Waterman Infrastructure & Environment Limited
5th Floor, One Cornwall Street
Birmingham, B3 2DX
www.watermangroup.com

Graven Hill

A41 Roundabout Drainage Strategy

Date: June 2020

Client Name: Graven Hill Village Development Company

Document Reference: WIE11386-101-TN-1-2-3

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

Issue	Prepared by	Checked & Approved by
First -24.06.20	Karthi Palanniyapan Senior Engineer	Nick Jones-Hill Senior Associate Director
Second 21.04.21	Karthi Palanniyappan	Nick Jones-Hill
Third 03.09.21	Karthi Palanniyappan	Nick Jones-Hill

1. Introduction

1.1. This technical note has been produced to brief the surface water drainage strategy proposed for A41 Roundabout adjacent to the Graven Hill Site. Proposed roundabout to replace existing Pioneer Road/A41 junction to improve traffic flow from Graven Hill Development and to provide a future vehicular link to the adjacent Wretchwick Green development site.

2. Surface Water Drainage Strategy

2.1. The drainage strategy has been developed on following design consideration.

- All highway surface, adjacent footways and verge between highway and footway has been considered to be 100% impermeable.
- Footway slopping towards embankment / verge will naturally drain into existing ditch.
- Drainage strategy has been prepared based on the standards set out in the Oxfordshire County Council(OCC) "Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire".
- A 40% reduction to brownfield runoff has been applied as per OCC's local standards set out under "Additional Local Guidance"
- Proposed roundabout to replace existing A41 / Pioneer road junction, therefore brownfield runoff rate with 40% reduction applied for storage estimate. Copy of brownfield runoff calculation and plans will form part of this technical note.

- Storage estimate has been calculated for 1 in 100year storm event plus 40% climate change allowance as set out in the OCC guide.
- MicroDrainage 2019.1 Quick Storage Estimator tool has been used to determine the attenuation requirements.
- Drainage catchment includes proposed A41 roundabout and highway widening on the east and west of the roundabout.
- Exiting surface water sewer arrangement serving the existing highway catchment will be retained where possible.
- Existing ditch used for conveyance of surface water flow to outfall will be regraded where required to achieve gentle slope towards outfall.
- Surface water from proposed highway widening formed at low level on the west arm would be discharged to existing ditch, due to gravity connection to proposed attenuation not being feasible.
- Swale and filter drains will be provided in the roundabout to treat and convey surface water flow towards centre of the roundabout.
- Kerb outlets will be used along the perimeter kerb of the central island to convey flow to swale.
- SuDS Maintenance plan will be provided as part of the detailed design.

3. Drainage Catchment

3.1. It should be noted that the proposed roundabout would replace the existing Pioneer Road and A41 junction. Proposed drainage catchment includes the full extent of the roundabout and road widening on both east and west arm.

3.2. The proposed road widening has been designed to tie-in to existing road levels, a small part of proposed highway formed at low level referred as AREA1 extends to an area of 0.112ha, which is unable to connect to attenuation by gravity sewer. Therefore, this area will be directly connected to the existing ditch to the north of the highway.

3.3. Existing highway has been previously connected to existing ditch referred as AREA2 which extends to an area of 0.22ha. AREA2 will be replaced by proposed roundabout, therefore extent of this impermeable area taken for brownfield runoff calculation.

3.4. Proposed drainage catchment is 0.536ha referred as AREA 3 in drainage strategy plan attached.

4. Brownfield Runoff Calculation

4.1. Brownfield runoff calculation worked out as per standards set out in Oxfordshire County Council's "Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire" under "Additional Local Guidance".

4.2. Existing road surface considered for brownfield runoff calculation noted as AREA2 is 0.22ha.

4.3. Modified rational method has been used to workout brownfield runoff calculation. A copy of calculation attached in Appendix A.

4.4. Rainfall intensity for the proposed site has been taken from Micodrainage calculation.

4.5. Based on the Modified Rational Method 0.22ha impermeable area generates 58.8l/sec flow for 1 in 100year storm event. As per OCC standards a 40% reduction applied, therefore discharge rate of 35.28 l/sec (58.8x0.6) has been used for storage calculation at the same storm event plus 40% climate change.

4.6. Table 1 below summarises the catchment impermeable area and discharge rate.

Table 1: Existing Highway Catchment Area and Brownfield Runoff Rate

Catchment	Impermeable Area (ha)	Flow Rate (l/s)	40% Reduced Flow(l/s)
A41 Highway (100%)	0.22	58.8	35.28

4.7. Table 2 below shows the Quick Storage estimate attenuation requirement based on the impermeable area and allowable discharge rate for 1 in 100year storm event plus 40% climate change. See Appendix B for Quick Storage Estimate Calculation.

Table 2: Attenuation Requirements

Catchment	Impermeable Area (ha)	Discharge Rate (l/s)	Attenuation Required (m^3)
A41	0.536	35.28	216

4.8. Option to provide a open pond at the middle of round has been explored. Proposed drainage pipes collecting surface water from road gullies are laid at least 1.2m below road surface therefore, minimum pond depth of 1.5m required to make pond as useful storage which has been omitted for the road user's safety.

4.9. Oversized pipes proposed for storage purpose as other options are not feasible.

5. Existing Ditches

5.1. Surface water runoff from A41 roundabout proposed to be discharged into existing surface water sewer manhole ExSW01 at agreed restricted rate. Exiting ditch runs to the north-east of proposed roundabout will be used for conveyance also to treat the highway runoff.

6. Proposed Drainage Design

6.1. Combination swales, filter drains and oversized storage pipes forms the part of overall drainage network. Swale and filter drains will be provided in the landscaped area of middle of roundabout to treat and convey surface runoff which flows towards centre of the roundabout.

6.2. Number of kerb outlets has been provided along inner circle of roundabout to allow surface water runoff flowing towards the centre of roundabout to reach swale.

6.3. Proposed swale is 600mm wide x 500mm deep and below this a 600mm x 600mm filter drain has been provided. Maximum water level during the 1 in 100 year storm + 40% CC even will be + 70.240, therefore in the worst case scenario maximum water depth in swale would be 360mm below lowest finished road level.

6.4. Proposed filter trench with 30% voided stone will provide additional capacity of 32cu.m approx. (90m long x0.6m deep x 0.6m wide), which hasn't been considered in overall storage requirement. Therefore, this additional storage would be utilised if the swale overloaded during the extreme storm event and blockage.

6.5. Drainage network modelled to restrict flow at 35.28 l/sec, excess water at the extreme storm event would be stored in oversized pipes, manholes, filter drain and swale.

6.6. Gullies proposed to the rest of the roundabout to collect runoff from surface and conveyed into the piped drainage system.

7. Conclusion

7.1. Proposed A41 roundabout surface water runoff will be collected through number of road gullies, conveyed through drainage pipes.

7.2. Storage has been designed to 1 in 100year storm event plus 40% climate change.

7.3. Hydro-brake would be used to control flow at 35.28 l/sec and excess water will be stored in oversized pipes.

7.4. Swale and filter drain has been provided behind the kerb at middle of the roundabout to treat and convey flow runs towards centre of the roundabout.

7.5. Controlled surface water flow will be discharged into existing ditch which finally connected to existing manhole ExSW01.

7.6. Surface water runoff conveyed through proposed swale and existing ditch to provide some extent of treatment before it discharged into watercourse which is a tributary of River Ray.

APPENDICES

A. Brownfield Runoff Calculation

Modified Rational Method Q = 2.78 C i A

Where:

Q = Runoff rate l/s

2.78 = A constant coefficient which accounts for the difference in units for the inputs and the outputs of the equation.

C = 0.975 total coefficient value of Cv and Cr. 0.975

i = Average rainfall intensity (mm/h)

A = Impermeable area in hectares (ha) 0.22

	Average Rainfall Intensity (mm/hr)	Brownfield Runoff Rate (l/s)
Storm Duration (mins)	1 in 1 year	Modified Rational Method Q = 2.78 C i A
15	31.0	18.5
30	20.2	12.1
60	12.8	7.6
120	7.9	4.7
240	4.9	2.9
360	3.6	2.2
600	2.5	1.5
1440	1.3	0.8

	Average Rainfall Intensity (mm/hr)	Brownfield Runoff Rate (l/s)
Storm Duration (mins)	1 in 30 year	Modified Rational Method Q = 2.78 C i A
15	76.0	45.3
30	49.5	29.5
60	30.8	18.4
120	18.6	11.1
240	11.0	6.6
360	8.0	4.8
600	5.4	3.2
1440	2.7	1.6

	Average Rainfall Intensity (mm/hr)	Brownfield Runoff Rate (l/s)
Storm Duration (mins)	1 in 100 year	Modified Rational Method Q = 2.78 C i A
15	98.7	58.8
30	64.8	38.6
60	40.5	24.2
120	24.5	14.6
240	14.3	8.6
360	10.4	6.2
600	7.0	4.1
1440	3.5	2.1

B. Quick Storage Estimate

CALCULATIONS

Company:	WIE	Office:	Birmingham
Sheet No:	1 of 1	Project No:	WIE11386
By	Karthi P	Date	21.04.2021
Checked:	Nick J	Date	21.04.2021

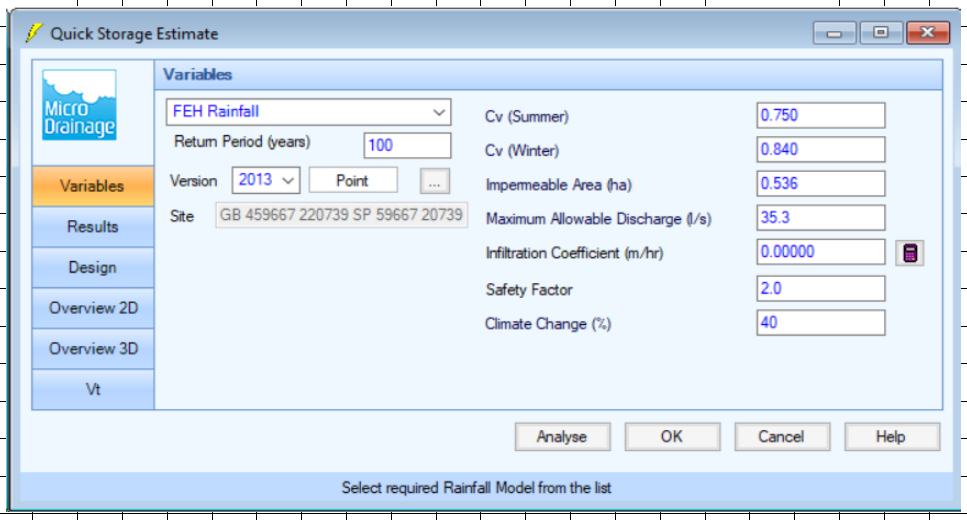
Project Title **WIE11386 - Graven Hill**

Calculations Title **Surface Water Storage Calculation - Cacthment A41 Roundabout**

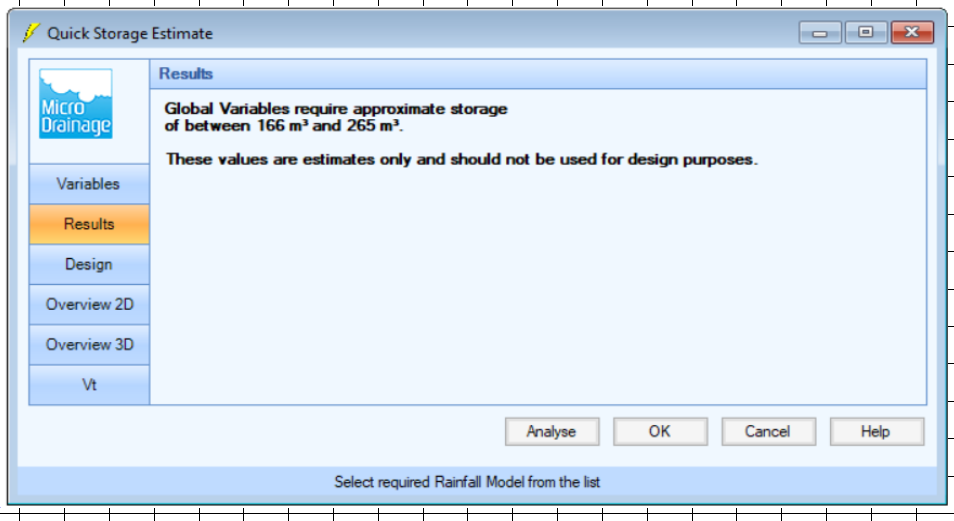
LOCATION	CALCULATIONS	OPTIONS

In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2019.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below;

Input:



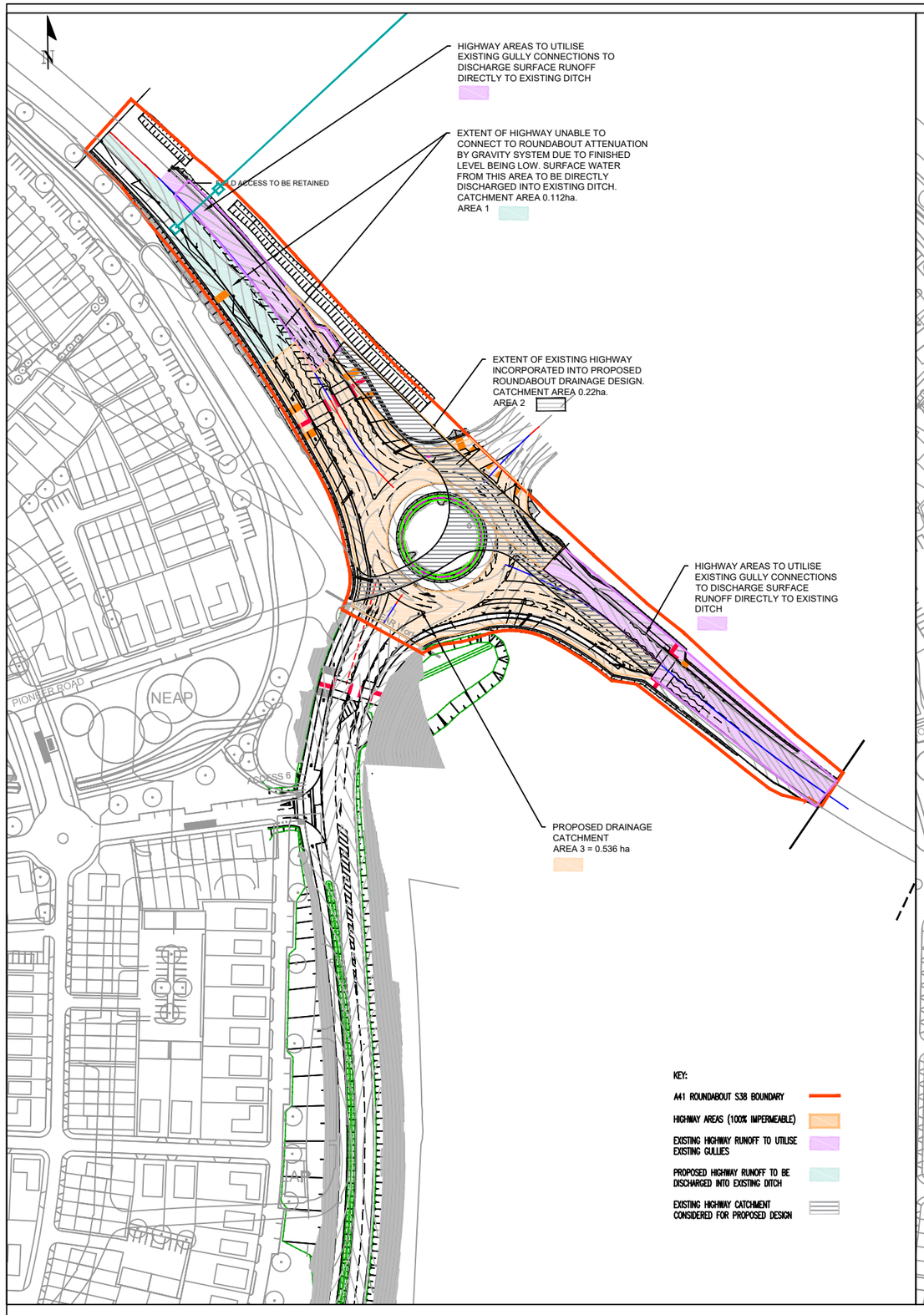
Output:



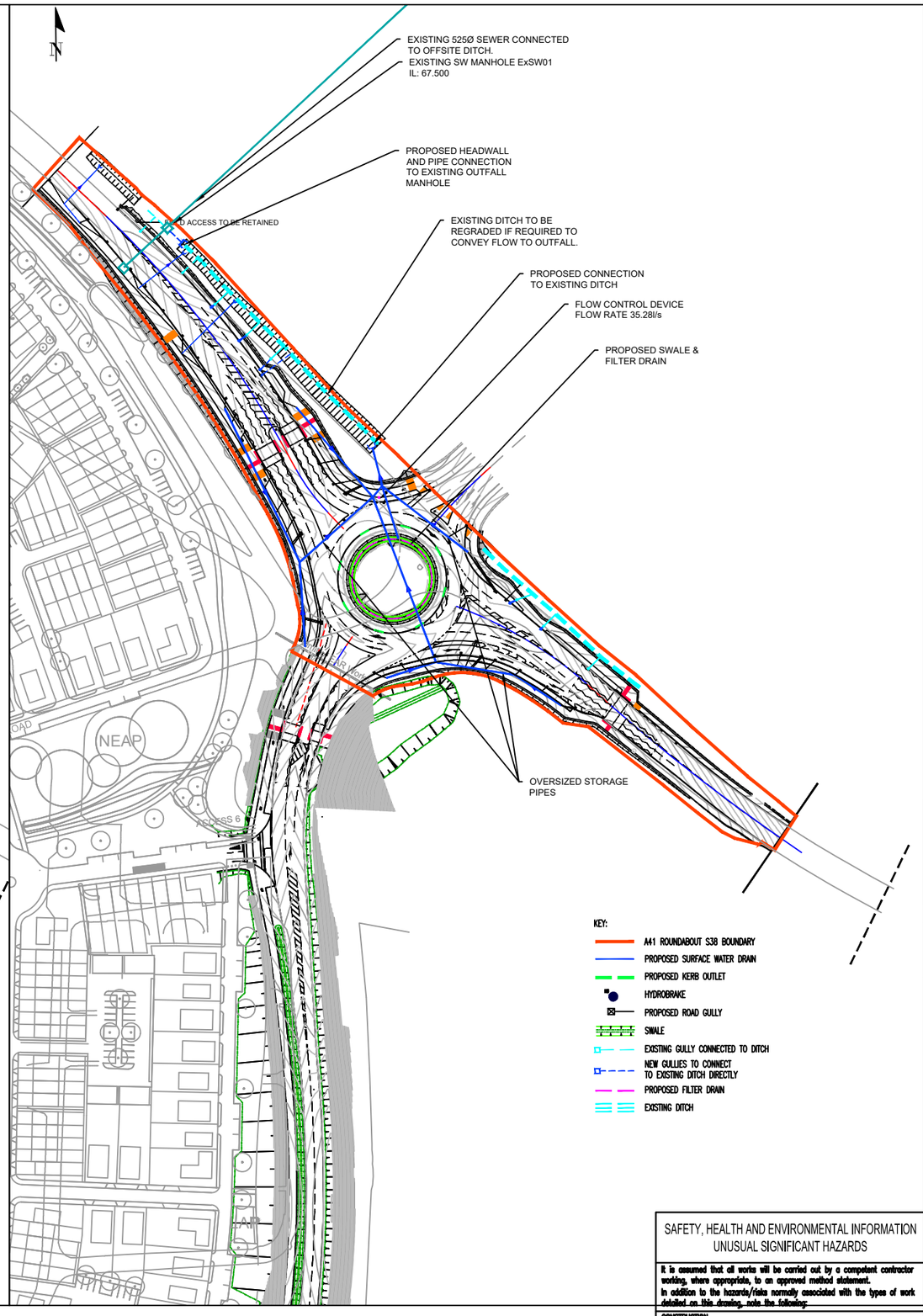
As Windes Quick Storage Estimate provides a range of attenuation volumes it is considered that an average value of the range is suitable for preliminary design sizing.

Minimum:	166.0	m^3			
Maximum:	265.0	m^3	Preliminary Estimate:	**216**	**m^3**

C. Drainage Strategy and Catchment Plan



DRAINAGE CATCHMENT PLAN



DRAINAGE STRATEGY PLAN

1:1 0 10 20 30 40 50 60 70 80 90 100
1:1 0 10 20 30 40 50 60 70 80 90 100

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
3. THE CONTRACTOR MUST ENSURE AND WILL BE HELD RESPONSIBLE FOR THE OVERALL STABILITY OF THE BUILDING/STRUCTURE/EXCAVATION AT ALL STAGES OF THE WORK.
4. ALL WORK BY THE CONTRACTOR MUST BE CARRIED OUT IN SUCH A WAY THAT ALL REQUIREMENTS UNDER THE HEALTH AND SAFETY AT WORK ACT ARE SATISFIED.
5. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.
6. OS DATA, TOPOGRAPHICAL SURVEY AND LIDAR DATA PROVIDED BY GLENN HOWELLS ARCHITECTS ON 3RD OCTOBER 2013
7. ADDITIONAL DRAINAGE SURVEY INFORMATION PROVIDED BY MK SURVEYS ON 18TH DECEMBER 2014
8. LAND TRANSFER AREA 1&2 BOUNDARY BASED ON GLENN HOWELLS ARCHITECTS DRAWING NO: 1982-A-L-573 REV V
9. NORTHERN AREA MASTERPLAN PROVIDED BY GLENN HOWELLS, DRAWING NO: 1982-A-L-011-AA
10. EMPLOYMENT AREA MASTERPLAN PROVIDED BY INC DESIGN, DRAWING NO: INC-SA[20]0020 REV. P08
11. CHOICE OF SURFACE WATER ATTENUATION FUTURE SUBJECT TO PROPOSED ROUNDABOUT FINISHED LEVELS.
12. INVERT LEVELS OF PIPE SHOWN HERE ARE INDICATIVE MINIMUM INVERT LEVELS SUBJECT TO FINAL ROUNDABOUT DESIGN LEVELS.
13. DRAINAGE PROPOSAL IS SUBJECT TO APPROVAL BY OXFORDSHIRE COUNTY COUNCIL HIGHWAYS/DRAINAGE ENGINEERS.

Rev	Date	Description	By
A04	03.09.21	DISCHARGE RATE AMENDED	KP
A03	25.05.21	GULLY LOCATION AND CATCHMENT AMENDED	KP
A02	21.04.21	DISCHARGE RATE REVISED AND OVERSIZED PIPES USED FOR ATTENUATION.	KP
A01	19.06.20	PLANNING ISSUE	KP

Amendments

Project: GRAVEN HILL, BICESTER

Title: A41 ROUNDABOUT SURFACE WATER DRAINAGE STRATEGY

Client: Graven Hill Village Development Company Limited

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
UNUSUAL SIGNIFICANT HAZARDS

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement.
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION
1.
2.
3.

MAINTENANCE / CLEANING
1.
2.
3.

DECOMMISSIONING / DEMOLITION
1.
2.
3.

Office Address
Telephone & Fax numbers
mail@watermangroup.com www.watermangroup.com

Drawing Status: PLANNING

Designed by	KP	Checked by	NJH
Drawn by	KP	Date	18.06.2020
Scales @ A1 work to figured dimensions only	NTS	Computer File No	WIE11386-R45-92-500 Roundabout Drainage Strategy A04.dwg

Publisher	Zone	Category	Number	Revision
WIE	145	92	500	A04

File Path: N:\Projects\WIE11386_GHV_LTA 2\WIO\A1_A41 ROUNDABOUT_Cat P07_CAD\02 Drainage\

A1-Wat-S-GHVDC, EAR - 00 Road Outline, Employment Masterplan INC-SA0S0011 - R191107_WIE, Masterplan Northern Area GH-1982-A-L-011-AA - R200131_WIE, R20 0302 - 20338_R8 - Topo Update 2020