Flood Risk Assessment

GTO House, Floral Mile, Hare Hatch

Client

GTO Engineering

Ref: 10946B

Date: December 2024

Consulting Engineers

GTA Civils & Transport Limited
Maple House
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Burgess Hill
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Index

Schedule of Appendices

Issue	Issue date	Compiled	Checked
First Issue	28 November 2024	PH	MR
Second Issue	18 December 2024	PH	MR

1 Introduction

1.1 This Flood Risk Assessment (FRA) has been prepared for the Client in relation to the proposed development at GTO House, Floral Mile, Bath Road, Hare Hatch, Berkshire, RG10 9ES. The Application Site lies within the Wokingham Borough Council (WBC) administrative area.

1.2 The proposals comprise: demolition of an existing barn and some sheds; erection of a new motor vehicle workshop building on a similar footprint to the existing barn; and some modifications to the existing hard and soft landscaping layout. The proposed site plan is included in Appendix A.

1.3 GTA Civils & Transport Ltd was appointed by the Client to provide a FRA to support the planning application to WBC as described above. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

1.4 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) (2023) and relevant planning practice guidance, in particular "Flood risk and coastal change" (updated August 2022).

2 Existing Site and Current Flood Conditions

2.1 GTO House lies on the north side of the junction between B477 Mumbery Hill and A4 Bath Road at Hare Hatch. A location plan is included in Appendix A. The site red line area comprises 1.36 ha.

2.2 Topography: Site survey details are shown on the plans in Appendix A. The survey shows the site slopes gently down to the south-west. Ground levels range from 55.8m AOD in the north-east corner down to 52.5m AOD at the Mumbery Hill entrance.

2.3 Hydrology: The site lies within Flood zone 1 removed from any fluvial flood risk area. There are no watercourses in the vicinity.

2.4 The Environment Agency's surface water flood risk mapping shows the following:

- High risk scenario – 1 in 30 annual exceedance probability (AEP): The only risk area shown is a small depression at the Mumbery Hill entrance. The Bath Road entrance remains dry.
- Medium risk scenario – 1 in 100 AEP: No new risk areas are shown within the site. An overland flow pathway becomes evident passing north-west of the site, but the site is not affected.
- Low risk scenario – 1 in 1,000 AEP: Some risk is shown across the south of the site, but the depth is indicated to be less than 0.15m. The location of the new workshop building is not affected.

2.5 No flood risk from any other source has been identified. The principal consideration is therefore the management of surface water runoff from the development itself.

2.6 Geology: The published geology at the site comprises Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated). No superficial deposits are shown. The Soilscape classification at the site is 7: Freely draining, loamy. The chalk bedrock is classed as a principal aquifer and the site lies in a Source Protection Zone III – Total Catchment (SPZ).

2.7 Ground investigations were conducted at the site in July 2012 by Terra Firma Wales Limited. The ground conditions encountered comprised Made Ground and sandy and gravelly Clay soils overlying the Chalk Formation, with the chalk horizon from 1.55m below ground level (bgl). No groundwater was encountered in the boreholes. Borehole

soakage tests were undertaken with calculated infiltration rates of 5.63 x 10^{-6} m/s and 7.09 x 10^{-6} m/s. Extracts of the Terra Firma Geotechnical and Geo-environmental Report are included in Appendix B.

2.8 Existing drainage: The existing development is served by soakaway drainage systems. The north side of the main GTO House building drains to a soakaway at the east side of the new workshop building footprint. This was confirmed by a CCTV and tracing survey and the findings are illustrated on the strategy plan in Appendix A.

2.9 There is also a foul drainage system from GTO House which drains to a package treatment plant (PTP), also located on the east side of the barn. It is assumed that there is a drainage field locally to discharge treated flows to ground.

3 SuDS Strategy

3.1 Sustainable drainage systems (SuDS) will be required for the development. Preference should be given to source control techniques and infiltration drainage before an off-site discharge is considered. The existing soakaway drainage indicates that infiltration techniques will be suitable to manage flows from the new building roof drainage and areas of new hardstanding.

3.2 A plan is included in Appendix A showing the extent of proposed changes to the permeable and impermeable surface areas at the site. This exercise reveals that there are four parts of the development which require a new soakaway solution. Other areas will remain unchanged or will experience a reduction in hard surfaced areas locally by introducing new soft landscaping. The four soakaway catchments are as follows:

- Soakaway 1 – roof drainage from the new workshop building and the north end of the main GTO House building (to replace the existing soakaway).
- Soakaway 2 – to serve the new hardstanding area on the south side of the new workshop building.
- Soakaway 3 – to serve the widened access road linking the west drive with the car park in front of the main GTO House building.
- Soakaway 4 – to serve the resurfaced former greenhouse area to the west.

3.3 The ground investigations indicate that soakaways would best be located within the chalk strata. Point-load cellular soakaways have thus been designed for each of the four catchments using a design infiltration rate of 5.5×10^{-6} m/s (0.0198 m/hr).

3.4 Due to the SPZ, additional runoff treatment will be required for hardstanding areas. These surfaces will therefore be constructed as permeable pavements with sub-base falls towards the soakaways. The permeable stone sub-base will filter out pollutants prior to discharge to ground.

3.5 The proposed SuDS strategy is illustrated in Appendix A. Calculations are included in Appendix C demonstrating that the proposed cellular soakaways have sufficient volume for the 1 in 100 AEP +40% rainfall events.

3.6 At the next stage, further in-situ testing will be carried out at each proposed soakaway location to verify the infiltration rate and the depth of the chalk horizon.

3.7 The foul discharge arrangements will be investigated and designed at the next stage. It should be noted that the new workshop itself has no foul drainage.

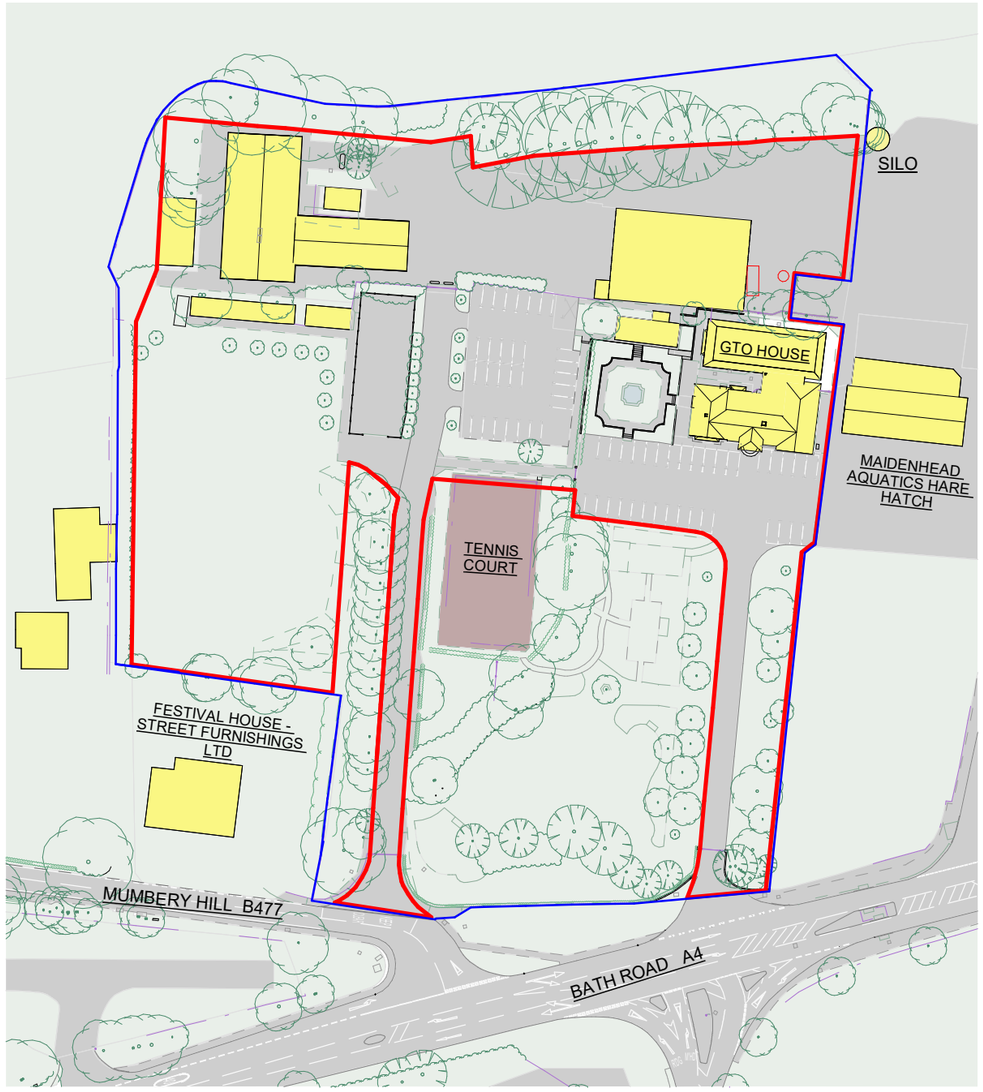
3.8 Ownership and maintenance: As a single property, responsibility for the drainage system within the curtilage will reside with the landowner. Maintenance will be carried out by specialist contractors or trained operatives in line with The SuDS Manual (CIRIA, C753) and manufacturer's instructions. A Draft Drainage Maintenance Plan (DMP) has been prepared and is included as Appendix D.

4 Conclusion

4.1 The proposed drainage strategy will mitigate the impacts of the runoff generated by the additional impermeable areas proposed. The new soakaways will be designed to current standards with capacity for greater storm events, and therefore a modest localised betterment in flood risk will be achieved.

4.2 The development complies with the NPPF and relevant planning practice guidance.

Appendix A: Plans



LEGEND

- OWNERSHIP BOUNDARY
- PLANNING BOUNDARY
- BUILDING FOOTPRINT
- GREEN AREAS
- ROAD / HARDSTANDING
- TREES
- FENCE LINE
- TENNIS COURT

10 0 10 20 30 40 50

SCALE 1:1250 m

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DISCLAIMER NOTES:

DRAWING NOTES:

- CDM REGULATIONS 2015
  SIGNIFICANT OR NON-OBVIOUS RISKS AND RISKS WHICH ARE DIFFICULT TO MANAGE ARE IDENTIFIED ON THIS DRAWING USING THE FOLLOWING SYMBOL IDENTIFIED TO THE RIGHT WITH BRIEF ACCOMPANYING TEXT. FOR FURTHER DETAILS OF THE RISKS IDENTIFIED BY DESIGNERS, REFERENCE SHOULD BE MADE TO CDM HAZARD REGISTER.

REV	DESCRIPTION	DATE	BY	CHKD
P01	ISSUED FOR PLANNING	17/12/2024	EH	AM

ORIGINATOR:

RIDGE

RIDGE PROJECT No: 5024150

CLIENT:

GTO ENGINEERING

IN ASSOCIATION WITH:

PROJECT:
GTO ENGINEERING - FERRARI WORKSHOP

TITLE:
SITE LOCATION PLAN - PLANNING

DRAWN BY: EH CHECKED BY: AM APPROVED BY: AM

SCALE: As indicated @ A3 DATE: 17/12/2024

STATUS: S2 DESCRIPTION: SUITABLE FOR INFORMATION

DRAWING No: 5024150 - RDG - XX - ST - D - A - 001000

PROJECT:	ORGINATOR:	FUNCTION:	SPATIAL:	FORM:	DISCIPLINE:	NUMBER:	REV:
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TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

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BS	Bus Stop	HH	Head Height	TH	Trial Pit
BU	Bush	IC	Inspection Cover	THL	Threshold Level
B/W	Barbed Wire Fence	IL	Invert Level	TL	Traffic Light
BX	Box (Utilities)	I/R	Iron Railings	ToW	Top of Wall
C/B	Close Board Fence	KO	Kerb Outlet	TP	Telegraph Pole
CH	C@ Height	LP	Lamp Post	TV	Cable TV Cover
CL	Cover Level	MH	Manhole	UB	Universal Beam
C/L	Chain Link Fence	MP	Marker Post	UC	Unknown Cover
C-Lev	Ceiling Level	NB	Name Board	UK	Unknown Tree
Coll	Column	OHL	Overhead Line (approx)	USB	Under Slde Beam
C/P	Chestnut Paling Fence	Pan	Panel Fence	UTL	Unable To Lift
CR	Cable Riser	PB	Post Box	VP	Vent Pipe
DC	Drainage Channel	PM	Parking Meter	WB	Waste Bin
DH	Door Head Height	PO	Post	WH	Weep Hole
DP	Down Pipe	P/R	Post & Rail Fence	WL	Water Level
DR	Drain	P/W	Post & Wire Fence	WM	Water Meter
EL	Eaves Levell	P/Wall	Partition Wall	WO	Wash Out
EP	Electric Pole	RE	Roofding Eye	(2.4m)	Floor to Ceiling Height
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FB	Flower Bed	RS	Road Sign		
FBD	Floor Board Direction	RSD	Roller Shutter Door		Survey Control Station

DRAWING NOTE

Topographical Surveys

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ALL LEVELS RELATE TO THE ORDNANCE SURVEY LEVEL DATUM FOR CONTROL STATION ST08 ESTABLISHED WITH GPS USING OSGM02(GB).

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REV	DESCRIPTION	DRAWN	APPR	DATE

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enquiries@survey-solutions.co.uk

LAND SURVEYING BUILDING SURVEYING UNDERGROUND SURVEYING

PROJECT TITLE
MABEY HOUSE, FLORAL MILE
TWYFORD, BERKSHIRE, RG10 9SQ

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 1 of 6

CLIENT				SCALE
GTO ENGINEERING LTD				1:200
SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS
TB	15/06/12	PDS	PDS	FINAL
DRAWING NUMBER		REVISION	ISSUE DATE	
14951cv-01			22.10.2014	

Original Sheet Size A1H

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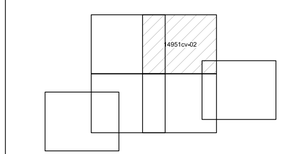

REV	DESCRIPTION	DRAWN	APPR	DATE

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LAND SURVEYING BUILDING SURVEYING UNDERGROUND SURVEYING

PROJECT TITLE	MABEY HOUSE, FLORAL MILE TWYFORD, BERKSHIRE, RG10 9SQ			
DRAWING DETAIL	TOPOGRAPHICAL SURVEY Sheet 2 of 6			
CLIENT	GTO ENGINEERING LTD			SCALE 1:200
SURVEYOR: TB	SURVEY DATE: 15/06/12	CHECKED BY: PDS	APPROVED BY: PDS	DWG STATUS: FINAL
DRAWING NUMBER: 14951cv-02			REVISION:	ISSUE DATE: 22.10.2014

Original Sheet Size A1H

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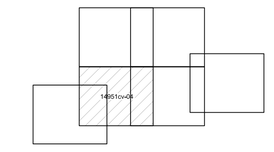

REV	DESCRIPTION	DRAWN	APPR	DATE

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BrP	Brace Post	GV	Gas Valve	TC	Telecom Cover
BS	Bus Stop	HH	Head Height	TH	Trial Pit
BU	Bush	IC	Inspection Cover	THL	Threshold Level
B/W	Barbed Wire Fence	IL	Invert Level	TL	Traffic Light
BX	Box (Utilities)	I/R	Iron Railings	ToW	Top of Wall
C/B	Close Board Fence	KO	Kerb Outlet	TP	Telegraph Pole
CH	Cill Height	LP	Lamp Post	TV	Cable TV Cover
CL	Cover Level	MH	Manhole	UB	Universal Beam
C/L	Chain Link Fence	MP	Marker Post	UC	Unknown Cover
C-Lev	Ceiling Level	NB	Name Board	UK	Unknown Tree
Col	Column	OHL	Overhead Line (approx)	USB	Under Side Beam
C/P	Chestnut Pailing Fence	Pan	Panel Fence	UTL	Unable To Lift
CR	Cable Riser	PB	Post Box	VP	Vent Pipe
DC	Drainage Channel	PM	Parking Meter	WB	Waste Bin
DH	Door Head Height	PO	Post	WH	Weep Hole
DP	Down Pipe	P/R	Post & Rail Fence	WL	Water Level
DR	Drain	P/W	Post & Wire Fence	WM	Water Meter
EL	Eaves Level	P/Wall	Partition Wall	WO	Wash Out
EP	Electric Pole	RE	Rodding Eye	2.00	Floor to Ceiling Height
ER	Earth Rod	RL	Ridge Level	2.00	F/C Floor to False Ceiling Ht
ET	EP+Transformer	RP	Reflector Post		
FB	Flower Bed	RS	Road Sign		
FBD	Floor Board Direction	RSD	Roller Shutter Door		Survey Control Station

DRAWING NOTE

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

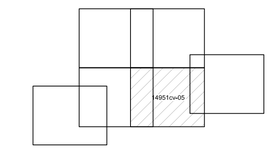
Do not scale from this drawing.

ORDNANCE SURVEY NATIONAL GRID COORDINATES HAVE BEEN ESTABLISHED FOR ST08 USING GPS AND RELATED TO OSTN02(GB) AND OSGM02(GB). THE GRID IS ORIENTATED TO GRID NORTH WITH A SCALE FACTOR OF 1.000.

ALL LEVELS RELATE TO THE ORDNANCE SURVEY LEVEL DATUM FOR CONTROL STATION ST08 ESTABLISHED WITH GPS USING OSGM02(GB).

SURVEY CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
ST01	480139.715	177927.102	55.221	PK Nail
ST02	480045.631	177908.426	54.193	PK Nail
ST03	479966.272	177870.346	53.495	PK Nail
ST04	479829.294	177851.708	52.706	PK Nail
ST05	479899.941	177883.316	52.948	PK Nail
ST06	479907.672	177941.354	53.236	PK Nail
ST07	479903.576	177985.026	53.905	PK Nail
ST08	479949.141	177977.419	54.021	PK Nail
ST09	479971.164	177965.827	53.849	PK Nail
ST10	479972.566	177919.777	53.373	PK Nail
ST11	479923.271	177990.799	54.098	PK Nail
ST12	479912.340	178028.162	54.664	PK Nail
ST13	479949.178	178035.154	54.840	PK Nail
ST14	479988.672	178036.794	55.110	PK Nail
ST15	479868.401	178033.432	54.402	PK Nail



REV	DESCRIPTION	DRAWN	APPR	DATE

SURVEY SOLUTIONS

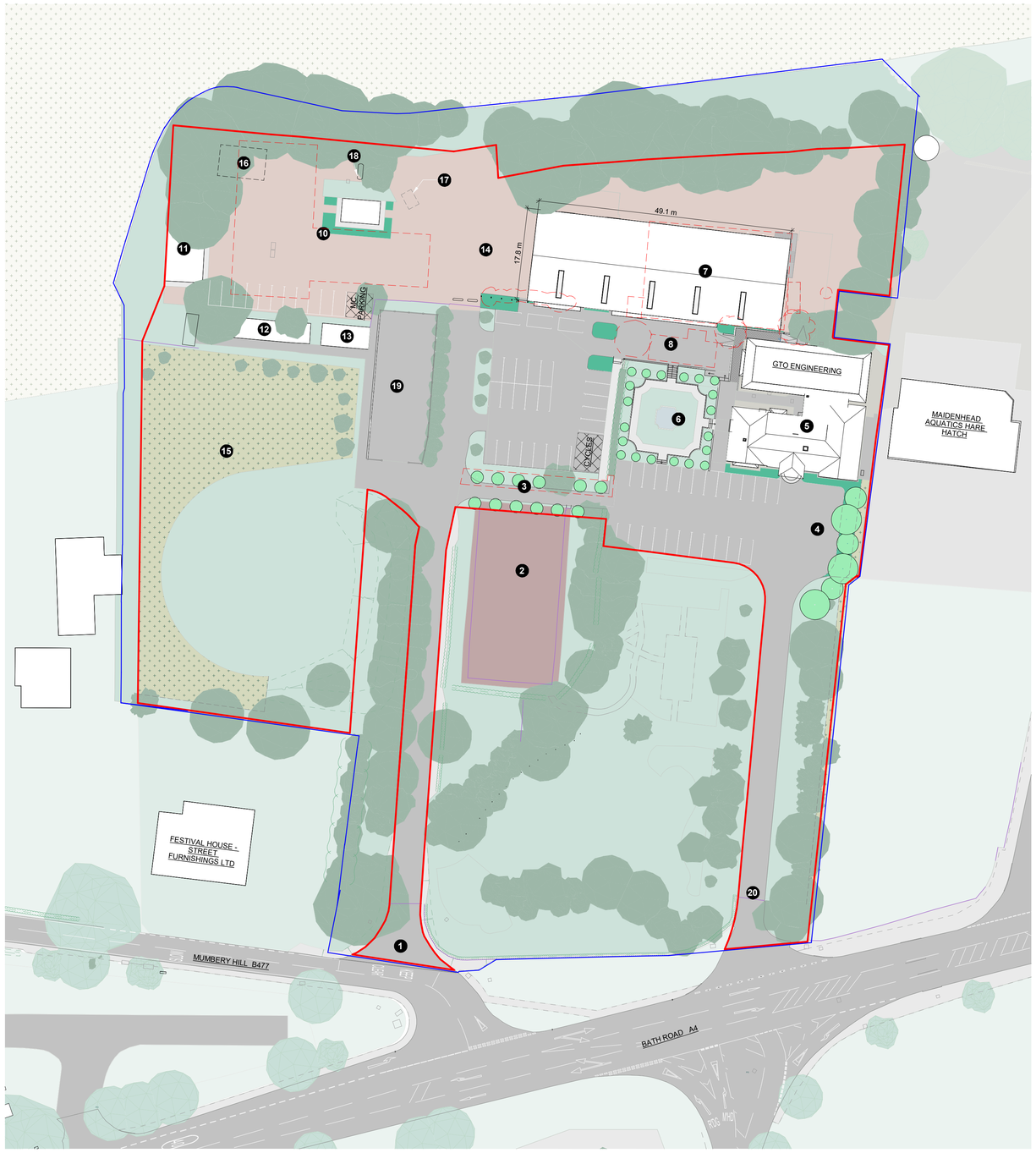
Ipswich Coventry Yeovil Norwich Perth Nottingham Brentwood

Tel No: 0845 0405 969 Fax No: 0845 0405 970
www.survey-solutions.co.uk enquiries@survey-solutions.co.uk

LAND SURVEYING BUILDING SURVEYING UNDERGROUND SURVEYING

PROJECT TITLE: MABEY HOUSE, FLORAL MILE TWYFORD, BERKSHIRE, RG10 9SQ				
DRAWING DETAIL: TOPOGRAPHICAL SURVEY Sheet 5 of 6				
CLIENT: GTO ENGINEERING LTD				SCALE: 1:200
SURVEYOR: TB	SURVEY DATE: 15/06/12	CHECKED BY: PDS	APPROVED BY: PDS	DWG STATUS: FINAL
DRAWING NUMBER: 14951cv-05			REVISION:	ISSUE DATE: 22.10.2014

Original Sheet Size A1H



4 NO. TREES TO BE REMOVED
(SEE TREE SURVEY 24/11/228/NH FOR MORE INFORMATION)

G12 - 1NO BUSH

G38 - 1NO TREE

T41 - 1NO TREE

T42 - 1NO TREE

SITE PARKING PROPOSED

Family	Count
RS_Standard Parking Space	59

Grand total: 59

SITE ATTRIBUTES KEY

1. MAIN ENTRANCE
2. TENNIS COURT - PLANTING TO NORTHERN PERIMETER
3. WIDEN ACCESS ROAD AND GATE TO GTO HOUSE CAR PARK ENTRANCE
4. LANDSCAPING AND PLANTING TO PERIMETER OF CLIENT CAR PARK
5. GTO HOUSE
6. LANDSCAPED GARDEN WITH POND AND NEW PLANTING
7. NEW WORKSHOP BUILDING
8. NEW HARDSTANDING TO AREA OF REMOVED OUTBUILDING
10. LANDSCAPING WITH PICKET FENCING TO AREA SURROUNDING BRICK BUILDING
11. MACHINE SHOP BUILDING
12. TIMBER SHED
13. BRICK SHED
14. YARD
15. PLANTING TO EXISTING GREEN SPACE FOR BNG - REFER TO BNG CALCULATIONS
16. RELOCATION OF WASTE STORAGE AREA TO NORTH EAST OF SITE
17. WASH GRATE
18. GAS TANK
19. PREVIOUS GREENHOUSE FOOTPRINT AND REMAINS
20. SECONDARY ACCESS - INFREQUENT USAGE

LEGEND

- OWNERSHIP BOUNDARY
- PLANNING BOUNDARY
- BUILDING FOOTPRINT
- EXISTING GREEN AREAS / SOFT LANDSCAPING
- PROPOSED GREEN AREAS / SOFT LANDSCAPING
- ROAD / HARDSTANDING
- EXISTING TREES
- EXISTING FENCE
- PROPOSED DEMOLISHED
- PROPOSED TREE INDICATIVE - LOCATIONS TCB FOLLOWING CONSULTATION WITH ARBORICULTURALIST & LANDSCAPE ARCHITECT
- PROPOSED AREA OF PLANTING FOR BNG INDICATIVE - TCB BY ECOLOGISTS & LANDSCAPE ARCHITECT

5 0 5 10 15 20 25
SCALE 1:500 m

N

DRAWING NOTES:

- CDM REGULATIONS 2015
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NOTE:

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REV	DESCRIPTION	DATE	BY	CHKD
P01	ISSUED FOR PLANNING	17/12/2024	EH	AM

ORIGINATOR: RIDGE

RIDGE PROJECT No: 5024150

CLIENT: GTO ENGINEERING

IN ASSOCIATION WITH:

PROJECT:
GTO ENGINEERING - FERRARI WORKSHOP

TITLE:

PROPOSED SITE PLAN - PLANNING

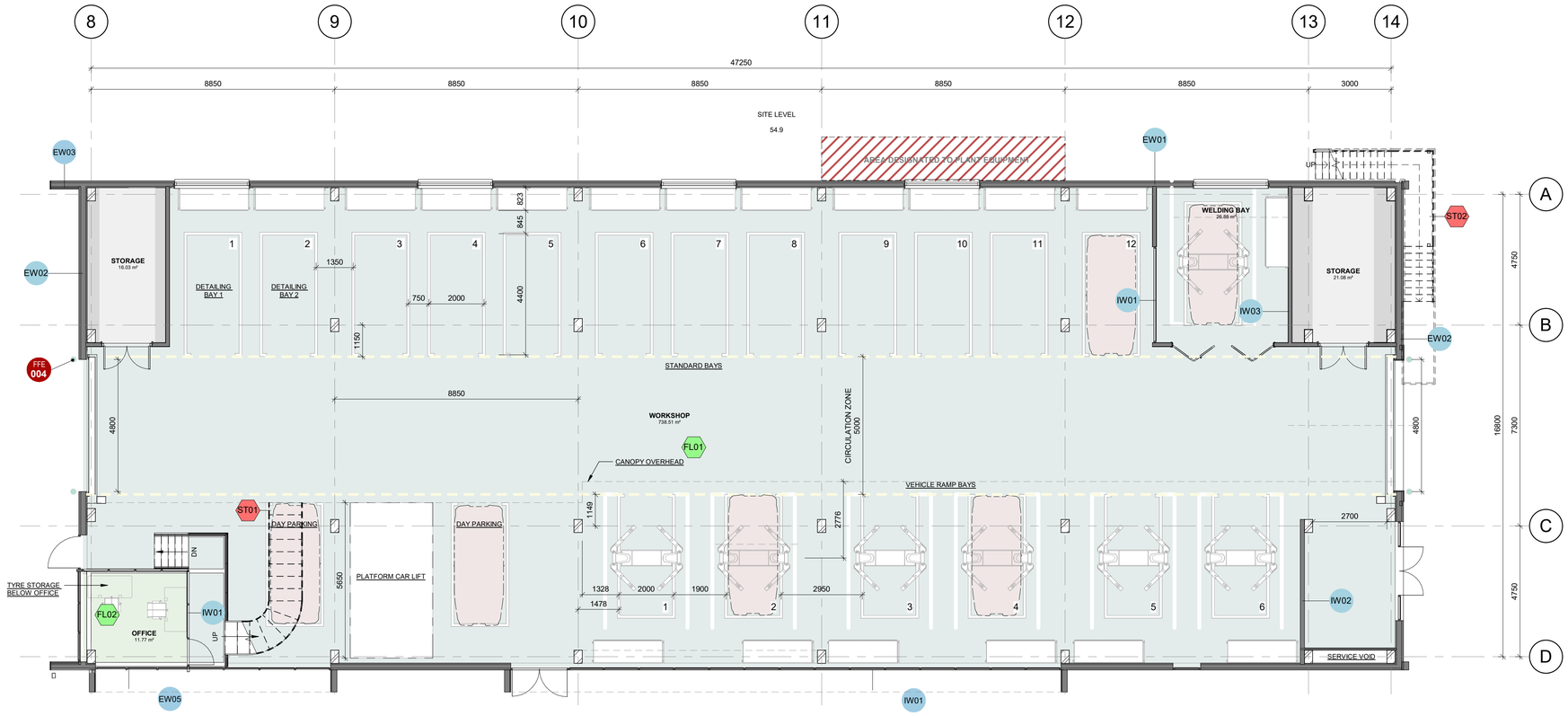
DRAWN BY: EH CHECKED BY: AM APPROVED BY: AM

SCALE: As indicated @ A1 DATE: 17/12/2024

STATUS: S2 DESCRIPTION: SUITABLE FOR INFORMATION

DRAWING No: 5024150 - RDG - XX - ST - D - A - 001021

PROJECT:	ORIGINATOR:	FUNCTION:	SPATIAL:	FORM:	DISCIPLINE:	NUMBER:	REV:
5024150	RDG	XX	ST	D	A	001021	P01



NEW HARDSTANDING TO AREA OF REMOVED OUTBUILDING

GTO HOUSE

DEPARTMENT KEY

- WORKSHOP
- OFFICE
- STORAGE
- MEZZENINE

WORKSHOP GF PROPOSED AREAS

Name	Area
OFFICE	11.77 m²
STORAGE	37.11 m²
WELDING BAY	26.88 m²
WORKSHOP	738.51 m²
Grand total: 13	814.27 m²

WORKSHOP PARKING BAYS

Type	Count
WORKSHOP STANDARD BAY	15
WORKSHOP VEHICLE RAMP BAY	6
Grand total: 21	

EQUIPMENT SCHEDULE

FFE XXX → EQUIPMENT TAG

001	VEHICLE RAMP
002	STORAGE RACKING
003	PLATFORM CAR LIFT
004	BOLLARD

FLOOR TYPES SCHEDULE

FLXX → FLOOR TAG

FL01	CONCRETE FLOOR WITH EPOXY RESIN FINISH
FL02	POLISHED CONCRETE
FL03	STRUCTURAL GLASS FLOOR 50m³

WALL TYPES SCHEDULE

XW.XX → WALL TAG

EW01	STANDING SEAM BACK SINUSOIDAL CLADDING INSULATION CORRUGATED METAL INTERNAL CLADDING
EW02	BRICK WALL
EW03	COWLING WALL STANDING SEAM BACK SINUSOIDAL CLADDING CONTRASTING INTERNAL CLADDING
EW04	BRISE SOLEIL (SOLAR SHADING)
EW05	GLAZED CURTAIN WALL
IW01	INTERNAL GLAZED CURTAIN WALL
IW02	LED LIT PERFORATED METAL FEATURE WALL
IW03	STEEL FRAME PARTITION WALL

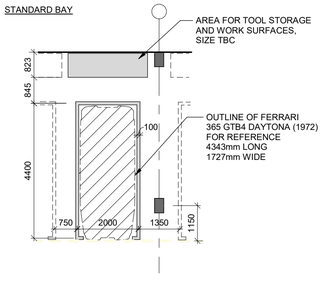
STAIR TYPES SCHEDULE

STXX → FLOOR TAG

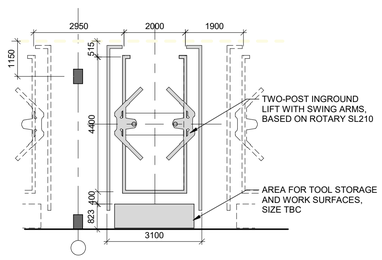
ST01	STAIRCASE - ACCESS BETWEEN WORKSHOP FLOOR, OFFICE & MEZZANINE LEVELS.
ST02	STANDARD EXTERNAL EGRESS STAIR DESIGNED TO COMPLY WITH PART B & PART K.

WORKSHOP BAY DIMENSIONS

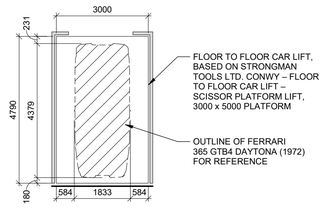
STANDARD BAY



VEHICLE RAMP BAY



FLOOR TO FLOOR CAR LIFT BAY



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DRAWING NOTES:

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NOTE:

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GTO HOUSE INTERNAL WALLS NOT VERIFIED VIA SURVEY.

1 0 1 2 3 4 5
SCALE 1:100 m

N

REV	DESCRIPTION	DATE	BY	CHKD
P01	ISSUED FOR PLANNING	17/12/2024	EH	AM

ORIGINATOR: RIDGE

RIDGE PROJECT No: 5024150

CLIENT: GTO ENGINEERING

IN ASSOCIATION WITH:

PROJECT: GTO ENGINEERING - FERRARI WORKSHOP

TITLE: PROPOSED GF GA PLAN - PLANNING

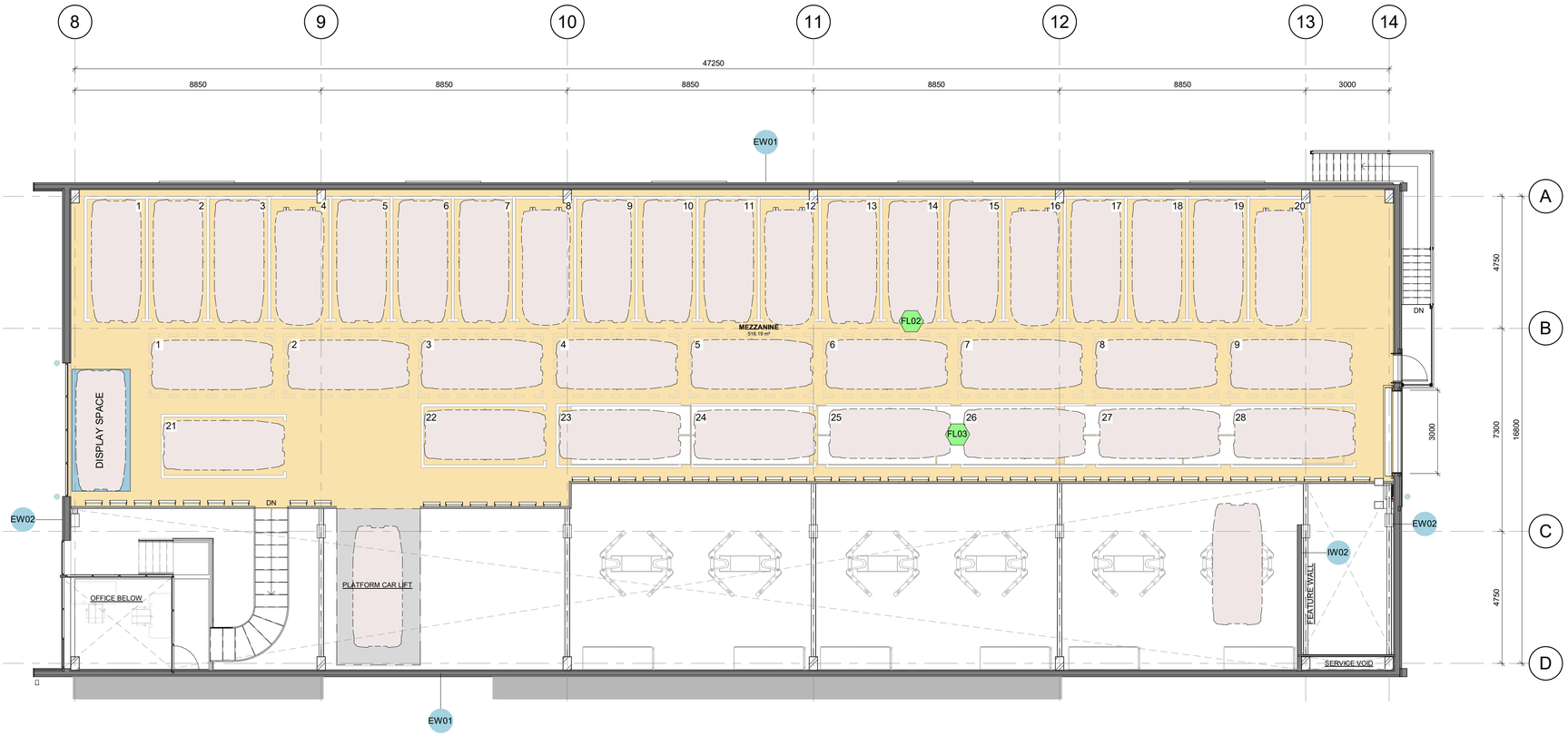
DRAWN BY: EH CHECKED BY: AM APPROVED BY: AM

SCALE: As indicated @ A1 DATE: 17/12/2024

STATUS: S2 DESCRIPTION: SUITABLE FOR INFORMATION

DRAWING No: 5024150 - RDG - XX - 00 - D - A - 001041

PROJECT:	ORIGINATOR:	FUNCTION:	SPATIAL:	FORM:	DISCIPLINE:	NUMBER:	REV:
5024150	RDG	XX	00	D	A	001041	P01



DEPARTMENT KEY

- WORKSHOP
- OFFICE
- STORAGE
- MEZZENINE

PROPOSED MEZZANINE AREAS

Name	Area
MEZZANINE	516.19 m²
Grand total: 1	516.19 m²

MEZZANINE STORAGE PARKING BAYS

Type	Count
MAX CAPACITY PARKING STORAGE BAY	9
STORAGE BAY	28
Grand total: 37	

EQUIPMENT SCHEDULE

FFE XXX → EQUIPMENT TAG

001	VEHICLE RAMP
002	STORAGE RACKING
003	PLATFORM CAR LIFT
004	BOLLARD

FLOOR TYPES SCHEDULE

FLXX → FLOOR TAG

FL01	CONCRETE FLOOR WITH EPOXY RESIN FINISH
FL02	POLISHED CONCRETE
FL03	STRUCTURAL GLASS FLOOR 50m³

WALL TYPES SCHEDULE

XW.XX → WALL TAG

EW01	STANDING SEAM BACK SINUSOIDAL CLADDING INSULATION CORRUGATED METAL INTERNAL CLADDING
EW02	BRICK WALL
EW03	COWLING WALL STANDING SEAM BACK SINUSOIDAL CLADDING CONTRASTING INTERNAL CLADDING
EW04	BRISE SOLEIL (SOLAR SHADING)
EW05	GLAZED CURTAIN WALL
IW01	INTERNAL GLAZED CURTAIN WALL
IW02	LED LIT PERFORATED METAL FEATURE WALL
IW03	STEEL FRAME PARTITION WALL

DRAWING NOTES:

- CDM REGULATIONS 2015
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NOTE:

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GTO HOUSE INTERNAL WALLS NOT VERIFIED VIA SURVEY.

1 0 1 2 3 4 5
SCALE 1:100 m

N

REV	DESCRIPTION	DATE	BY	CHKD
P01	ISSUED FOR PLANNING	17/12/2024	EH	AM

ORIGINATOR: RIDGE

RIDGE PROJECT No: 5024150

CLIENT: GTO ENGINEERING

IN ASSOCIATION WITH:

PROJECT: GTO ENGINEERING - FERRARI WORKSHOP

TITLE: PROPOSED LEVEL 01 GA PLAN - PLANNING

DRAWN BY: EH CHECKED BY: AM APPROVED BY: AM

SCALE: As indicated @ A1 DATE: 17/12/2024

STATUS: S2 DESCRIPTION: SUITABLE FOR INFORMATION

DRAWING No: 5024150 - RDG - XX - 01 - D - A - 001042

PROJECT:	ORIGINATOR:	FUNCTION:	SPATIAL:	FORM:	DISCIPLINE:	NUMBER:	REV:
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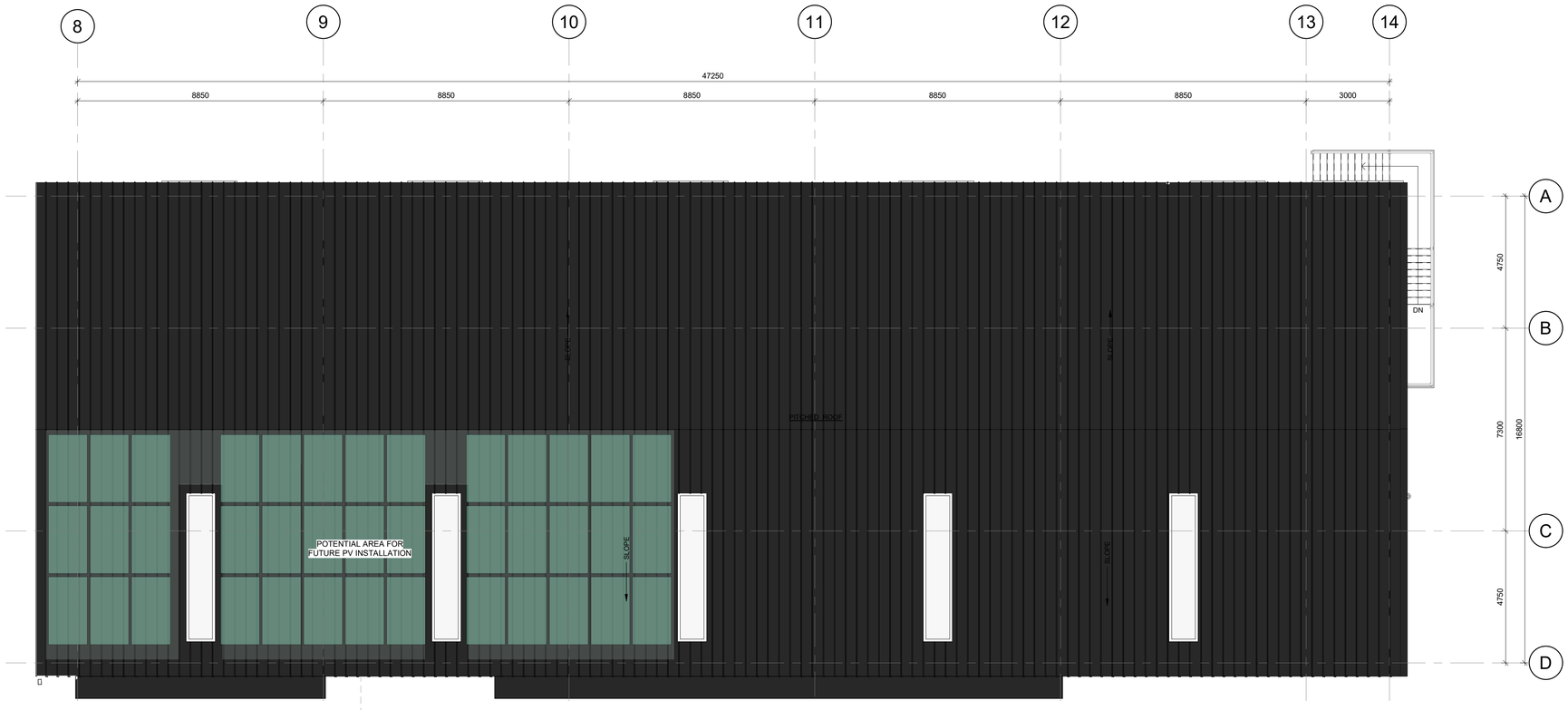

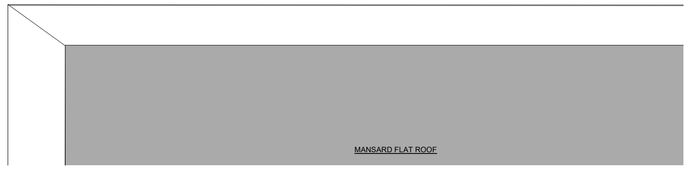

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DRAWING NOTES:

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1 0 1 2 3 4 5
SCALE 1:100 m

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REV	DESCRIPTION	DATE	BY	CHKD
P01	ISSUED FOR PLANNING	17/12/2024	EH	AM

ORIGINATOR:

RIDGE

RIDGE PROJECT No: 5024150

CLIENT:

GTO ENGINEERING

IN ASSOCIATION WITH:

PROJECT:
GTO ENGINEERING - FERRARI WORKSHOP

TITLE:

PROPOSED ROOF PLAN - PLANNING

DRAWN BY:	CHECKED BY:	APPROVED BY:
EH	AM	AM

SCALE: 1 : 100 @ A1 DATE: 17/12/2024

STATUS: S2 DESCRIPTION: SUITABLE FOR INFORMATION

DRAWING No: 5024150 - RDG - XX - R1 - D - A - 001045

PROJECT:	ORIGINATOR:	FUNCTION:	SPATIAL:	FORM:	DISCIPLINE:	NUMBER:	REV:
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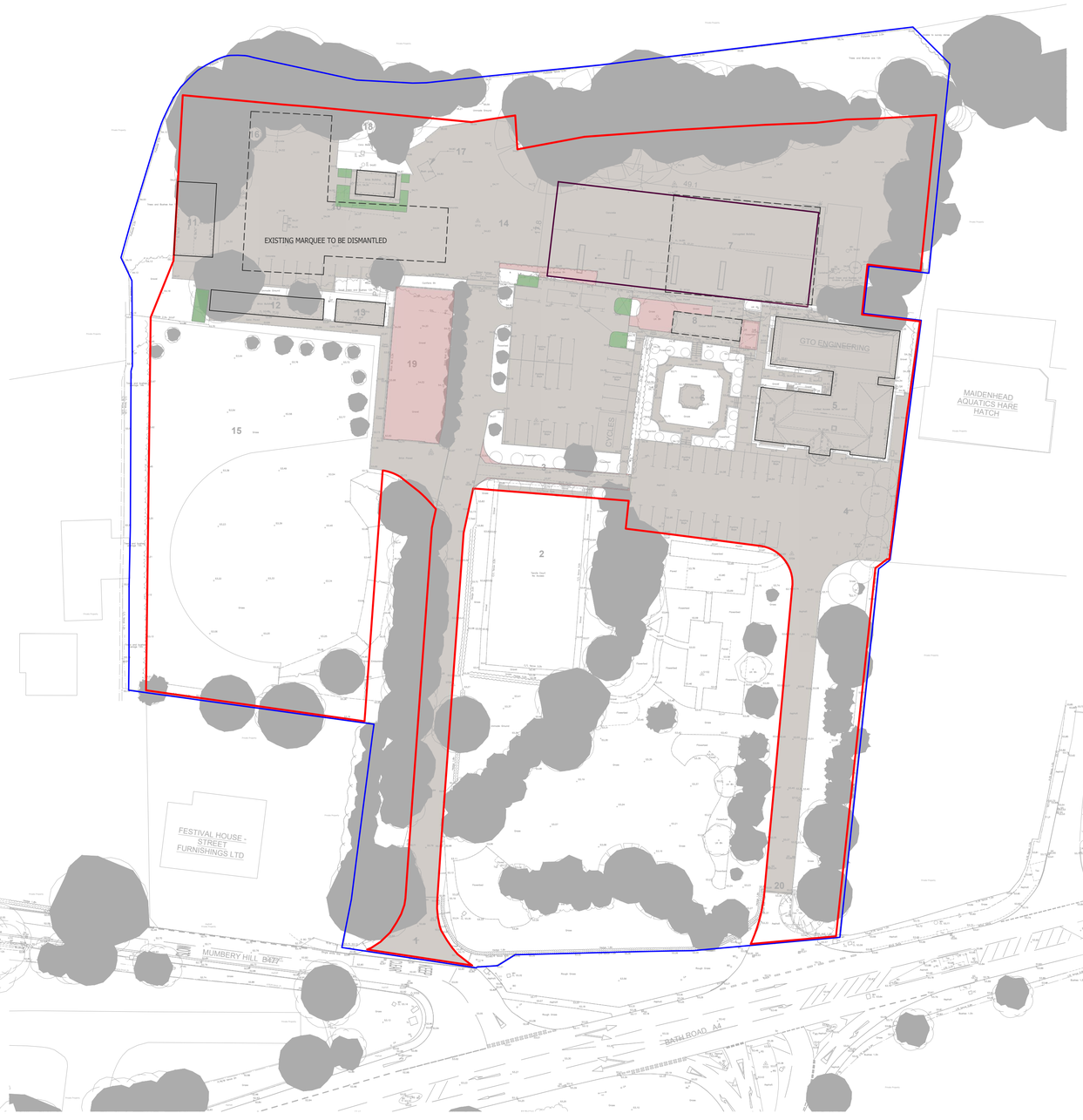

KEY

- SITE BOUNDARY (1.36 ha)
- LAND UNDER APPLICANT'S CONTROL
- EXISTING IMPERMEABLE SURFACING RETAINED (0.825 - 0.008 = 0.817 ha)
- NEW IMPERMEABLE SURFACING (0.043 ha)
- NEW SOFT LANDSCAPING IN PLACE OF EXISTING IMPERMEABLE SURFACING (0.008 ha)
- EXISTING BUILDINGS RETAINED
- EXISTING BUILDINGS TO BE REMOVED
- PROPOSED BUILDING FOOTPRINT

0 10m 20m 40m

GENERAL NOTES

1. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations , record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. any discrepancies shall be notified to gta prior to works commencing.

2. Tender or billing drawings shall not be used for construction or the ordering of materials.

3. Do not scale. All dimensions and levels to be site confirmed.

4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.

5. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.

6. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

7. If viewing this drawing as an Autocad file (.dwg) in digital format then it is done so with this Disclaimer due to the fact that it can be altered and manipulated following its issue by GTA Civils & Transport and therefore, any alteration or modification of DWG data files provided by GTA Civils & Transport, by you or a third party, without GTA Civils and Transport's express written approval, is done so entirely at your own risk. Modification includes (but is not limited to) turning layers on and off, unfreezing layers and reloading, turning on and off print functions and unloading x-refs.

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It is your responsibility to ensure that the correct issue or revision of the DWG data file is being used and requests for updated information made accordingly.

9. Should any apparent discrepancies between the data contained within the DWG file and the current contract drawings become evident, it must be reported back to GTA Civils & Transport as soon as reasonably practicable. Precedence should be given to the current contract drawings (PDF) unless advised otherwise.

Rev	Amendments	Date	Dsn	Chk
P2	LAYOUT AMENDMENTS	18.12.24	PH	MR
P1	INITIAL ISSUE	26.11.24	PH	MR

Status: PLANNING

Client: GTO GROUP LTD

Architect: RIDGE

Project: GTO ENGINEERING
FERRARI WORKSHOP

Title: PROPOSED IMPERMEABLE AREAS PLAN

Date: NOVEMBER 2024

Scale @ A1: 1 : 500

Clients Ref.:

Project Ref.: 10946

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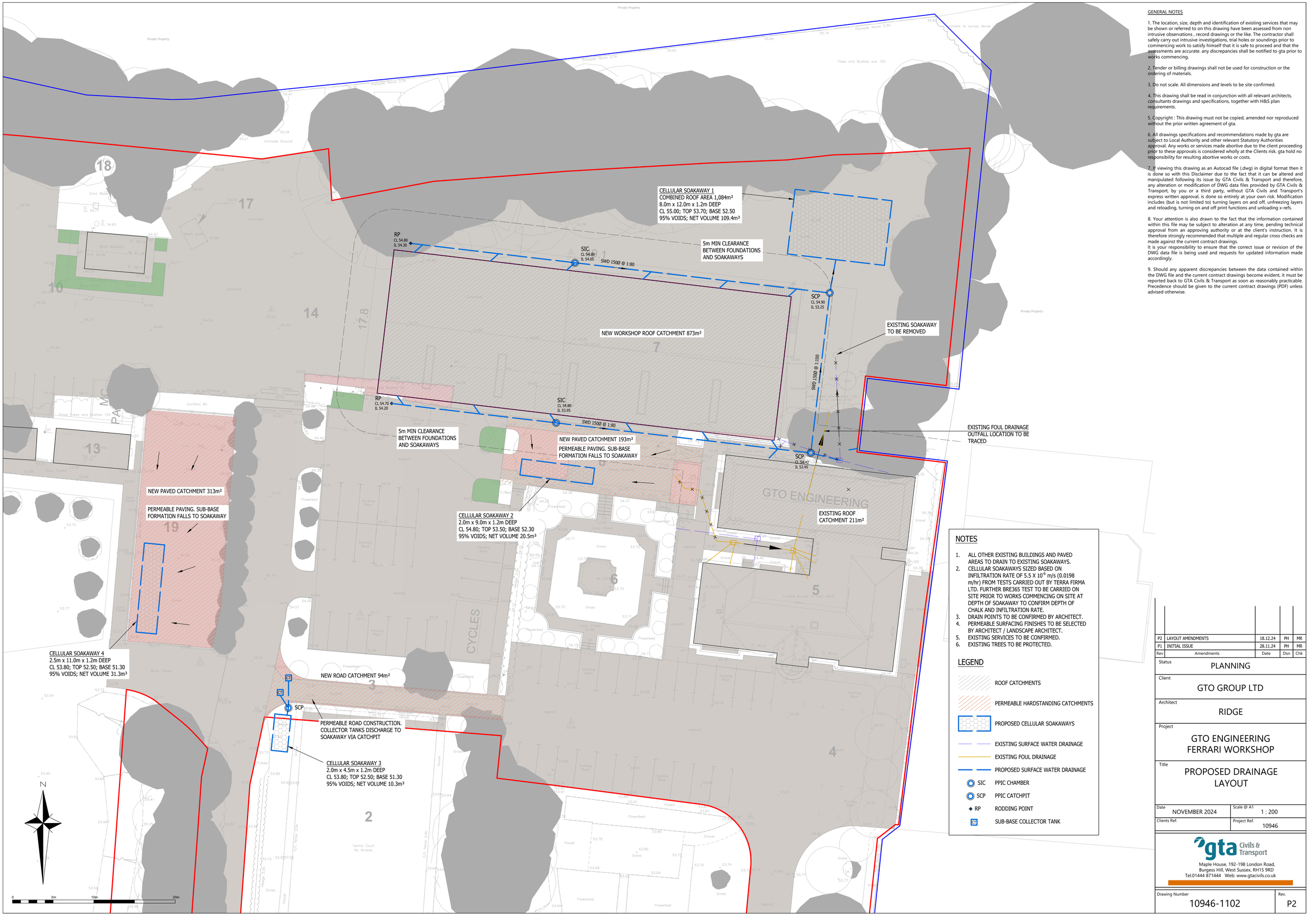
Drawing Number: 10946-1101

Rev.: P2



GENERAL NOTES

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2. Tender or billing drawings shall not be used for construction or the ordering of materials.

3. Do not scale. All dimensions and levels to be site confirmed.

4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.

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NOTES

1. ALL OTHER EXISTING BUILDINGS AND PAVED AREAS TO DRAIN TO EXISTING SOAKAWAYS.
2. CELLULAR SOAKAWAYS SIZED BASED ON INFILTRATION RATE OF 5.5 X 10^{-6} m/s (0.0198 m/hr) FROM TESTS CARRIED OUT BY TERRA FIRMA LTD. FURTHER BRE365 TEST TO BE CARRIED ON SITE PRIOR TO WORKS COMMENCING ON SITE AT DEPTH OF SOAKAWAY TO CONFIRM DEPTH OF CHALK AND INFILTRATION RATE.
3. DRAIN POINTS TO BE CONFIRMED BY ARCHITECT.
4. PERMEABLE SURFACING FINISHES TO BE SELECTED BY ARCHITECT / LANDSCAPE ARCHITECT.
5. EXISTING SERVICES TO BE CONFIRMED.
6. EXISTING TREES TO BE PROTECTED.

LEGEND

- ROOF CATCHMENTS
- PERMEABLE HARDSTANDING CATCHMENTS
- PROPOSED CELLULAR SOAKAWAYS
- EXISTING SURFACE WATER DRAINAGE
- EXISTING FOUL DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- SIC — PPIC CHAMBER
- SCP — PPIC CATCHPIT
- RP — RODDING POINT
- ST — SUB-BASE COLLECTOR TANK

Rev	Amendments	Date	Dsn	Chk
P2	LAYOUT AMENDMENTS	18.12.24	PH	MR
P1	INITIAL ISSUE	28.11.24	PH	MR

Status: PLANNING

Client: GTO GROUP LTD

Architect: RIDGE

Project: GTO ENGINEERING
FERRARI WORKSHOP

Title: PROPOSED DRAINAGE
LAYOUT

Date	Scale @ A1
NOVEMBER 2024	1 : 200
Clients Ref.	Project Ref.
	10946

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10946-1102	P2

Appendix B: Ground Investigations

SECTION 4 Field Investigation

4.1 Site Works

A geo-technical and geo-environmental site investigation was carried out by Terra Firma Wales Limited on the 3rd and 4th July 2012 comprising 8 No. Windowless Sampler Boreholes. Following a consideration of the solution feature risk at the site, supplementary probing was performed at the site on 24th July.

The boreholes and probes were performed using a Terrier Mini-Percussive Rig.

The fieldworks were supervised by Terra Firma (Wales) Limited and the boreholes were logged to the requirements of BS5930:1999. Chalk was logged in accordance in Ciria C574 when sample quality permitted.

The borehole logs are presented in **Annex C.** The additional probing is detailed in Annex H. The positions of the Boreholes (WS) and Probes (DP) are shown on **Figure 02.**

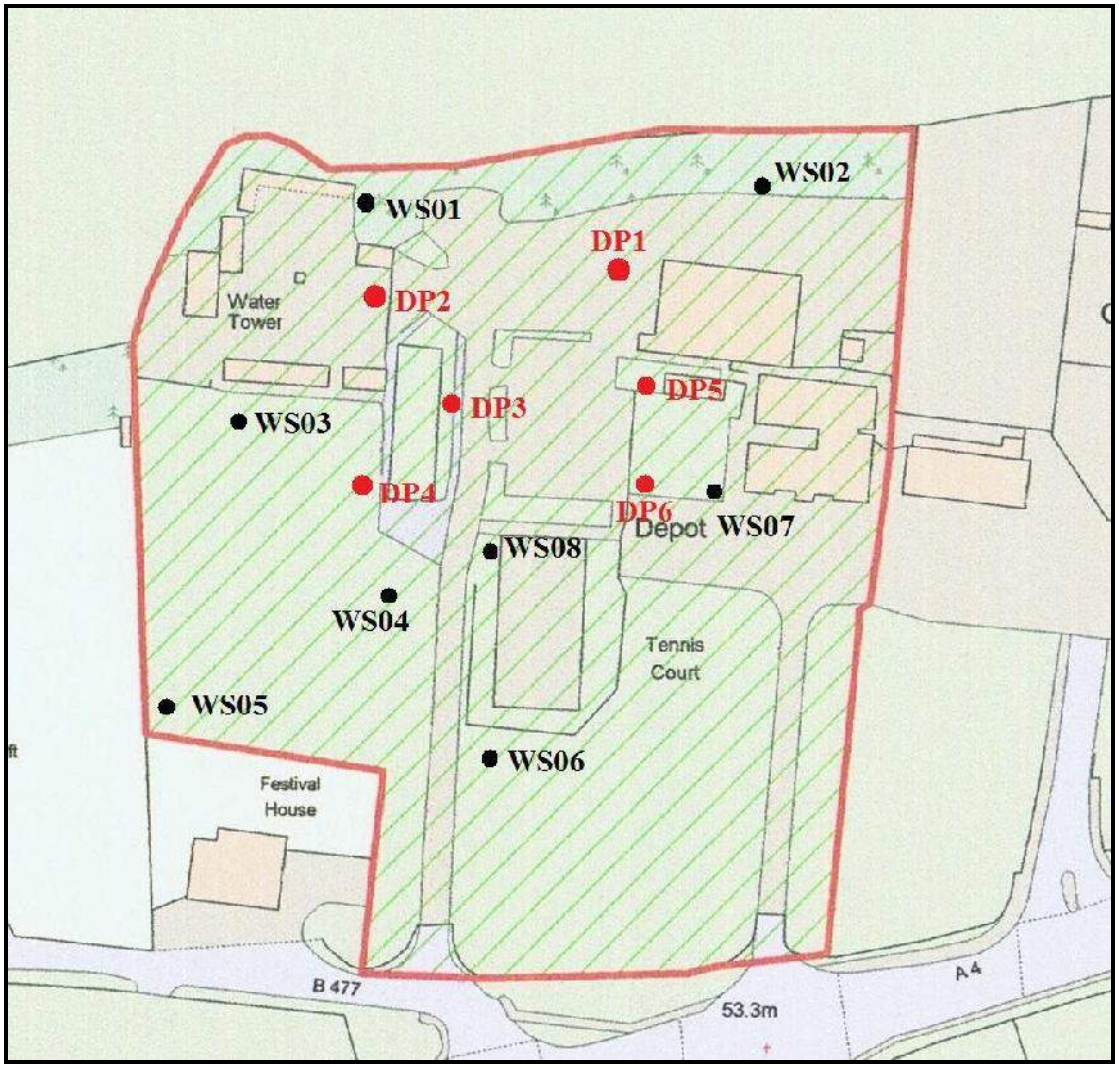

Figure 02. Site Layout and Borehole Locations

4.2 Ground Conditions

The ground conditions encountered can in general be summarised as shown in **Table 4.1.**

Table 4.1 Summary of Ground Conditions

Depth (m)	Thickness (m)	Stratum
GL - 0.00/0.90	0.00/0.90	**MADE GROUND:** Generally soft to firm, variably sandy, variably gravelly CLAY with inclusions of brick, chalk and flint.
GL/0.90 - 1.15/2.15	0.60/1.97	Typically firm to stiff, variably sandy and gravelly CLAY. Gravel comprises chalk and flint fragments.
1.55/2.15 - >4.00	>1.80	**UPPER CHALK FORMATION:** Typically Weak, medium density, Grade B4/C4/C5.

The two phases of investigation did not encounter evidence of solution features.

4.3 Water Strikes

Boreholes remained dry during drilling.

7.3 Excavations and Formations

Most of the shallow excavations should be possible with normal soil excavating machinery, although allowances should be made for breaking out buried obstructions such as former foundations.

The sides of any excavations deeper than 1.0m should be supported by planking and strutting or other proprietary means.

The sub-formations/formations will be susceptible to loosening, softening and deterioration by exposure to weather (rain, frost and drying conditions), the action of water (flood water or removal of groundwater) and site traffic.

Formations should never be left unprotected and continuously exposed to rain causing degradation, or left exposed/uncovered overnight, unless permitted by a qualified engineer.

Construction plant and other vehicular traffic should not be operated on unprotected formations. Allowances should be made for special precautions to prevent formation deterioration in addition to the above. Chalk is especially susceptible to deterioration during excavation and exposure.

It is recommended that approval be gained from a qualified engineer of the formation condition before covering them with any subsequent construction.

7.4 Protection of Buried Concrete

The laboratory soil chemical tests revealed total sulphate content below 200mg/kg to 400 mg/kg and pH values of between 8.1 and 8.9. Groundwater was not encountered within founding depth and is thus considered as static.

Based on the above it is recommended that all buried concrete should as a minimum conform to Class AC-1s, DS-1 of BRE Digest 1:2005.

7.5 Sustainable Urban Drainage

Borehole Soakage Tests were performed in duplicate in Window Sampler Boreholes WS03 and WS06. The tests were performed on partially sunk boreholes and boreholes were cased to provide a defined soakage surface. The tests were performed under the following conditions;

Table 7.1. Borehole Soakage Test Conditions

	WS03	WS06
Borehole Depth During Test (m)	2.0 (Borehole Partially Sunk)	3.0 (Borehole Partially Sunk)
Casing Depth (m)	2.0	2.0
Casing Diameter, D (m)	0.116	0.116
Intake Factor from BS:5930:1999 (2.75D)	0.319	0.319

The soakage rates were calculated in accordance with BS:5930, 1999. The testing calculated soil infiltration rates of between 5.63×10^{-6} ms^{-1} and 7.09×10^{-6} ms^{-1} for the chalk. We would recommend that the lower bound value be employed for design purposes.

The site locates within a Source Protection Zone and the Environment Agency should be consulted about the feasibility of discharging directly into this strata.

The Soak Test calculations are presented in **Annex F**.

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Borehole No
WS01
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Twyford	11839		MP
Location:		Level: -	Scale 1:50
Client:		Dates: 03/07/2012	Logged By

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.18			MADE GROUND: Stiff, dark-brown, sandy gravelly CLAY/SILT.
		1.00	CPT	N=17 N=17 (4,6,4,5,4,4)				Stiff/Compact, yellow-brown, very slightly gravelly (rounded flint and angular chalk) very sandy SILT/CLAY. Contains occasional cobble of flint.
		2.00	CPT	N=27 N=27 (4,4,6,7,7,7)	2.15			Weak, low density, white with Mn and Fe staining, CHALK. Bedding fractures horizontal, extremely closely to very closely spaced (5/20/30) closed to infilled (0/3/5). Occasional flint gravel noted. (Upper Chalk, low density, Grade B4)
		3.00	CPT	N=23 N=23 (5,5,5,6,7,5)				
		4.00	CPT	N=19 N=19 (7,4,3,5,5,6)	4.00			End of Borehole at 4.95 m
		4.45 4.45-4.83	CPT D	50/230mm 230mm (8,9,8,16,24,2)				
			Type	Results				

Remarks: Borehole Dry during drilling

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Borehole No
WS02
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Twyford	11839		MP
Location:		Level: -	Scale 1:50
Client:		Dates: 03/07/2012	Logged By

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Stiff, dark-brown, very occasionally gravelly, very sandy CLAY. Gravel comprises rounded flint and angular chalk. Contains occasional cobble.
		1.00	CPT	N=26 N=26 (3,3,4,7,6,9)	1.20			
								Weak, medium density, white with Mn and Fe staining, CHALK. Bedding fractures horizontal extremely closely to closely spaced (2/20/25), closed to open and infilled (0/5/10). Occasional flint present. (Upper Chalk, Medium Density, Grade C5)
		2.00	CPT	N=44 N=44 (7,10,10,11,10,13)				
		2.45	CPT	N=41 N=41 (9,9,9,10,10,12)				
		3.00	CPT	51/285mm 285mm (12,13,13,11,14,13)	3.00			
								End of Borehole at 3.45 m
			Type	Results				

Remarks: Borehole Dry during drilling

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Borehole No
WS03
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Twyford	11839		MP
Location:		Level: -	Scale 1:50
Client:		Dates: 03/07/2012	Logged By

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.10			MADE GROUND: Soft, dark-brown, gravelly sandy CLAY.
					0.30			MADE GROUND: Medium dense, red, GRAVEL to COBBLE of brick.
					0.50			MADE GROUND: Firm, dark-brown, sandy CLAY with flints.
		1.00	CPT	N=11 N=11 (2,3,4,2,2,3)				Firm to stiff, yellow-brown, gravelly sandy CLAY. Gravel comprises angular chalk and rounded flints.
					1.20			Structureless CHALK composes of clasts up to 20mm in a matrix of cominuted chalk. Gravel is weak, mainly angular, white with Fe and Mn staining. Matrix has inclusions of brown clay. (Grade Dc).
					1.80			Weak, medium density, white with Fe and Mn staining, CHALK. Bedding fractures extremely close to closely spaced (5/30/50). Fractures closed to open and infilled (0/3/5). Contains flints. (Upper Chalk, Medium Density, Grade B4).
		2.00	CPT	N=17 N=17 (3,4,4,4,4,5)				
		3.00	CPT	N=27 N=27 (5,6,5,7,8,7)				
		3.60	CPT	50/180mm 180mm (11,8,7,20,23)	3.60			End of Borehole at 4.05 m
			Type	Results				

Remarks: Borehole Dry during drilling

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Borehole No
WS04
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Twyford	11839		MP
Location:		Level: -	Scale 1:50
Client:		Dates: 03/07/2012	Logged By

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.15			MADE GROUND: Soft, dark-brown, gravelly sandy CLAY with inclusions of brick fragments.
					0.55			MADE GROUND: Firm, light brown, slightly sandy CLAY with occasional flint fragments.
		1.00	CPT	N=12 N=12 (3,4,4,3,2,3)				Firm to stiff, yellow-brown, slightly sandy gravelly CLAY. Gravel comprises angular chalk and rounded flint gravel.
					1.25			Weak, medium density, white with Fe and Mn staining, CHALK. Bedding fractures extremely close to closely spaced (5/20/70), closed to open and infilled (0/3/5). (Upper Chalk, Medium Density, Grade B4)
		2.00	CPT	N=23 N=23 (4,4,5,5,6,7)				
		3.00	CPT	50/255mm 255mm (6,8,9,12,12,17)	3.00			End of Borehole at 3.45 m
			Type	Results				

Remarks: Borehole Dry during drilling

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Borehole No
WS05
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Twyford	11839		MP
Location:		Level: -	Scale 1:50
Client:		Dates: 03/07/2012	Logged By

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								MADE GROUND: Brown, very gravelly CLAY. Includes fragments of brick, flint and chalk.
					0.55			Firm to stiff, yellow-brown, sandy gravelly CLAY. Gravel comprises angular chalk and rounded flint clasts.
		1.00	CPT	N=12 N=12 (1,2,3,3,3,3)	1.15			Weak, medium density, white with Fe and Mn staining, CHALK. Bedding fractures closely spaced (20/25/60) closed or open and infilled (0/3/5). (Upper Chalk, Medium Density, Grade B4)
		2.00	CPT	N=23 N=23 (6,4,4,5,4,10)				
		2.80	CPT	50/255mm 255mm (10,13,15,12,15,8)	2.80			End of Borehole at 3.25 m
			Type	Results				

Remarks: Borehole Dry during drilling

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Borehole No
WS06
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Twyford	11839		MP
Location:		Level: -	Scale 1:50
Client:		Dates: 04/07/2012	Logged By

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.45			MADE GROUND: Firm, dark-brown, sandy gravelly SILT/CLAY including brick and flint.
					0.55			Stiff, yellow-brown, CLAY.
		1.00	CPT	N=14 N=14 (3,3,5,4,3,2)				Stiff, yellow-brown, sandy gravelly CLAY with angular chalk and rounded flint gravel.
					1.20			Weak, medium density, white with Fe and Mn stained CHALK. Bedding fractures extremely close to closely spaced (5/20/50) closed to open and infilled (0/5/10). (Upper Chalk, Medium Density, Grade C4)
		2.00	CPT	N=17 N=17 (5,5,4,4,4,5)				
		3.00	CPT	N=25 N=25 (5,7,6,6,6,7)				
		4.00	CPT	N=48 N=48 (6,8,12,10,11,15)	4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Borehole Dry during drilling

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Borehole No
WS07
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Twyford	11839		MP
Location:		Level: -	Scale 1:50
Client:		Dates: 04/07/2012	Logged By

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								MADE GROUND: Soft, dark-brown, slightly gravelly sandy CLAY.
		1.00	CPT	N=20 N=20 (5,6,5,5,6,4)	0.90			Stiff, yellow-brown, sandy gravelly CLAY. Gravel comprises angular chalk and rounded flint fragments. Includes occasional flint cobble.
					1.50			Weak, medium dense, white CHALK. Sample disturbed by flint. (Upper Chalk).
		2.00	CPT	N=26 N=26 (4,6,6,6,6,8)	2.00			End of Borehole at 2.00 m
			Type	Results				

Remarks: Borehole Dry during drilling

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Borehole No
WS08
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Twyford	11839		MP
Location:		Level: -	Scale 1:50
Client:		Dates: 04/07/2012	Logged By

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								MADE GROUND: Soft to firm, dark-brown, gravelly sandy CLAY including brick fragments.
					0.68			Stiff, yellow-brown, sandy gravelly CLAY. Gravel conmprises angular chalk and rounded flint upto cobble size.
		1.00	CPT	N=22 N=22 (2,4,6,6,6,4)				
					1.50			Weak, medium dense, white with Fe and Mn staining, CHALK. Bedding fractures horizontal, extremely close to closely spaced (5/20/70) closed or open and infilled (0/5/10). (Upper Chalk, Medium Dense, Grade C4)
		2.00	CPT	N=23 N=23 (6,6,5,5,6,7)				
		3.00	CPT	N=38 N=38 (6,7,9,9,10,10)	3.00			End of Borehole at 3.00 m
			Type	Results				

Remarks: Borehole Dry during drilling

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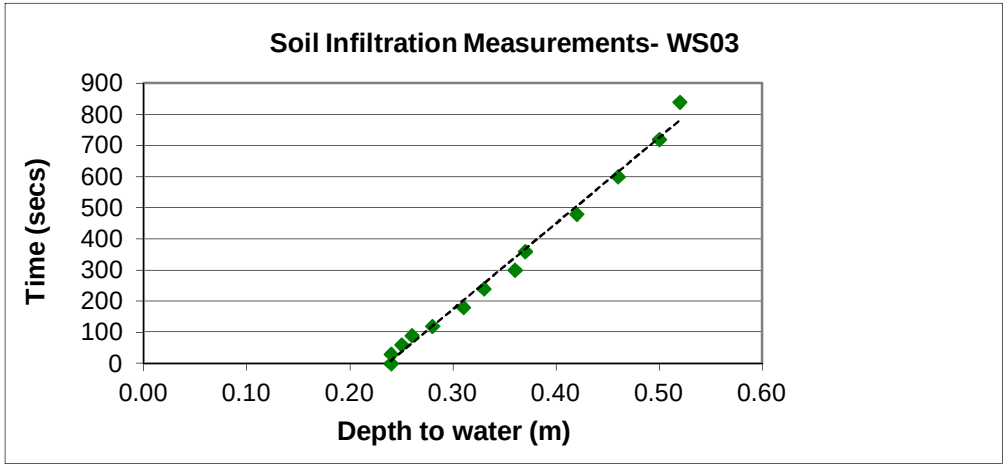
TERRAFIRMA (WALES) LIMITED

Site Name: Twyford WS03 (1)
Date Undertaken: 03/07/2012

	Depth to Water (m)	Time- t (secs)	Head at time t- H	Head Ratio- H/Ho
Initial Measurement (m)	0.24	0	1.760	1.000
	0.24	30	1.760	1.000
	0.25	60	1.750	0.994
	0.26	90	1.740	0.989
	0.28	120	1.720	0.977
	0.31	180	1.690	0.960
	0.33	240	1.670	0.949
	0.36	300	1.640	0.932
	0.37	360	1.630	0.926
	0.42	480	1.580	0.898
	0.46	600	1.540	0.875
	0.50	720	1.500	0.852
Last Measurement (m)	0.52	840	1.480	0.841

Depth of Borehole (m)	2.00
Diameter of Borehole- **D** (m)	0.116
Cross-sectional Area- **A** (m^2)	0.010568
Intake Factor- **F**	0.319
Head at Commencemant- **H_o** (m)	1.76
Time **t_1** (secs)	30
Variable head at time t_1- **H_1**	1.76
Time **t_2** (secs)	840
Variable head at time t_2- **H_2**	1.480
Head Ration (H_1/H_2)	1.189
log $_e$ (H_1/H_2)	0.173271721
Soil infiltration rate- k (m/s)	**7.08693E-06**



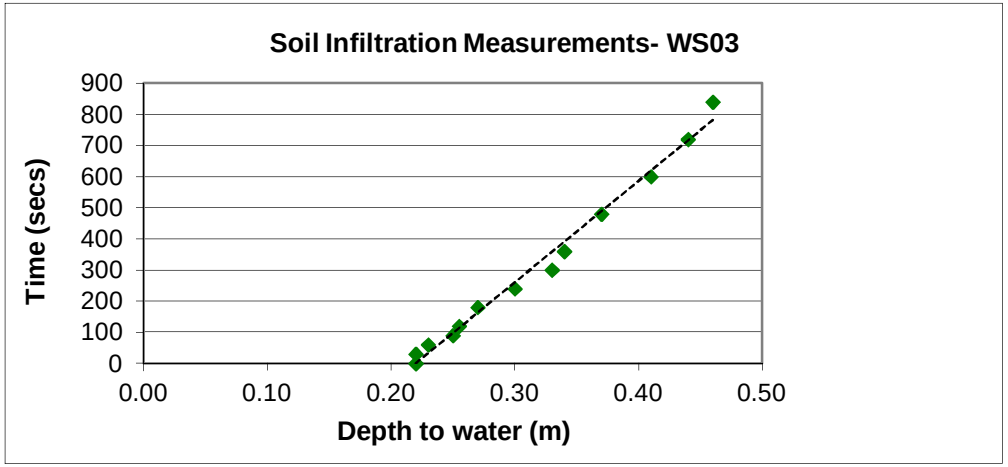
Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BS 5930:1999, Section 25.4'
This worksheet can be used to determine soil infiltration rates from borehole field measurements
Worksheet options are identified by a green background

TERRAFIRMA (WALES) LIMITED

Site Name: Twyford WS03 (2)
Date Undertaken: 03/07/2012

	Depth to Water (m)	Time- t (secs)	Head at time t- H	Head Ratio- H/Ho
Initial Measurement (m)	0.22	0	1.780	1.000
	0.22	30	1.780	1.000
	0.23	60	1.770	0.994
	0.25	90	1.750	0.983
	0.26	120	1.745	0.980
	0.27	180	1.730	0.972
	0.30	240	1.700	0.955
	0.33	300	1.670	0.938
	0.34	360	1.660	0.933
	0.37	480	1.630	0.916
	0.41	600	1.590	0.893
	0.44	720	1.560	0.876
Last Measurement (m)	0.46	840	1.540	0.865

Depth of Borehole (m)	2.00
Diameter of Borehole- **D** (m)	0.116
Cross-sectional Area- **A** (m^2)	0.010568
Intake Factor- **F**	0.319
Head at Commencemant- **H_o** (m)	1.78
Time **t_1** (secs)	30
Variable head at time t_1- **H_1**	1.78
Time **t_2** (secs)	840
Variable head at time t_2- **H_2**	1.540
Head Ration (H_1/H_2)	1.156
log $_e$ (H_1/H_2)	0.144830948
Soil infiltration rate- k (m/s)	**5.92368E-06**



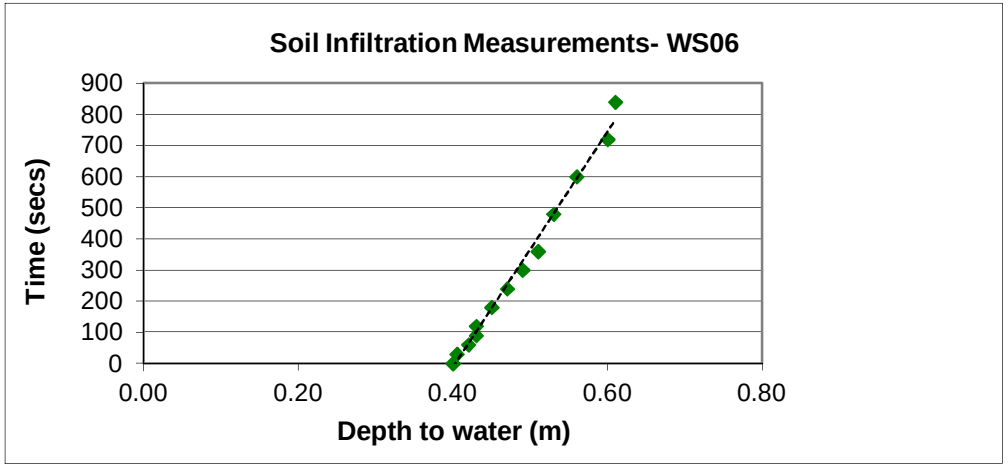
Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BS 5930:1999, Section 25.4'
This worksheet can be used to determine soil infiltration rates from borehole field measurements
Worksheet options are identified by a green background

TERRAFIRMA (WALES) LIMITED

Site Name: Twyford WS06 (1)
Date Undertaken: 04/07/2012

	Depth to Water (m)	Time- t (secs)	Head at time t- H	Head Ratio- H/H_o
Initial Measurement (m)	0.40	0	1.600	1.000
	0.41	30	1.595	0.997
	0.42	60	1.580	0.988
	0.43	90	1.570	0.981
	0.43	120	1.570	0.981
	0.45	180	1.550	0.969
	0.47	240	1.530	0.956
	0.49	300	1.510	0.944
	0.51	360	1.490	0.931
	0.53	480	1.470	0.919
	0.56	600	1.440	0.900
	0.60	720	1.400	0.875
Last Measurement (m)	0.61	840	1.390	0.869

Depth of Borehole (m)	2.00
Diameter of Borehole- **D** (m)	0.116
Cross-sectional Area- **A** (m_2)	0.010568
Intake Factor- **F**	0.319
Head at Commencemant- H_o (m)	1.60
Time t_1 (secs)	30
Variable head at time t_1- H_1	1.60
Time t_2 (secs)	840
Variable head at time t_2- H_2	1.390
Head Ration (H_1/H_2)	1.147
log e (H_1/H_2)	0.137569989
Soil infiltration rate- k (m/s)	**5.6267E-06**



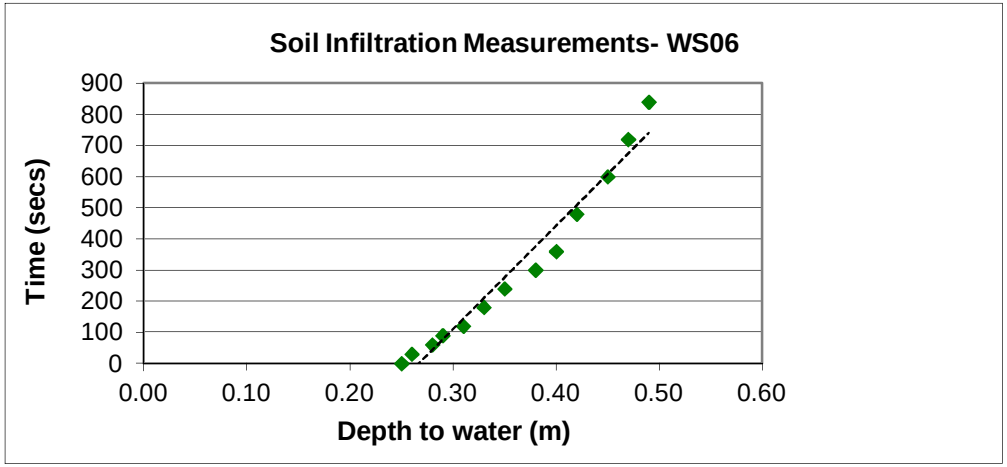
Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BS 5930:1999, Section 25.4'
This worksheet can be used to determine soil infiltration rates from borehole field measurements
Worksheet options are identified by a green background

TERRAFIRMA (WALES) LIMITED

Site Name: Twyford WS06 (2)
Date Undertaken: 04/07/2012

	Depth to Water (m)	Time- t (secs)	Head at time t- H	Head Ratio- H/Ho
Initial Measurement (m)	0.25	0	1.750	1.000
	0.26	30	1.740	0.994
	0.28	60	1.720	0.983
	0.29	90	1.710	0.977
	0.31	120	1.690	0.966
	0.33	180	1.670	0.954
	0.35	240	1.650	0.943
	0.38	300	1.620	0.926
	0.40	360	1.600	0.914
	0.42	480	1.580	0.903
	0.45	600	1.550	0.886
	0.47	720	1.530	0.874
Last Measurement (m)	0.49	840	1.510	0.863

Depth of Borehole (m)	2.00
Diameter of Borehole- **D** (m)	0.116
Cross-sectional Area- **A** (m^2)	0.010568
Intake Factor- **F**	0.319
Head at Commencemant- **H_o** (m)	1.75
Time **t_1** (secs)	30
Variable head at time t_1- **H_1**	1.74
Time **t_2** (secs)	840
Variable head at time t_2- **H_2**	1.510
Head Ration (H_1/H_2)	1.152
log e (H_1/H_2)	0.141775462
Soil infiltration rate- k (m/s)	**5.79871E-06**



Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BS 5930:1999, Section 25.4'
This worksheet can be used to determine soil infiltration rates from borehole field measurements
Worksheet options are identified by a green background

Appendix C: Calculations

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SOAKAWAY 1	0.109	55.000	10	479985.000	178037.000	2.500
SOAKAWAY 2	0.020	54.800	10	479948.000	178008.000	2.500
SOAKAWAY 3	0.010	53.800	10	479913.000	177975.000	2.500
SOAKAWAY 4	0.032	53.800	10	479897.000	177992.000	2.500

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	1.000	Drain Down Time (mins)	2880	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0	Check Discharge Volume	x
Summer CV	1.000	Skip Steady State	x	Starting Level (m)			

Storm Durations

360	480	600	720	960	1440	2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	30	35	0	0
10	0	0	0	100	40	0	0

Node SOAKAWAY 1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.01980	Porosity	0.95	Pit Width (m)	8.000	Inf Depth (m)	
Side Inf Coefficient (m/hr)	0.01980	Invert Level (m)	52.500	Pit Length (m)	12.000	Number Required	1
Safety Factor	2.0	Time to half empty (mins)	2764	Depth (m)	1.200		

Node SOAKAWAY 2 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.01980	Porosity	0.95	Pit Width (m)	2.000	Inf Depth (m)	
Side Inf Coefficient (m/hr)	0.01980	Invert Level (m)	52.300	Pit Length (m)	9.000	Number Required	1
Safety Factor	2.0	Time to half empty (mins)	1993	Depth (m)	1.200		

Node SOAKAWAY 3 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.01980	Porosity	0.95	Pit Width (m)	2.000	Inf Depth (m)	
Side Inf Coefficient (m/hr)	0.01980	Invert Level (m)	51.300	Pit Length (m)	4.500	Number Required	1
Safety Factor	2.0	Time to half empty (mins)	1851	Depth (m)	1.200		

Node SOAKAWAY 4 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.01980	Porosity	0.95	Pit Width (m)	2.500	Inf Depth (m)	
Side Inf Coefficient (m/hr)	0.01980	Invert Level (m)	51.300	Pit Length (m)	11.000	Number Required	1
Safety Factor	2.0	Time to half empty (mins)	2174	Depth (m)	1.200		

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	SOAKAWAY 1	720	52.686	0.186	1.8	16.9676	0.0000	OK
600 minute winter	SOAKAWAY 2	555	52.488	0.188	0.3	3.2065	0.0000	OK
1440 minute winter	SOAKAWAY 3	930	51.484	0.184	0.1	1.5703	0.0000	OK
600 minute summer	SOAKAWAY 4	600	51.497	0.197	0.7	5.1396	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
960 minute summer	SOAKAWAY 1	Infiltration	0.3
600 minute winter	SOAKAWAY 2	Infiltration	0.1
1440 minute winter	SOAKAWAY 3	Infiltration	0.0
600 minute summer	SOAKAWAY 4	Infiltration	0.1

Results for 10 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	SOAKAWAY 1	705	52.991	0.491	3.2	44.7425	0.0000	OK
960 minute winter	SOAKAWAY 2	930	52.753	0.453	0.5	7.7495	0.0000	OK
720 minute winter	SOAKAWAY 3	675	51.811	0.511	0.3	4.3688	0.0000	OK
720 minute winter	SOAKAWAY 4	690	51.794	0.494	0.9	12.9181	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
720 minute winter	SOAKAWAY 1	Infiltration	0.3
960 minute winter	SOAKAWAY 2	Infiltration	0.1
720 minute winter	SOAKAWAY 3	Infiltration	0.0
720 minute winter	SOAKAWAY 4	Infiltration	0.1

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	SOAKAWAY 1	945	53.395	0.895	4.3	81.5985	0.0000	OK
600 minute summer	SOAKAWAY 2	600	53.140	0.840	1.7	14.3681	0.0000	OK
960 minute summer	SOAKAWAY 3	960	52.159	0.859	0.6	7.3425	0.0000	OK
720 minute winter	SOAKAWAY 4	720	52.183	0.883	1.6	23.0625	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
960 minute winter	SOAKAWAY 1	Infiltration	0.4
600 minute summer	SOAKAWAY 2	Infiltration	0.1
960 minute summer	SOAKAWAY 3	Infiltration	0.1
720 minute winter	SOAKAWAY 4	Infiltration	0.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	SOAKAWAY 1	945	53.694	1.194	5.5	108.8510	0.0000	OK
600 minute winter	SOAKAWAY 2	600	53.402	1.102	1.5	18.8509	0.0000	OK
960 minute summer	SOAKAWAY 3	960	52.421	1.121	0.8	9.5821	0.0000	OK
720 minute winter	SOAKAWAY 4	705	52.500	1.200	2.1	31.3523	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
960 minute winter	SOAKAWAY 1	Infiltration	0.4
600 minute winter	SOAKAWAY 2	Infiltration	0.1
960 minute summer	SOAKAWAY 3	Infiltration	0.1
720 minute winter	SOAKAWAY 4	Infiltration	0.2

Appendix D: Draft Drainage Maintenance Plan

1. Ownership & Maintenance Responsibilities

As a single property, responsibility for the drainage system within the curtilage will reside with the Landowner. It is the responsibility of the Landowner to ensure the drainage systems at the property are maintained in accordance with this Plan. The Plan includes the drainage systems at ground level and below.

2. Health and Safety

All those responsible for and involved in the maintenance of the site drainage systems should be safety-conscious and comply with the relevant health and safety legislation. This includes:

- The Health and Safety at Work etc Act 1974
- The Management of Health and Safety at Work Regulations 1999
- The Workplace (Health, Safety and Welfare) Regulations 1992

The Landowner is responsible for suitable risk assessment and management to ensure safe working conditions and practices. Measures to protect potential visitors also need to be considered.

Specialist contractors used should work to industry guidelines and be able to demonstrate safe working practices.

Employers have a duty to employees to inform them about the risks of their work environment and to decrease the risk as far as reasonably practicable. Appropriate personal protective equipment (PPE) should be provided and policies implemented based on risk assessment.

Operatives should be trained for working near water. Risks of contaminated water should be considered. Checking for open cuts and using nitrile gloves, waterproof plasters etc is advised.

Entry of pipes, chambers, tanks and culverts should be avoided wherever possible. Work should be carried out from the surface using appropriate equipment. In the event that entry cannot be avoided to perform a critical task, the required safety training, protection measures and precautions must be implemented prior to entry. Lone working should never be attempted.

For further information refer to Section 36 of The SuDS Manual (CIRIA C753).

3. Contamination or Dilution of Spillage

In the event of a spillage, it is the responsibility of the landowner to clear up any spillage before it enters the drainage system. The primary method of dealing with any spillage of hydrocarbons should be using sand to soak up the leak and prevent any hydrocarbons entering the drainage system. Once sand has been contaminated it should not be washed into the drainage system but disposed of by a Licensed Contractor.

Environment Agency (EA) – Emergency Contact Number

In the event of a spillage the EA should be contacted to notify the event and seek advice. The EA Incident Hotline is 0800 80 70 60 (Freephone 24hrs).

4. Schedule A – Sewers, Manholes, Gullies, Channel Drains

Regular inspection and maintenance are required to ensure the effective long-term operation of private drains, manholes, gullies & channel drains.

Post Completion: the contractor should carry out a CCTV survey on all new and retained existing drainage systems and any downstream receiving systems. The report will be used to prove the integrity of the as-built drainage system prior to issue of practical completion certificate and will be handed over to the Client for future reference.

Operation and maintenance requirements for all sewers, manholes, gullies and channel drains are described in the following table:

Schedule	Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	6 Monthly
	Common yard & car park & other hard standing areas to be swept clear of debris, to prevent possibility of blockages to the receiving drainage systems	Monthly
	Debris removal from gullies & channel drains.	6 Monthly intervals, after autumn leaf fall, or as required based on observations.
	Lift and inspect receiving manholes to check for any blockages	Monthly

Remedial Actions	Repair any damaged drains or gratings Replace / fix any loose manhole covers	As required As required
Monitoring	Carry out CCTV survey to confirm ongoing integrity of all drains. Inspect all gullies and silt pits & drainage channels during the survey.	Suggest 10-yearly intervals

Where appropriate refer also to specialist drainage manufacturer's information and maintenance requirements.

In all instances, inspection and cleaning should be carried out only by a specialist contractor and in accordance with the guidelines given in `Safe Working in Sewers and at Sewage Works' published by National Joint Health and Safety Committee for the Water Services. Further information on safety is set out in Section 2.

5. Schedule B – Permeable Pavements

Inspection Frequency and Maintenance Requirements: as per table below.

Schedule	Action	Frequency
Regular Maintenance	Sweeping of surface	Annually after autumn leaf fall
Occasional Maintenance	Weed removal	Annually
Remedial Actions	Remediate adjacent landscaping to original levels Paving repairs including replenishment of lost jointing material Rehabilitation of surface and upper substructure by replacing top dressing layers	As required As required Every 10 to 15 years or as required
Monitoring	Initial inspection Inspection for evidence of poor operation	Monthly for first three months Quarterly, 48 hrs after storms in first 6

	and/or weed growth	months
	Inspection for silt accumulation to establish sweeping frequencies	Annually
	Monitor inspection chambers	Annually

Safety information is set out in Section 2.

6. Schedule C – Cellular Soakaways

Inspection Frequency and Maintenance Requirements: as per table below.

Schedule	Action	Frequency
Regular Maintenance	Remove debris which could impact performance from catchment surface	Monthly
	Remove sediment from upstream catchpits	Annually
Remedial Actions	Repair inlets, outlets, overflow weirs and vents	As required
	Reconstruct soakaway if performance deteriorates, geotextile is clogged or failure occurs	As required
Monitoring	Inspect full system to ensure good condition and operating correctly	Monthly for first 3 months, then annually
	Inspect soakaway to ensure emptying is occurring	Annually
	CCTV survey inside tanks for sediment build-up	5 years

Further safety information is set out in Section 2.

7. Foul Drainage

Carry out annual visual check of all inspection chambers to ensure all pipes are clear and free flowing. If not, clean out by rodding or jetting.

Package treatment plants to be maintained in accordance with manufacturer's instructions.

Civil Engineering - Transport Planning - Flood Risk

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