

Project: Lucas Lane, Whittle-le-Woods:
Drainage

Client: Fellows Homes Ltd

Date: July 2022

Project Reference: 2434

Document Reference: D1

Document Version: 1.1

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of Structural
Engineers*



Project: Lucas Lane Drainage

Reference: 2434

Date: 2022

Schedule of Revision

Revision	Date	Details
1.0	July 2022	First Issue
1.1	November 2023	Updated to site revised hydraulic design



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Introduction

The following calculations describe the hydraulic simulations undertaken and show the pipe network analysis for the proposed site. This report should be read with the current revisions of the associated drainage and external works arrangement drawings.

Infiltration testing has shown that soakaways are not feasible due to the ground conditions. The drainage strategy therefore adopts partial infiltration in the form of paths and driveways laid to falls to the soft landscaping, with the main run-offs directed to watercourse. Discharge is restricted to 2 l/s.

Foul water is directed to a packaged treatment facility, with the clean outfall directed to watercourse.



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Hydraulic Calculations



File SN1 Rev C.MDX

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Network 2020.1.3

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SN1.SWS

Pipe Sizes SN1 Manhole Sizes UU MH

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.500	Add Flow / Climate Change (%)	0
Ratio R	0.348	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	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)	400

Designed with Level Soffits

Network Design Table for SN1.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)	Section Type	Auto Design
1.000	17.100	0.311	55.0	0.025	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	21.348	0.388	55.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	27.502	0.069	398.6	0.081	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.003	24.120	0.060	402.0	0.108	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.004	54.411	0.907	60.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	15.840	0.264	60.0	0.000	0.00	0.0	0.600	o	150	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	59.49	5.21	89.634	0.025	0.0	0.0	0.0	1.36	24.0	4.0
1.001	58.29	5.47	89.323	0.025	0.0	0.0	0.0	1.36	24.0	4.0
1.002	57.36	5.69	87.585	0.106	0.0	0.0	0.0	2.14	3785.9	16.5
1.003	56.56	5.87	87.516	0.214	0.0	0.0	0.0	2.13	3769.6	32.8
1.004	57.31	5.70	87.456	0.000	2.0	0.0	0.0	1.30	23.0	2.0
1.005	56.46	5.90	84.870	0.000	2.0	0.0	0.0	1.30	23.0	2.0



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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SN1.SWS

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 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.332
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 18.700 Cv (Winter) 0.840
 Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF
 Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	2	+0%	100/240 Winter				89.677
1.001	2	15 Winter	2	+0%	100/240 Winter				89.365
1.002	3	240 Winter	2	+0%	100/120 Winter				88.110
1.003	4	240 Winter	2	+0%	100/120 Winter				88.111
1.004	5	240 Winter	2	+0%	2/15 Summer				88.111
1.005	6	15 Summer	2	+0%					84.891

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Time (mins)	Flow (l/s)		
1.000	1	-0.107	0.000	0.18		3.9	OK	
1.001	2	-0.108	0.000	0.17		3.9	OK	
1.002	3	-0.975	0.000	0.00		3.2	OK	



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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for
SN1.SWS

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)				
1.003	4	-0.905	0.000	0.00			4.5	OK	
1.004	5	0.505	0.000	0.05			1.0	SURCHARGED	
1.005	6	-0.129	0.000	0.05			1.0	OK	



File SN1 Rev C.MDX

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1.SWS

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 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.332
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 18.700 Cv (Winter) 0.840
 Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF
 Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%	100/240 Winter				89.694
1.001	2	15 Winter	30	+0%	100/240 Winter				89.383
1.002	3	360 Winter	30	+0%	100/120 Winter				88.492
1.003	4	360 Winter	30	+0%	100/120 Winter				88.492
1.004	5	360 Winter	30	+0%	2/15 Summer				88.492
1.005	6	360 Winter	30	+0%					84.893

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Time (mins)	Flow (l/s)		
1.000	1	-0.090	0.000	0.33		7.4	OK	
1.001	2	-0.090	0.000	0.33		7.4	OK	
1.002	3	-0.593	0.000	0.00		4.4	OK	



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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1.SWS

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)				
1.003	4	-0.524	0.000	0.00			5.1	OK	
1.004	5	0.886	0.000	0.05			1.2	SURCHARGED	
1.005	6	-0.127	0.000	0.06			1.2	OK	



File SN1 Rev C.MDX

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Network 2020.1.3

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1.SWS

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 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.332
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 18.700 Cv (Winter) 0.840
 Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
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 Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	480 Winter	100	+40%	100/240 Winter				90.275
1.001	2	480 Winter	100	+40%	100/240 Winter				90.280
1.002	3	480 Winter	100	+40%	100/120 Winter				90.284
1.003	4	480 Winter	100	+40%	100/120 Winter				90.283
1.004	5	480 Winter	100	+40%	2/15 Summer				90.284
1.005	6	480 Winter	100	+40%					84.900

PN	US/MH Name	Depth (m)	Surcharged Volume (m ³)	Flooded Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.491	0.000	0.08		1.8	SURCHARGED	
1.001	2	0.807	0.000	0.08		1.8	SURCHARGED	
1.002	3	1.199	0.000	0.00		6.5	SURCHARGED	



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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1.SWS

PN	US/MH Name	Surcharged Flooded		Half Drain		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Time (mins)		
1.003	4	1.267	0.000	0.00		7.2	SURCHARGED	
1.004	5	2.678	0.000	0.08		1.9	SURCHARGED	
1.005	6	-0.120	0.000	0.09		1.9	OK	



Project: Lucas Lane Drainage

Reference: 2434

Date: 2022

Infiltration Testing

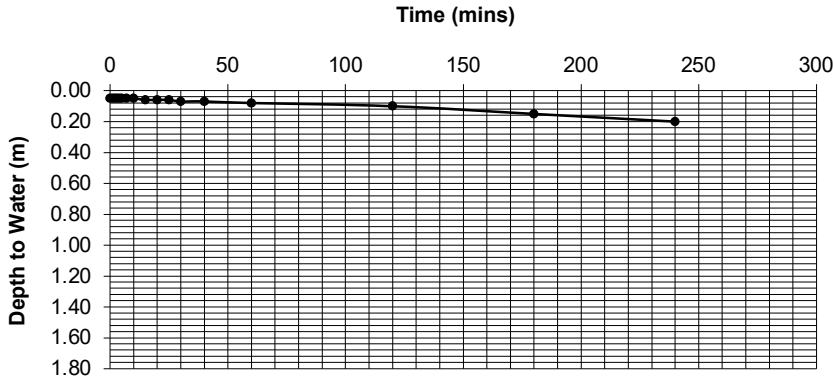
Site: LUCAS GREEN, LUCAS LANE EAST, WHITTLE-LE-WOODS, CHORLEY, PR6 7DA
 Client: FELLOWS HOMES LIMITED
 Engineer: S-MECH LTD

Job Number
7714
 Sheet:
1 / 2

SOAKAWAY TEST

Position: TP1

Test Number: 1
 Date: 14/04/23



Time (min)	Depth (m)
0	0.05
1	0.05
2	0.05
3	0.05
4	0.05
5	0.05
7	0.05
10	0.05
15	0.06
20	0.06
25	0.06
30	0.07
40	0.07
60	0.08
120	0.10
180	0.15
240	0.20

Length of pit: L = 0.40 m
 Width of pit: W = 1.40 m
 Depth of pit: D = 1.70 m
 Base area of pit: A = 0.56 m²

100% effective depth D100 = 0.05 m
 75% effective depth D75 = 0.46 m
 50% effective depth D50 = 0.88 m
 25% effective depth D25 = 1.29 m

time to D75 T75 = - sec
 time to D25 T25 = - sec

time from D75 to D25 t_{p75-25} = - sec
 (T25 - T75)

volume between D75 & D25 V_{p75-25} = 0.46 m³
 (A x (D25 - D75))

surface area to D50 inc. base a_{p50} = 3.53 m²
 ((2x(D-D50)x(W+L)) + A)

SOIL INFILTRATION RATE f = $\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

f = - m/sec

Test Strata: See trial pit logs for TP1

Remarks: Unable to calculate soil infiltration rate due to low permeability of strata.

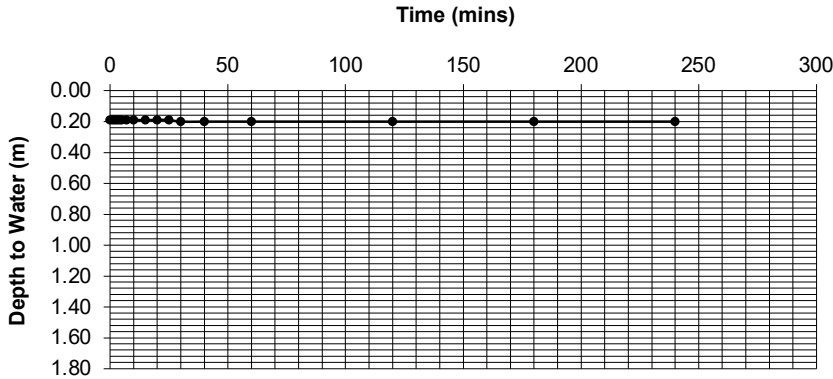
Site: LUCAS GREEN, LUCAS LANE EAST, WHITTLE-LE-WOODS, CHORLEY, PR6 7DA
 Client: FELLOWS HOMES LIMITED
 Engineer: S-MECH LTD

Job Number
7714
 Sheet:
2 / 2

SOAKAWAY TEST

Position: TP2

Test Number: 1
 Date: 14/04/23



Time (min)	Depth (m)
0	0.19
1	0.19
2	0.19
3	0.19
4	0.19
5	0.19
7	0.19
10	0.19
15	0.19
20	0.19
25	0.19
30	0.20
40	0.20
60	0.20
120	0.20
180	0.20
240	0.20

Length of pit: L = 0.40 m
 Width of pit: W = 1.40 m
 Depth of pit: D = 1.70 m
 Base area of pit: A = 0.56 m²

100% effective depth D100 = 0.19 m
 75% effective depth D75 = 0.57 m
 50% effective depth D50 = 0.95 m
 25% effective depth D25 = 1.32 m

time to D75 T75 = - sec
 time to D25 T25 = - sec

time from D75 to D25 t_{p75-25} = - sec
 (T25 - T75)

volume between D75 & D25 V_{p75-25} = 0.42 m³
 (A x (D25 - D75))

surface area to D50 inc. base a_{p50} = 3.28 m²
 ((2x(D-D50)x(W+L)) + A)

SOIL INFILTRATION RATE

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

f = - m/sec

Test Strata: See trial pit logs for TP2

Remarks: Unable to calculate soil infiltration rate due to low permeability of strata.



SUB SURFACE

SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Site

LUCAS GREEN, LUCAS LANE EAST,
WHITTLE-LE-WOODS, CHORLEY

**Trial Pit
Number
TP1**

Excavation Method

MECHANICAL EXCAVATOR

Dimensions

0.40m x 1.40m

Ground Level (mOD)

Client

FELLOWS HOMES LIMITED

**Job
Number
7714**

Location

AS PLAN

Dates

14/04/2023

Engineer

S-MECH LTD

**Sheet
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	B				(0.50)	Dark brown slightly gravelly sandy clayey SILT. Gravel is subangular fine to coarse sandstone and quartz with occasional roots and rootlets.		
0.50-0.70	B				0.50	Firm to stiff reddish brown and occasional grey mottled slightly gravelly slightly sandy silty CLAY with occasional pockets of sand and occasional rootlets. Gravel is subangular to subrounded fine to coarse sandstone, siltstone and quartz.		
1.00-1.20	B				(1.20)			
1.50-1.70	B				1.70	Complete at 1.70m		
			14/04/2023: DRY					

Plan

Remarks

Pit sides remained vertical and stable.
No groundwater encountered.
On completion backfilled with arisings.

Scale (approx)


1:25

Logged By

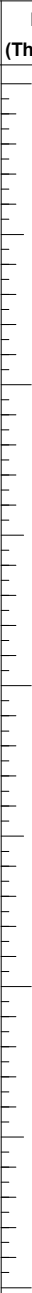
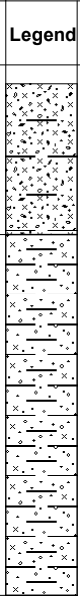
WJP/VW

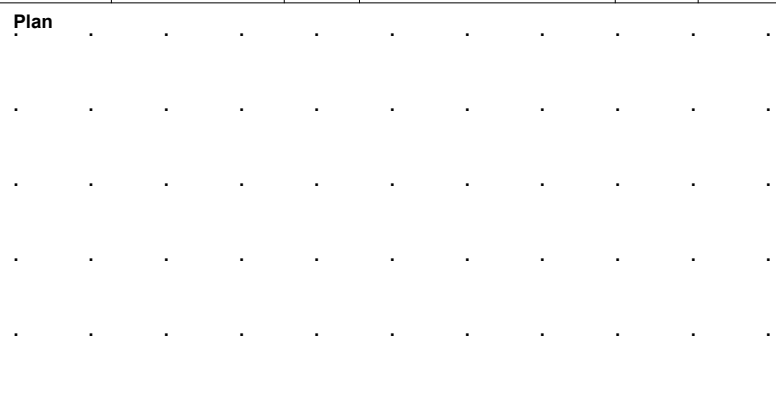
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7714.TP1

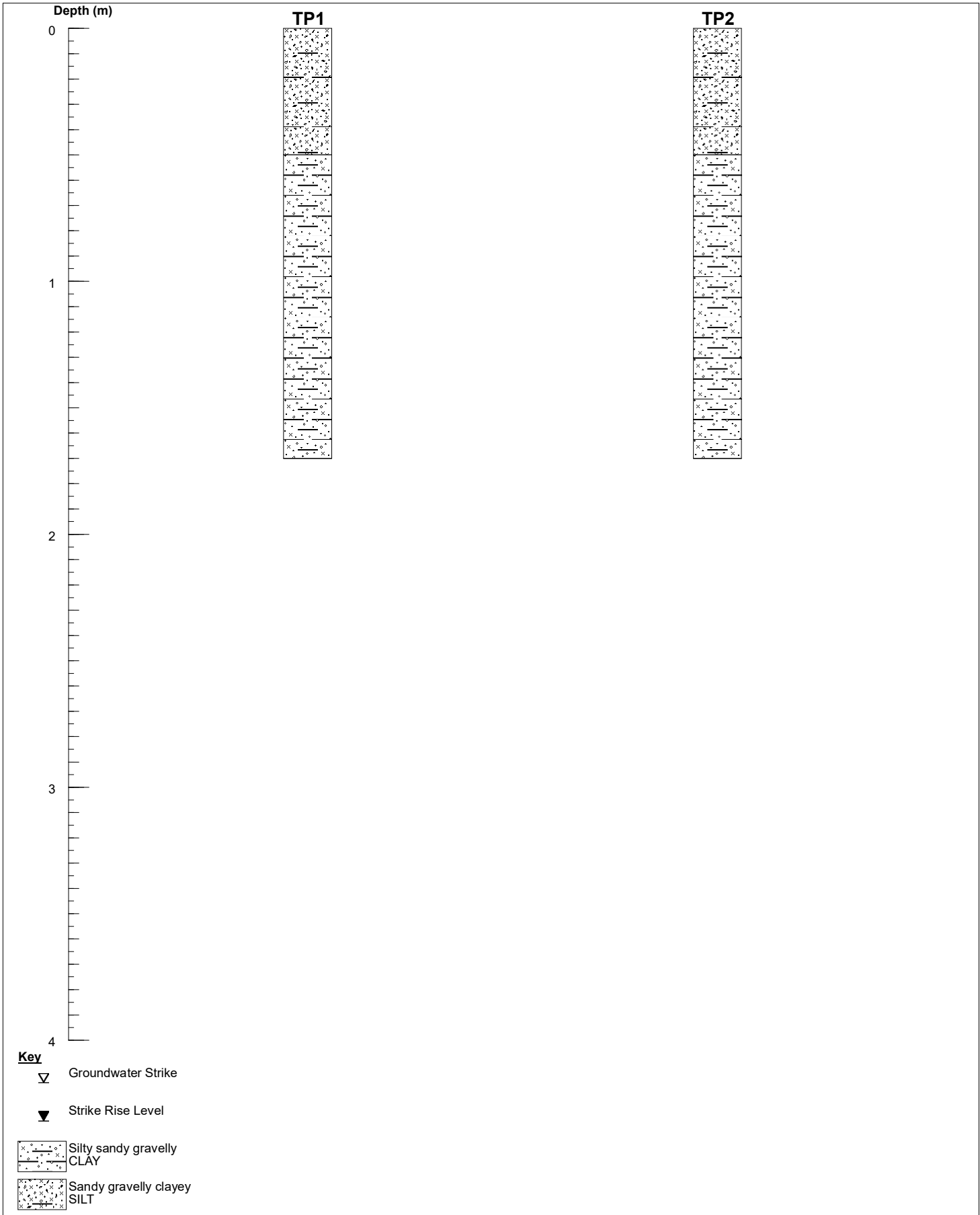
 SUB SURFACE SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS 3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907	Site LUCAS GREEN, LUCAS LANE EAST, WHITTLE-LE-WOODS, CHORLEY	Trial Pit Number TP2
	Excavation Method MECHANICAL EXCAVATOR	Dimensions 0.40m x 1.40m

Excavation Method MECHANICAL EXCAVATOR	Dimensions 0.40m x 1.40m	Ground Level (mOD)	Client FELLOWS HOMES LIMITED	Job Number 7714
	Location AS PLAN		Dates 14/04/2023	Engineer S-MECH LTD

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	B					Dark brown slightly gravelly slightly sandy clayey SILT with occasional roots and rootlets. Gravel is subangular to subrounded fine to coarse sandstone and quartz.		
0.50-0.70	B					Stiff reddish brown and occasional grey mottled slightly gravelly slightly sandy silty CLAY with occasional pockets of sand. Gravel is subangular to subrounded fine to coarse sandstone, siltstone and quartz.		
1.50-1.70	B					Complete at 1.70m		

Plan 	Remarks Pit sides remained vertical and stable. No groundwater encountered. On completion backfilled with arisings.
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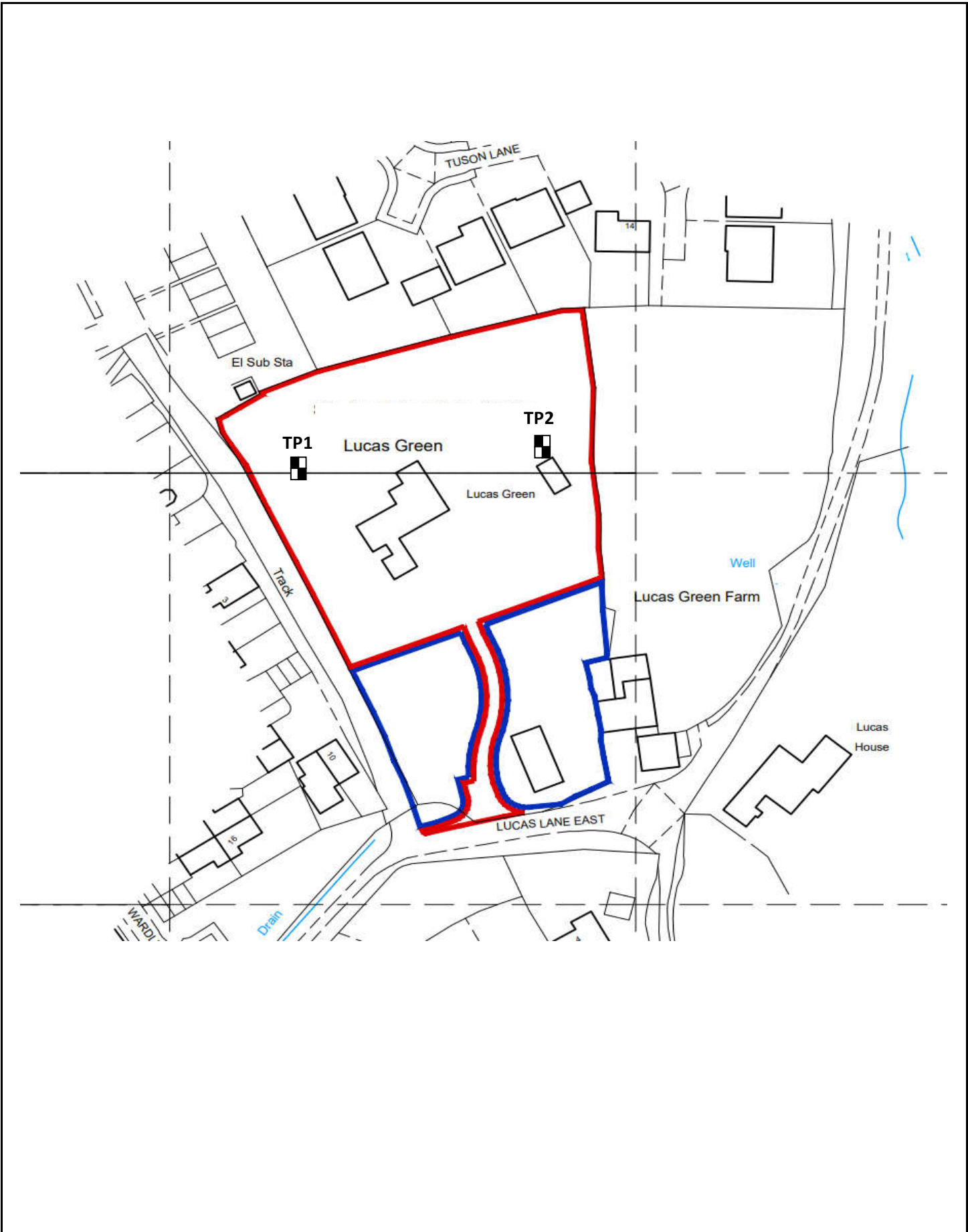
Scale (approx) 1:25	Logged By WJP/VW	Figure No. 7714.TP2
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SS SUB SURFACE
 SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS
 3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Nominal Section

Site LUCAS GREEN, LUCAS LANE EAST, WHITTLE-LE-WOODS, CHORLEY	Date Drawn 07/06/2023	Date Checked	Sheet 1/1	Job Number 7714
Client FELLOWS HOMES LIMITED	Drawn By	Checked By	Scale 1:20[V]	Figure No. 7714.1



 SUB SURFACE SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS 3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907	Trial Pit Location Plan			
	Site: LUCAS GREEN, LUCAS LANE EAST, WHITTLE-LE-WOODS, CHORLEY, PR6 7DA	Date Drawn: 19-Apr-23	Date Checked:	Orientation: 
Client: FELLOWS HOMES LIMITED	Drawn By: WJP	Checked By:	Scale: -	Figure Number: 1