow / Climate Change (%)	20	Min Slope for Optimisation (1:X)	500
Maximum Rainfall (mm/hr)	0	Minimum Backdrop Height (m)	0.500		
Maximum Time of Concentration (mins)	30	Maximum Backdrop Height (m)	10.000		

Designed with Level Soffits

Network Design Table for FROM PDS N1.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	44.882	0.090	498.7	0.108	5.00	0.0	0.600	o	900	
S1.001	95.278	0.191	498.8	0.180	0.00	0.0	0.600	o	1050	
S1.002	12.595	0.622	20.2	0.000	0.00	0.0	0.600	o	150	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	0.00	5.54	70.152	0.108	0.0	0.0	0.0	1.40	888.2	0.0
S1.001	0.00	6.57	69.912	0.288	0.0	0.0	0.0	1.54	1330.1	0.0
S1.002	0.00	6.66	69.721	0.288	0.0	0.0	0.0	2.25	39.7	0.0

Manhole Schedules for FROM PDS N1.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	75.975	5.823	Open Manhole	2400	S1.000	70.152	900				
S2	74.475	4.563	Open Manhole	2400	S1.001	69.912	1050	S1.000	70.062	900	
S3	71.000	1.279	Open Manhole	2400	S1.002	69.721	150	S1.001	69.721	1050	
S4	71.100	2.001	Open Manhole	2400		OUTFALL		S1.002	69.099	150	

PIPELINE SCHEDULES for FROM PDS N1.SWS

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	900	S1	75.975	70.152	4.923	Open Manhole	2400
S1.001	o	1050	S2	74.475	69.912	3.513	Open Manhole	2400
S1.002	o	150	S3	71.000	69.721	1.129	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	44.882	498.7	S2	74.475	70.062	3.513	Open Manhole	2400
S1.001	95.278	498.8	S3	71.000	69.721	0.229	Open Manhole	2400
S1.002	12.595	20.2	S4	71.100	69.099	1.851	Open Manhole	2400

Simulation Criteria for FROM PDS N1.SWS

Volumetric Runoff Coeff 0.750 Manhole Headloss Coeff (Global) 0.500 Inlet Coeffiecient 0.800
Areal Reduction Factor 1.000 Foul Sewage per hectare (l/s) 0.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Additional Flow - % of Total Flow 0.000 Run Time (mins) 60
Hot Start Level (mm) 0 MADD Factor * 10m³/ha Storage 2.000 Output Interval (mins) 1

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 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Return Period (years) 2 Ratio R 0.390 Cv (Winter) 0.840
Region England and Wales Profile Type Summer Storm Duration (mins) 30

Online Controls for FROM PDS N1.SWS

Hydro-Brake® Manhole: S3, DS/PN: S1.002, Volume (m³): 86.2

Design Head (m) 1.400 Hydro-Brake® Type Md6 SW Only Invert Level (m) 69.721
Design Flow (l/s) 5.0 Diameter (mm) 86

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)	Depth (m)	Flow (l/s)
0.100	2.5	0.600	3.3	1.600	5.3	2.600	6.8	5.000	9.4	7.500	11.6
0.200	3.3	0.800	3.8	1.800	5.7	3.000	7.3	5.500	9.9	8.000	11.9
0.300	3.1	1.000	4.2	2.000	6.0	3.500	7.9	6.000	10.3	8.500	12.3
0.400	3.0	1.200	4.6	2.200	6.3	4.000	8.4	6.500	10.8	9.000	12.7
0.500	3.1	1.400	5.0	2.400	6.5	4.500	9.0	7.000	11.2	9.500	13.0

Summary of Critical Results by Maximum Level (Rank 1) for FROM PDS N1.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 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 0 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 0.367 Cv (Winter) 0.840

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

Profile(s)

Summer and Winter

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

Return Period(s) (years) 100
Climate Change (%) 40

									Water Surcharged Flooded					Pipe
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)
S1.000	S1 180	Winter	100	+40%					71.010	-0.042	0.000	0.02		13.5
S1.001	S2 180	Winter	100	+40%	100/120 Winter				71.008	0.046	0.000	0.02		27.4
S1.002	S3 180	Winter	100	+40%	100/15 Summer	100/120 Winter			71.008	1.137	8.214	0.13		4.8

US/MH		Level	
PN	Name	Status	Exceeded
S1.000	S1	OK	
S1.001	S2	SURCHARGED	
S1.002	S3	FLOOD	4

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for FROM PDS N2.SWS

Pipe Sizes For PDS Manhole Sizes For PDS

FSR Rainfall Model - England and Wales					
Return Period (years)	2	Foul Sewage (l/s/ha)	0.000	Min Design Depth for Optimisation (m)	1.200
M5-60 (mm)	18.000	Volumetric Runoff Coeff.	0.750	Min Vel for Auto Design only (m/s)	1.00
Ratio R	0.374	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Rainfall (mm/hr)	0	Minimum Backdrop Height (m)	0.500		
Maximum Time of Concentration (mins)	30	Maximum Backdrop Height (m)	10.000		

Designed with Level Soffits

Network Design Table for FROM PDS N2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	53.878	0.180	299.3	0.135	5.00	0.0	0.600	o	1200	
S1.001	66.801	0.140	477.2	0.135	0.00	0.0	0.600	o	750	
S1.002	10.250	0.070	146.4	0.000	0.00	0.0	0.600	o	150	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	0.00	5.42	68.180	0.135	0.0	0.0	0.0	2.16	2439.8	0.0
S1.001	0.00	6.29	68.000	0.270	0.0	0.0	0.0	1.27	563.0	0.0
S1.002	0.00	6.50	67.860	0.270	0.0	0.0	0.0	0.83	14.6	0.0

Manhole Schedules for FROM PDS N2.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S5	70.875	2.695	Open Manhole	4000	S1.000	68.180	1200				
S6	70.425	2.425	Open Manhole	2100	S1.001	68.000	750	S1.000	68.000	1200	
S7	69.225	1.365	Open Manhole	2100	S1.002	67.860	150	S1.001	67.860	750	
S00	69.301	1.511	Open Manhole	2400		OUTFALL		S1.002	67.790	150	

PIPELINE SCHEDULES for FROM PDS N2.SWS

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	1200	S5	70.875	68.180	1.495	Open Manhole	4000
S1.001	o	750	S6	70.425	68.000	1.675	Open Manhole	2100
S1.002	o	150	S7	69.225	67.860	1.215	Open Manhole	2100

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	53.878	299.3	S6	70.425	68.000	1.225	Open Manhole	2100
S1.001	66.801	477.2	S7	69.225	67.860	0.615	Open Manhole	2100
S1.002	10.250	146.4	S00	69.301	67.790	1.361	Open Manhole	2400

Simulation Criteria for FROM PDS N2.SWS

Volumetric Runoff Coeff 0.750 Manhole Headloss Coeff (Global) 0.500 Inlet Coeffiecient 0.800
Areal Reduction Factor 1.000 Foul Sewage per hectare (l/s) 0.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Additional Flow - % of Total Flow 0.000 Run Time (mins) 60
Hot Start Level (mm) 0 MADD Factor * 10m³/ha Storage 2.000 Output Interval (mins) 1

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 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Return Period (years) 2 Ratio R 0.390 Cv (Winter) 0.840
Region England and Wales Profile Type Summer Storm Duration (mins) 30

Online Controls for FROM PDS N2.SWS

Hydro-Brake® Manhole: S7, DS/PN: S1.002, Volume (m³): 33.3

Design Head (m) 0.950 Hydro-Brake® Type Md6 SW Only Invert Level (m) 67.860
Design Flow (l/s) 5.0 Diameter (mm) 94

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)	Depth (m)	Flow (l/s)
0.100	2.8	0.600	4.0	1.600	6.4	2.600	8.1	5.000	11.3	7.500	13.8
0.200	4.1	0.800	4.5	1.800	6.8	3.000	8.7	5.500	11.8	8.000	14.3
0.300	3.9	1.000	5.0	2.000	7.1	3.500	9.4	6.000	12.3	8.500	14.7
0.400	3.8	1.200	5.5	2.200	7.5	4.000	10.1	6.500	12.9	9.000	15.1
0.500	3.8	1.400	6.0	2.400	7.8	4.500	10.7	7.000	13.3	9.500	15.5

Summary of Critical Results by Maximum Level (Rank 1) for FROM PDS N2.SWS

Simulation Criteria

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Region England and Wales Ratio R 0.390 Cv (Winter) 0.840

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

Profile(s)

Summer and Winter

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

Return Period(s) (years) 100
Climate Change (%) 40

									Water	Surcharged	Flooded				Pipe
PN	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	
	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)	(l/s)	
S1.000	S5	240 Winter	100	+40%					69.243	-0.137	0.000	0.01		11.5	
S1.001	S6	240 Winter	100	+40%	100/30 Summer				69.241	0.491	0.000	0.03		17.1	
S1.002	S7	240 Winter	100	+40%	100/15 Summer	100/60 Winter			69.241	1.231	16.365	0.38		5.0	

US/MH		Level	
PN	Name	Status	Exceeded
S1.000	S5	OK	
S1.001	S6	SURCHARGED	
S1.002	S7	FLOOD	15

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File N3 11-08-16.MDX	Checked by	
XP Solutions	Network 2015.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for FROM PDS N3.SWS

Pipe Sizes For PDS Manhole Sizes For PDS

FSR Rainfall Model - England and Wales

Return Period (years)	100	Foul Sewage (l/s/ha)	0.000	Min Design Depth for Optimisation (m)	1.200
M5-60 (mm)	18.000	Volumetric Runoff Coeff.	0.750	Min Vel for Auto Design only (m/s)	1.00
Ratio R	0.367	Add Flow / Climate Change (%)	20	Min Slope for Optimisation (1:X)	1000
Maximum Rainfall (mm/hr)	150	Minimum Backdrop Height (m)	0.500		
Maximum Time of Concentration (mins)	30	Maximum Backdrop Height (m)	10.000		

Designed with Level Soffits

Network Design Table for FROM PDS N3.SWS

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	25.000	0.114	219.3	0.170	5.00	0.0	0.600	o	300	
S2.000	18.000	0.083	216.9	0.016	5.00	0.0	0.600	o	300	
S1.001	55.000	0.092	597.8	0.022	0.00	0.0	0.600	o	1800	
S3.000	30.000	0.100	300.0	0.825	5.00	0.0	0.600	o	1500	
S3.001	30.000	0.100	300.0	0.000	0.00	0.0	0.600	o	225	
S1.002	90.000	0.151	596.0	0.128	0.00	0.0	0.600	o	1800	
S4.000	45.000#	0.100	450.0	0.418	5.00	0.0	0.600	o	900	
S5.000	45.000#	0.100	450.0	0.036	5.00	0.0	0.600	o	900	
S1.003	60.000	0.101	594.1	0.273	0.00	0.0	0.600	o	1800	
S6.000	30.000	0.030	1000.0	1.898	5.00	0.0	0.600	o	1500	
S6.001	30.000	0.963	31.2	0.000	0.00	0.0	0.600	o	225	
S1.004	7.000	0.207	33.8	0.160	0.00	0.0	0.600	o	300	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	135.35	5.39	68.465	0.170	0.0	0.0	12.5	1.06	74.8«	74.8
S2.000	136.40	5.28	68.434	0.016	0.0	0.0	1.2	1.06	75.2	7.1
S1.001	131.14	5.86	66.851	0.208	0.0	0.0	14.8	1.95	4970.8	88.6
S3.000	137.17	5.20	67.500	0.825	0.0	0.0	61.3	2.47	4367.2	367.8
S3.001	131.09	5.87	67.400	0.825	0.0	0.0	61.3	0.75	29.8«	367.8
S1.002	124.89	6.64	66.759	1.161	0.0	0.0	78.5	1.96	4978.4	471.2
S4.000	134.28	5.51	66.708	0.418	0.0	0.0	30.4	1.47	935.5	182.4
S5.000	134.28	5.51	66.708	0.036	0.0	0.0	2.6	1.47	935.5	15.7
S1.003	121.16	7.15	66.608	1.888	0.0	0.0	123.9	1.96	4986.7	743.4
S6.000	135.56	5.37	68.025	1.898	0.0	0.0	139.4	1.35	2382.0	836.2
S6.001	133.61	5.58	67.995	1.898	0.0	0.0	139.4	2.35	93.5«	836.2
S1.004	120.85	7.19	66.507	3.946	0.0	0.0	258.3	2.71	191.8«	1549.8

Manhole Schedules for FROM PDS N3.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S8	69.925	1.460	Open Manhole	1500	S1.000	68.465	300				
S14	69.425	0.991	Open Manhole	1500	S2.000	68.434	300				
S9	69.875	3.024	Open Manhole	2700	S1.001	66.851	1800	S1.000	68.351	300	
								S2.000	68.351	300	
S00	70.500	3.000	Open Manhole	2100	S3.000	67.500	1500				
S00	70.500	3.100	Open Manhole	2100	S3.001	67.400	225	S3.000	67.400	1500	
S10	70.025	3.266	Open Manhole	2700	S1.002	66.759	1800	S1.001	66.759	1800	
								S3.001	67.300	225	
S15	70.250	3.542	Open Manhole	2700	S4.000	66.708	900				
S16	69.975	3.267	Open Manhole	2700	S5.000	66.708	900				
S11	69.525	2.917	Open Manhole	2700	S1.003	66.608	1800	S1.002	66.608	1800	
								S4.000	66.608	900	
								S5.000	66.608	900	
S00	70.500	2.475	Open Manhole	2100	S6.000	68.025	1500				
S00	70.500	2.505	Open Manhole	2100	S6.001	67.995	225	S6.000	67.995	1500	
S12	69.075	2.568	Open Manhole	2700	S1.004	66.507	300	S1.003	66.507	1800	
								S6.001	67.032	225	
S13	68.946	2.646	Open Manhole	2700		OUTFALL		S1.004	66.300	300	450

PIPELINE SCHEDULES for FROM PDS N3.SWS

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	300	S8	69.925	68.465	1.160	Open Manhole	1500
S2.000	o	300	S14	69.425	68.434	0.691	Open Manhole	1500
S1.001	o	1800	S9	69.875	66.851	1.224	Open Manhole	2700
S3.000	o	1500	S00	70.500	67.500	1.500	Open Manhole	2100
S3.001	o	225	S00	70.500	67.400	2.875	Open Manhole	2100
S1.002	o	1800	S10	70.025	66.759	1.466	Open Manhole	2700
S4.000	o	900	S15	70.250	66.708	2.642	Open Manhole	2700
S5.000	o	900	S16	69.975	66.708	2.367	Open Manhole	2700
S1.003	o	1800	S11	69.525	66.608	1.117	Open Manhole	2700
S6.000	o	1500	S00	70.500	68.025	0.975	Open Manhole	2100
S6.001	o	225	S00	70.500	67.995	2.280	Open Manhole	2100
S1.004	o	300	S12	69.075	66.507	2.268	Open Manhole	2700

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	25.000	219.3	S9	69.875	68.351	1.224	Open Manhole	2700
S2.000	18.000	216.9	S9	69.875	68.351	1.224	Open Manhole	2700
S1.001	55.000	597.8	S10	70.025	66.759	1.466	Open Manhole	2700
S3.000	30.000	300.0	S00	70.500	67.400	1.600	Open Manhole	2100
S3.001	30.000	300.0	S10	70.025	67.300	2.500	Open Manhole	2700
S1.002	90.000	596.0	S11	69.525	66.608	1.117	Open Manhole	2700
S4.000	45.000#	450.0	S11	69.525	66.608	2.017	Open Manhole	2700
S5.000	45.000#	450.0	S11	69.525	66.608	2.017	Open Manhole	2700
S1.003	60.000	594.1	S12	69.075	66.507	0.768	Open Manhole	2700
S6.000	30.000	1000.0	S00	70.500	67.995	1.005	Open Manhole	2100
S6.001	30.000	31.2	S12	69.075	67.032	1.818	Open Manhole	2700
S1.004	7.000	33.8	S13	68.946	66.300	2.346	Open Manhole	2700

Simulation Criteria for FROM PDS N3.SWS

Volumetric Runoff Coeff 0.840Manhole Headloss Coeff (Global) 0.500Inlet Coeffiecient 0.800

Areal Reduction Factor 1.000Foul Sewage per hectare (l/s) 0.000Flow per Person per Day (l/per/day) 0.000

Hot Start (mins) 0Additional Flow - % of Total Flow 0.000Run Time (mins) 360

Hot Start Level (mm) 0MADD Factor * 10m³/ha Storage 2.000Output Interval (mins) 3

Number of Input Hydrographs 0Number of Offline Controls 0Number of Time/Area Diagrams 0

Number of Online Controls 4Number of Storage Structures 2Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall ModelFSRM5-60 (mm) 18.100Cv (Summer) 0.750

Return Period (years)100Ratio R 0.390Cv (Winter) 0.840

Region England and WalesProfile Type Winter Storm Duration (mins) 180

Online Controls for FROM PDS N3.SWS

Non Return Valve Manhole: S9, DS/PN: S1.001, Volume (m³): 20.1

Pump Manhole: S00, DS/PN: S3.001, Volume (m³): 60.0

Invert Level (m) 67.400

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)	Depth (m)	Flow (l/s)
0.200	4.1250	1.200	4.1250	2.200	4.1250	3.200	4.1250	4.200	4.1250	5.200	4.1250
0.400	4.1250	1.400	4.1250	2.400	4.1250	3.400	4.1250	4.400	4.1250	5.400	4.1250
0.600	4.1250	1.600	4.1250	2.600	4.1250	3.600	4.1250	4.600	4.1250	5.600	4.1250
0.800	4.1250	1.800	4.1250	2.800	4.1250	3.800	4.1250	4.800	4.1250	5.800	4.1250
1.000	4.1250	2.000	4.1250	3.000	4.1250	4.000	4.1250	5.000	4.1250	6.000	4.1250

Pump Manhole: S00, DS/PN: S6.001, Volume (m³): 58.0

Invert Level (m) 67.995

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)	Depth (m)	Flow (l/s)
0.200	9.4900	1.200	9.4900	2.200	9.4900	3.200	9.4900	4.200	9.4900	5.200	9.4900
0.400	9.4900	1.400	9.4900	2.400	9.4900	3.400	9.4900	4.400	9.4900	5.400	9.4900
0.600	9.4900	1.600	9.4900	2.600	9.4900	3.600	9.4900	4.600	9.4900	5.600	9.4900
0.800	9.4900	1.800	9.4900	2.800	9.4900	3.800	9.4900	4.800	9.4900	5.800	9.4900
1.000	9.4900	2.000	9.4900	3.000	9.4900	4.000	9.4900	5.000	9.4900	6.000	9.4900

Hydro-Brake® Manhole: S12, DS/PN: S1.004, Volume (m³): 161.6

Design Head (m) 2.400 Hydro-Brake® Type Md6 SW Only Invert Level (m) 66.507
Design Flow (l/s) 24.5 Diameter (mm) 166

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)	Depth (m)	Flow (l/s)
0.100	5.5	0.600	15.8	1.600	19.9	2.600	25.4	5.000	35.2	7.500	43.1
0.200	13.2	0.800	15.6	1.800	21.1	3.000	27.2	5.500	36.9	8.000	44.5
0.300	16.6	1.000	16.4	2.000	22.2	3.500	29.4	6.000	38.5	8.500	45.8
0.400	16.9	1.200	17.5	2.200	23.3	4.000	31.4	6.500	40.1	9.000	47.2
0.500	16.4	1.400	18.7	2.400	24.4	4.500	33.4	7.000	41.6	9.500	48.5

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Summary of Critical Results by Maximum Level (Rank 1) for FROM PDS N3.SWS

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 4 Number of Storage Structures 2 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 0.376 Cv (Winter) 0.840

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

Profile(s)

Summer and Winter

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

Return Period(s) (years) 100
Climate Change (%) 40

										Water	Surcharged	Flooded			Pipe
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	
S1.000	S8 960 Winter		100	+40%	100/15 Summer				69.173	0.408	0.000	0.10		6.3	
S2.000	S14 960 Winter		100	+40%	100/180 Winter				69.171	0.437	0.000	0.01		0.6	
S1.001	S9 960 Winter		100	+40%	100/180 Winter				69.171	0.520	0.000	0.00		7.1	
S3.000	S00 240 Winter		100	+40%					68.475	-0.525	0.000	0.03		90.3	
S3.001	S00 600 Winter		100	+40%	100/15 Summer				68.456	0.831	0.000	0.15		4.1	
S1.002	S10 960 Winter		100	+40%	100/180 Winter				69.172	0.613	0.000	0.00		12.5	
S4.000	S15 960 Winter		100	+40%	100/30 Summer				69.171	1.563	0.000	0.02		14.6	
S5.000	S16 960 Winter		100	+40%	100/30 Summer				69.172	1.564	0.000	0.00		1.1	
S1.003	S11 960 Winter		100	+40%	100/120 Winter				69.172	0.764	0.000	0.01		30.9	
S6.000	S00 15 Winter		100	+40%					68.970	-0.555	0.000	0.87		1004.6	
S6.001	S00 600 Winter		100	+40%	100/15 Summer				68.698	0.478	0.000	0.11		9.5	
S1.004	S12 960 Winter		100	+40%	100/15 Summer	100/180 Winter			69.172	2.365	96.721	0.21		24.4	

		US/MH			Level
PN	Name	Status			Exceeded
S1.000	S8	SURCHARGED			
S2.000	S14	FLOOD RISK			
S1.001	S9	SURCHARGED			
S3.000	S00	OK			
S3.001	S00	SURCHARGED			
S1.002	S10	SURCHARGED			
S4.000	S15	SURCHARGED			
S5.000	S16	SURCHARGED			
S1.003	S11	SURCHARGED			
S6.000	S00	OK			
S6.001	S00	SURCHARGED			
S1.004	S12	FLOOD			15

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for FROM PDS N4.SWS

Pipe Sizes For PDS Manhole Sizes For PDS

FSR Rainfall Model - England and Wales					
Return Period (years)	100	Foul Sewage (l/s/ha)	0.000	Min Design Depth for Optimisation (m)	1.200
M5-60 (mm)	18.100	Volumetric Runoff Coeff.	0.750	Min Vel for Auto Design only (m/s)	1.00
Ratio R	0.390	Add Flow / Climate Change (%)	20	Min Slope for Optimisation (1:X)	500
Maximum Rainfall (mm/hr)	0	Minimum Backdrop Height (m)	0.500		
Maximum Time of Concentration (mins)	30	Maximum Backdrop Height (m)	10.000		

Designed with Level Soffits

Network Design Table for FROM PDS N4.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	50.000	0.107	467.3	0.147	5.00	0.0	0.600	o	1500	
S2.000	30.000	0.060	500.0	2.383	5.00	0.0	0.600	o	675	
S2.001	30.000	1.497	20.0	0.000	0.00	0.0	0.600	o	225	
S3.000	30.000	0.100	300.0	1.199	5.00	0.0	0.600	o	675	
S3.001	30.000	0.107	280.4	0.000	0.00	0.0	0.600	o	225	
S1.001	35.000	0.070	500.0	0.059	0.00	0.0	0.600	o	1500	
S1.002	25.000	0.050	500.0	0.042	0.00	0.0	0.600	o	1500	
S1.003	90.000	0.180	500.0	0.149	0.00	0.0	0.600	o	1500	
S4.000	30.000	0.060	500.0	2.357	5.00	0.0	0.600	o	600	
S4.001	30.000	0.797	37.6	0.000	0.00	0.0	0.600	o	225	
S5.000	30.000	0.060	500.0	0.811	5.00	0.0	0.600	o	600	
S5.001	30.000	0.872	34.4	0.000	0.00	0.0	0.600	o	225	
S1.004	85.000	0.170	500.0	0.149	0.00	0.0	0.600	o	1500	
S1.005	5.000	0.023	217.4	0.151	0.00	0.0	0.600	o	300	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	0.00	5.42	66.900	0.147	0.0	0.0	0.0	1.98	3494.8	0.0
S2.000	0.00	5.43	69.625	2.383	0.0	0.0	0.0	1.17	417.0	0.0
S2.001	0.00	5.60	69.565	2.383	0.0	0.0	0.0	2.94	116.8	0.0
S3.000	0.00	5.33	67.000	1.199	0.0	0.0	0.0	1.51	539.6	0.0
S3.001	0.00	5.98	66.900	1.199	0.0	0.0	0.0	0.78	30.9	0.0
S1.001	0.00	6.28	66.793	3.788	0.0	0.0	0.0	1.91	3377.8	0.0
S1.002	0.00	6.50	66.723	3.830	0.0	0.0	0.0	1.91	3377.8	0.0
S1.003	0.00	7.28	66.673	3.979	0.0	0.0	0.0	1.91	3377.8	0.0
S4.000	0.00	5.46	68.625	2.357	0.0	0.0	0.0	1.08	306.0	0.0
S4.001	0.00	5.70	68.565	2.357	0.0	0.0	0.0	2.14	85.0	0.0
S5.000	0.00	5.46	68.700	0.811	0.0	0.0	0.0	1.08	306.0	0.0
S5.001	0.00	5.69	68.640	0.811	0.0	0.0	0.0	2.24	89.0	0.0
S1.004	0.00	8.03	66.493	7.296	0.0	0.0	0.0	1.91	3377.8	0.0
S1.005	0.00	8.10	66.323	7.447	0.0	0.0	0.0	1.06	75.1	0.0

Manhole Schedules for FROM PDS N4.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S17	70.110	3.210	Open Manhole	2400	S1.000	66.900	1500				
S00	71.500	1.875	Open Manhole	2400	S2.000	69.625	675				
S00	71.500	1.935	Open Manhole	2400	S2.001	69.565	225	S2.000	69.565	675	
S00	71.500	4.500	Open Manhole	2400	S3.000	67.000	675				
S00	71.500	4.600	Open Manhole	2400	S3.001	66.900	225	S3.000	66.900	675	
S18	70.050	3.257	Open Manhole	2400	S1.001	66.793	1500	S1.000	66.793	1500	
								S2.001	68.068	225	
								S3.001	66.793	225	
S19	69.900	3.177	Open Manhole	2400	S1.002	66.723	1500	S1.001	66.723	1500	
S20	69.800	3.127	Open Manhole	2400	S1.003	66.673	1500	S1.002	66.673	1500	
S00	70.500	1.875	Open Manhole	2400	S4.000	68.625	600				
S00	70.500	1.935	Open Manhole	2400	S4.001	68.565	225	S4.000	68.565	600	
S00	70.500	1.800	Open Manhole	2400	S5.000	68.700	600				
S00	70.500	1.860	Open Manhole	2400	S5.001	68.640	225	S5.000	68.640	600	
S21	69.350	2.857	Open Manhole	2400	S1.004	66.493	1500	S1.003	66.493	1500	
								S4.001	67.768	225	
								S5.001	67.768	225	
S22	69.000	2.677	Open Manhole	2400	S1.005	66.323	300	S1.004	66.323	1500	
S23	69.100	2.800	Open Manhole	2400		OUTFALL		S1.005	66.300	300	

PIPELINE SCHEDULES for FROM PDS N4.SWS

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	1500	S17	70.110	66.900	1.710	Open Manhole	2400
S2.000	o	675	S00	71.500	69.625	1.200	Open Manhole	2400
S2.001	o	225	S00	71.500	69.565	1.710	Open Manhole	2400
S3.000	o	675	S00	71.500	67.000	3.825	Open Manhole	2400
S3.001	o	225	S00	71.500	66.900	4.375	Open Manhole	2400
S1.001	o	1500	S18	70.050	66.793	1.757	Open Manhole	2400
S1.002	o	1500	S19	69.900	66.723	1.677	Open Manhole	2400
S1.003	o	1500	S20	69.800	66.673	1.627	Open Manhole	2400
S4.000	o	600	S00	70.500	68.625	1.275	Open Manhole	2400
S4.001	o	225	S00	70.500	68.565	1.710	Open Manhole	2400
S5.000	o	600	S00	70.500	68.700	1.200	Open Manhole	2400
S5.001	o	225	S00	70.500	68.640	1.635	Open Manhole	2400
S1.004	o	1500	S21	69.350	66.493	1.357	Open Manhole	2400
S1.005	o	300	S22	69.000	66.323	2.377	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	50.000	467.3	S18	70.050	66.793	1.757	Open Manhole	2400
S2.000	30.000	500.0	S00	71.500	69.565	1.260	Open Manhole	2400
S2.001	30.000	20.0	S18	70.050	68.068	1.757	Open Manhole	2400
S3.000	30.000	300.0	S00	71.500	66.900	3.925	Open Manhole	2400
S3.001	30.000	280.4	S18	70.050	66.793	3.032	Open Manhole	2400
S1.001	35.000	500.0	S19	69.900	66.723	1.677	Open Manhole	2400
S1.002	25.000	500.0	S20	69.800	66.673	1.627	Open Manhole	2400
S1.003	90.000	500.0	S21	69.350	66.493	1.357	Open Manhole	2400
S4.000	30.000	500.0	S00	70.500	68.565	1.335	Open Manhole	2400
S4.001	30.000	37.6	S21	69.350	67.768	1.357	Open Manhole	2400
S5.000	30.000	500.0	S00	70.500	68.640	1.260	Open Manhole	2400
S5.001	30.000	34.4	S21	69.350	67.768	1.357	Open Manhole	2400
S1.004	85.000	500.0	S22	69.000	66.323	1.177	Open Manhole	2400
S1.005	5.000	217.4	S23	69.100	66.300	2.500	Open Manhole	2400

Simulation Criteria for FROM PDS N4.SWS

Volumetric Runoff Coeff 0.840 Manhole Headloss Coeff (Global) 0.500 Inlet Coeffiecient 0.800
Areal Reduction Factor 1.000 Foul Sewage per hectare (l/s) 0.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Additional Flow - % of Total Flow 0.000 Run Time (mins) 4320
Hot Start Level (mm) 0 MADD Factor * 10m³/ha Storage 2.000 Output Interval (mins) 24

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Return Period (years) 100 Ratio R 0.390 Cv (Winter) 0.840
Region England and Wales Profile Type Winter Storm Duration (mins) 2160

Online Controls for FROM PDS N4.SWS

Pump Manhole: S00, DS/PN: S2.001, Volume (m³): 18.6

Invert Level (m) 69.565

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)	Depth (m)	Flow (l/s)
0.200	11.9150	1.200	11.9150	2.200	11.9150	3.200	11.9150	4.200	11.9150	5.200	11.9150
0.400	11.9150	1.400	11.9150	2.400	11.9150	3.400	11.9150	4.400	11.9150	5.400	11.9150
0.600	11.9150	1.600	11.9150	2.600	11.9150	3.600	11.9150	4.600	11.9150	5.600	11.9150
0.800	11.9150	1.800	11.9150	2.800	11.9150	3.800	11.9150	4.800	11.9150	5.800	11.9150
1.000	11.9150	2.000	11.9150	3.000	11.9150	4.000	11.9150	5.000	11.9150	6.000	11.9150

Pump Manhole: S00, DS/PN: S3.001, Volume (m³): 30.7

Invert Level (m) 66.900

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)	Depth (m)	Flow (l/s)
0.200	6.0000	1.200	6.0000	2.200	6.0000	3.200	6.0000	4.200	6.0000	5.200	6.0000
0.400	6.0000	1.400	6.0000	2.400	6.0000	3.400	6.0000	4.400	6.0000	5.400	6.0000
0.600	6.0000	1.600	6.0000	2.600	6.0000	3.600	6.0000	4.600	6.0000	5.600	6.0000
0.800	6.0000	1.800	6.0000	2.800	6.0000	3.800	6.0000	4.800	6.0000	5.800	6.0000
1.000	6.0000	2.000	6.0000	3.000	6.0000	4.000	6.0000	5.000	6.0000	6.000	6.0000

Pump Manhole: S00, DS/PN: S4.001, Volume (m³): 16.6

Invert Level (m) 68.565

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)	Depth (m)	Flow (l/s)
0.200	11.7850	1.200	11.7850	2.200	11.7850	3.200	11.7850	4.200	11.7850	5.200	11.7850
0.400	11.7850	1.400	11.7850	2.400	11.7850	3.400	11.7850	4.400	11.7850	5.400	11.7850
0.600	11.7850	1.600	11.7850	2.600	11.7850	3.600	11.7850	4.600	11.7850	5.600	11.7850
0.800	11.7850	1.800	11.7850	2.800	11.7850	3.800	11.7850	4.800	11.7850	5.800	11.7850
1.000	11.7850	2.000	11.7850	3.000	11.7850	4.000	11.7850	5.000	11.7850	6.000	11.7850

Pump Manhole: S00, DS/PN: S5.001, Volume (m³): 16.2

Invert Level (m) 68.640

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)	Depth (m)	Flow (l/s)
0.200	4.0550	1.200	4.0550	2.200	4.0550	3.200	4.0550	4.200	4.0550	5.200	4.0550
0.400	4.0550	1.400	4.0550	2.400	4.0550	3.400	4.0550	4.400	4.0550	5.400	4.0550
0.600	4.0550	1.600	4.0550	2.600	4.0550	3.600	4.0550	4.600	4.0550	5.600	4.0550
0.800	4.0550	1.800	4.0550	2.800	4.0550	3.800	4.0550	4.800	4.0550	5.800	4.0550
1.000	4.0550	2.000	4.0550	3.000	4.0550	4.000	4.0550	5.000	4.0550	6.000	4.0550

Hydro-Brake® Manhole: S22, DS/PN: S1.005, Volume (m³): 158.1

Design Head (m) 2.100 Hydro-Brake® Type Md6 SW Only Invert Level (m) 66.323
Design Flow (l/s) 38.8 Diameter (mm) 216

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)	Depth (m)	Flow (l/s)
0.100	7.2	0.600	32.1	1.600	34.1	2.600	42.9	5.000	59.5	7.500	72.9
0.200	19.0	0.800	30.5	1.800	35.9	3.000	46.1	5.500	62.4	8.000	75.3
0.300	28.6	1.000	30.1	2.000	37.7	3.500	49.8	6.000	65.2	8.500	77.6
0.400	32.2	1.200	30.9	2.200	39.5	4.000	53.2	6.500	67.9	9.000	79.9
0.500	32.7	1.400	32.4	2.400	41.3	4.500	56.5	7.000	70.4	9.500	82.0

Summary of Critical Results by Maximum Level (Rank 1) for FROM PDS N4.SWS

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 4 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 0.381 Cv (Winter) 0.840

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

Profile(s)

Summer and Winter

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

Return Period(s) (years) 100
Climate Change (%) 40

									Water Surcharged Flooded						Pipe
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Flow (l/s)
S1.000	S17	2160 Winter	100	+40%	100/360 Winter				69.028	0.628	0.000	0.00			2.6
S2.000	S00	15 Winter	100	+40%	100/15 Summer				71.198	0.898	0.000	3.74			1237.8
S2.001	S00	720 Winter	100	+40%	100/15 Summer				70.498	0.708	0.000	0.11			11.9
S3.000	S00	600 Winter	100	+40%	100/15 Summer				70.446	2.771	0.000	0.15			63.4
S3.001	S00	600 Winter	100	+40%	100/15 Summer				70.445	3.320	0.000	0.21			6.0
S1.001	S18	2160 Winter	100	+40%	100/360 Summer				69.028	0.735	0.000	0.01			20.7
S1.002	S19	2160 Winter	100	+40%	100/360 Summer				69.028	0.805	0.000	0.01			21.3
S1.003	S20	2160 Winter	100	+40%	100/360 Summer				69.027	0.854	0.000	0.01			23.3
S4.000	S00	15 Winter	100	+40%	100/15 Summer	100/15 Winter			70.505	1.280	5.425	4.68			1168.1
S4.001	S00	720 Winter	100	+40%	100/15 Summer				69.493	0.703	0.000	0.15			11.8
S5.000	S00	720 Winter	100	+40%	100/15 Summer				69.512	0.212	0.000	0.15			36.6
S5.001	S00	720 Winter	100	+40%	100/15 Summer				69.511	0.646	0.000	0.05			4.1
S1.004	S21	2160 Winter	100	+40%	100/240 Summer				69.028	1.035	0.000	0.02			41.2
S1.005	S22	2160 Winter	100	+40%	100/15 Summer	100/480 Winter			69.028	2.405	27.613	0.79			39.3

		US/MH		Level	
PN	Name	Status	Exceeded		
S1.000	S17	SURCHARGED			
S2.000	S00	SURCHARGED			
S2.001	S00	SURCHARGED			
S3.000	S00	SURCHARGED			
S3.001	S00	SURCHARGED			
S1.001	S18	SURCHARGED			
S1.002	S19	SURCHARGED			
S1.003	S20	SURCHARGED			
S4.000	S00	FLOOD	1		
S4.001	S00	SURCHARGED			
S5.000	S00	SURCHARGED			
S5.001	S00	SURCHARGED			
S1.004	S21	SURCHARGED			
S1.005	S22	FLOOD	8		

Appendix 11

Culvert Details

Spine Road 2015

曼彻斯特空港城

CONSULTANT

AECOM Manchester
Bridgewater House, Whitworth Street,
Manchester, M1 6LT
0161 907 3500 tel 0161 907 3599 fax
www.aecom.com

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REGISTRATION

ISSUE/REVISION		
P1	15/12/15	FOR INFORMATION
I/R	DATE	DESCRIPTION

KEY PLAN	
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PROJECT NUMBER

47070180

Proposed Culvert 2 Sections & Details

SHEET NUMBER

47070180_ACN_C_2007



NOTES

1. DRAWING TO BE USED FOR COSTING PURPOSES ONLY.
2. DO NOT SCALE FROM THIS DRAWING - REFER TO WRITTEN SCALES ONLY.
3. ALL PIPE DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
4. MANHOLE DIMENSIONS ARE INDICATIVE ONLY.
5. WHERE SIMILAR OR APPROVED APPLIES THIS IS TO BE REFERRED TO THE DESIGNER.
6. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE SURFACE DRAINAGE DRAWINGS - DRAWING NO. 47/07/18/1, ACONSR, 2000-2004.
7. REFER TO DRAWING NO. 47/07/18/2, ACONSR, 2005 FOR SURFACE WATER MANHOLE SCHEDULE.