

WATERCOURSE TEMPORARY DIVERSION HYDRAULIC CALCULATIONS

THQ PHASE 1

for

Airport City Limited Partnership
(ACLP)

civil

structural

earth sciences

strategic land

special projects

COMPLEX CHALLENGES ...
MADE SIMPLE

17 / 02 / 2020



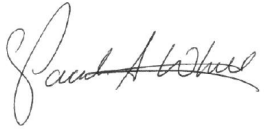
COMPLEX CHALLENGES ...
MADE SIMPLE

WATERCOURSE TEMPORARY DIVERSION HYDRAULIC CALCULATIONS

THQ PHASE 1

for

Airport City Limited Partnership
(ACLP)

TITLE	NAME	SIGNATURE	DATE
Report Author	DAVID EATO		17.02.2020
Operations Director	PAUL WHITE		17.02.2020
Revisions			
Report Reference	3647/THQ-ROC-XX-XX-CA-C-503/DAE/NA/17.02.02020		
Report Status	FINAL		





COMPLEX CHALLENGES ...
MADE SIMPLE

CONTENTS

1.0	INTRODUCTION	1
2.0	SCOPE OF WORKS	2
2.1	EXISTING INFORMATION.....	2
3.0	HYDRAULIC CALCULATIONS	3
	APPENDIX A – HYDRAULIC CALCULATION.....	4





**COMPLEX CHALLENGES ...
MADE SIMPLE**

1.0 Introduction

RoC Consulting has been appointed by Airport City Limited Partnership (ACLP) as part of the THQ Phase 1 Enabling Works package to design and detail a watercourse temporary diversion of the ordinary watercourse, known as the Easterly watercourse crossing north-westerly across the site to facilitate the enabling works earthworks package.

2.0 Scope of Works

The following calculations have been prepared to support an Application for Ordinary Watercourse Land Drainage Consent under the Land Drainage Act Section 23 from Manchester City Council as Lead Local Flood Authority (LLFA) for the watercourse temporary diversion of the ordinary watercourse, known as the Easterly watercourse crossing north-westerly across the site.

2.1 Existing Information

Further to a meeting with the LLFA, it was agreed that the hydraulic calculations for the watercourse temporary diversion, could be based on the maximum calculated flow rate of 992 litres/per second (1% ARP + 20% allowance for C.C) for the downstream Culvert 2 beneath Enterprise Way prepared and submitted by AECOM as part of the Airport City North Spine Road - Drainage Strategy Report 170816 for the Easterly Watercourse.

Current site levels are taken from a topographical survey undertaken by Survey Operations 18E137 2D_A dated September 2018 to OS Grid and Levels.

3.0 Hydraulic Calculations

Hydraulic calculations have been prepared for the watercourse temporary diversion of the ordinary watercourse to confirm the adequacy of the watercourse diversion and temporary culvert crossing provided for site construction traffic, using a simple 3 length Microdrainage model Network 2019.1.

The model has assumed the existing watercourse cross section as that at the start/end of the diversion as being trapezoidal is section with;

- an average bed width of 0.80m
- maximum depth of 1.20m
- side slopes of 1 in 1
- Mannings 'n' value of 0.035

A 1050dia Class 120 concrete pipe has been selected for the temporary culvert fort the watercourse crossing, with a 150mm gravel bed set to watercourse bed level to mimic the watercourse base.

Base flow of 992 litres per second for the 1% +20% C.C adjust for 40% C.C
Adjusted $Q_{\max} = (992/1.2) \times 1.4 = 1158$ litres per second.

Gradients ranging between 1 in 222-200 have been set to tie-in with existing levels up/downstream and the interception points of existing outfalls from a 900dia surface water United Utilities surface water sewer and an existing ditch.

Results for the simulation runs with the base flow of 1148 litres per second applied at the head of the network, confirm that the ditch profile and temporary 1050 dia culvert crossing are adequate.

For a copy of the Hydraulic Calculations 3647-001 refer to Appendix A.

These calculations as based on the following RoC Consulting drawings.

- THQ-ROC-XX-XX-PL-C-501
- THQ-ROC-XX-XX-DT-C-502



COMPLEX CHALLENGES ...
MADE SIMPLE

APPENDIX A – HYDRAULIC CALCULATION

ROC Consulting		Page 1
Commercial Wharf 6 Commercial Street Manchester M15 4PZ	Easterly Temp Culvert Div. ACN THQ Site Manchester	
Date 12/02/2020 File 3647 001.MDX	Designed by DAE Checked by PAW	
XP Solutions Network 2019.1		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.367	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	15	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)
----------------	--------------

0-4	0.000
-----	-------

Total Area Contributing (ha) = 0.000

Total Pipe Volume (m³) = 82.579

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	11.100	0.050	222.0	0.000	5.00	1158.0		0.035	\/	-1	Pipe/Conduit	
1.001	10.000	0.050	200.0	0.000	0.00	0.0	0.600		o	1050	Pipe/Conduit	
1.002	19.700	0.090	218.9	0.000	0.00	0.0		0.035	\/	-1	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.14	67.380	0.000	1158.0	0.0	0.0	1.32	3172.2	1158.0
1.001	50.00	5.21	67.180	0.000	1158.0	0.0	0.0	2.43	2107.0	1158.0
1.002	50.00	5.46	67.280	0.000	1158.0	0.0	0.0	1.33	3194.6	1158.0

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, 0 egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	\/	800	1200	45.0		2.289	2.400

ROC Consulting		Page 2
Commercial Wharf 6 Commercial Street Manchester M15 4PZ	Easterly Temp Culvert Div. ACN THQ Site Manchester	
Date 12/02/2020 File 3647 001.MDX	Designed by DAE Checked by PAW	
XP Solutions	Network 2019.1	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002	Ditch 2 Outfall	68.600	67.190	0.000	0	0

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 Coefficient	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	0	Number of Storage Structures	0
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.000	Cv (Summer)	0.750
Return Period (years)	2	Ratio R	0.367	Cv (Winter)	0.840
Region	England and Wales	Profile Type	Summer	Storm Duration (mins)	30

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
1.000	Ditch 1	0.500
1.001	Temp Culvert	0.500
1.002	Ditch 2	0.500

ROC Consulting		Page 3
Commercial Wharf 6 Commercial Street Manchester M15 4PZ	Easterly Temp Culvert Div. ACN THQ Site Manchester	
Date 12/02/2020 File 3647 001.MDX	Designed by DAE Checked by PAW	
XP Solutions	Network 2019.1	

Summary Wizard of 360 minute 100 year Winter I+40% 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 0 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

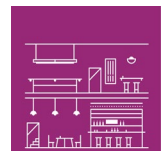
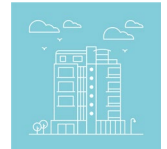
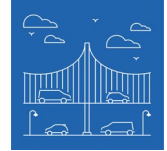
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm Rank	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	Ditch 1	32	68.262	-0.318	0.000	0.50		1158.2	OK
1.001	Temp Culvert	45	68.230	0.000	0.000	1.22		1159.7	OK*
1.002	Ditch 2	25	68.062	-0.418	0.000	0.45		1166.0	OK



An award-winning practice
serving the property and
construction industry for
more than 25 years



RoCP Ltd
(Trading as RoC Consulting)
Commercial Wharf
6 Commercial Street
MANCHESTER
M15 4PZ

T | 0161 214 5390
W | www.rocconsulting.com