GROUND ASSESSMENT REPORT
&
DRAINAGE RECOMMENDATIONS

PROPOSED 3 NEW DWELLINGHOUSES
LAND AT MILL OF KINCARDINE
FETTERCAIRN
LAURENCEKIRK
ABERDEENSHIRE
AB30 1HA

Clients:	Tulloch Farm
Architects:	A.B Roger & Young Ltd
Contract No.:	3386/23
Report Issued:	21 June 2023

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APPENDIX A

GROUND ASSESSMENT & DRAINAGE RECOMMENDATION REPORT

PROPOSED 4 NEW DWELLINGHOUSES
LAND AT MILL OF KINCARDINE
FETTERCAIRN, LAURENCEKIRK
ABERDEENSHIRE, AB30 1HA

INTRODUCTION

At the request of A.B Roger & Young Ltd on behalf of Tulloch Farm, a ground assessment investigation was undertaken on land at Mill of Kincardine, Fettercairn, north of Laurencekirk, Aberdeenshire.

It is proposed to demolish the existing redundant and storm damaged buildings and erect three new dwellinghouses on the site.

The purpose of the visit was to carry out a ground investigation to determine the nature of the materials underlying the area of the site and to undertake the following: -

- to assess the underlying ground conditions
- to carry out percolation testing to assess the suitability of the underground strata for the disposal of effluent from a sewage treatment system to the ground via a designed sub-surface soakaway system
- to carry infiltration testing for the disposal design for surface waters from the proposed development

SITE LOCATION & BRIEF DESCRIPTION

The site is located on land at Mill of Kincardine, Fettercairn, north of Laurencekirk with access off the B974 and B966 and local roads on land all under the ownership of the applicant, OS Grid Ref NO 69354 75907 (approx. centre of site), see Fig. 1. General & Site Location Plans.

The proposed development site is occupied by the existing redundant farm buildings and large areas of concrete. The site has a general fall to the south-west.

The site is serviced by, mains water, electricity and telephone. The existing cottages are served by a shared septic tank located in the garden to the south-east. There is no mains sewer available for the proposed development.

There are no known wells supplying potable water within 50m of the site. There are no watercourses within 10m of the site. The Devilly Burn flow >200m to the west of the site.

SITE WORK

Trial Pits

On the 26th May 2023, a tracked excavator with a 0.90m bucket excavated trial pits to carry out an assessment of the underlying ground conditions, to carry out infiltration testing in the areas of the potential surface water sub-surface soakaways.

The locations of the trial pits were decided on site taking into account the site topography and indicated development layout and are all indicated on Fig. 2. Test Location Plan in Appendix A.

Percolation Testing

Percolation testing was carried out in test holes adjacent to observation trial pits TP1 & TP3 and TP4 in accordance with Section 3.9 of the Scottish Building Standards Technical Handbook (Domestic) and SEPA CAR Regulations. The test results are shown on the following table: -

Date of Testing 26/5/22	TP1	TP3
Average time taken for water to drain 3 times in each sump hole (middle 150mm)	2445	1800
Depth of Water Table below Ground Level (m)	> 2.50	
Soil Percolation Values, Vp, s/mm	**16.3**	**12.0**

Infiltration Testing

Infiltration tests were carried out in trial pits TP2 & TP4 in accordance with BRE Digest 365. The test results are tabulated below: -

Trial Pit No.	**Pit Dimensions (W x L)m**	**Test Zone (mbegl)**	**In-Fill**	**Soil Infiltration Rate, *f* (m/s)**
TP2	0.90 x 1.80	1.00 – 2.00	Open	**8.37×10^{-5}**
TP4	0.90 2.00	1.00-2.00		**2.77×10^{-4}**

GROUND ASSESSMENT

Published Geology

The British Geological Survey 1:50,000 Quaternary and Solid maps indicate that the site is overlain by Drumlithie Sand and Gravel Formation – sand and gravel. Sedimentary superficial deposits formed between 116 and 11.8 thousand years ago in the Quaternary Period. The site is underlain by Teith Sandstone Formation – sandstone. Sedimentary bedrock formed between 407.6 and 393.3 million years ago in the Devonian Period.

Encountered Ground Conditions

Made Ground and Topsoil: The majority of the site is overlain by made ground, 250-600mm in thickness consisting of reworked topsoils and compacted gravels. Topsoil was encountered beneath the made ground, 300-600mm in thickness to approximately 1.20m below ground level. Only TP4 was overlain by topsoil 350mm in thickness.

Natural Sub-Soils: The natural underlying sub-soils have an upper mantle of loose to medium dense red brown silty sand and gravel becoming medium dense red brown sand and gravel with rounded cobbles below 1.50m and proved to the maximum investigated depth of 2.50m.

Bedrock: Bedrock was not encountered during this investigation.

Groundwater Observations

No groundwater ingress was encountered during the investigation. There were no visual (no seepages or discoloration) indications of the seasonally high or fluctuating ground water table seen in the strata above 2.50m.

DISCUSSION

Sub-Soils
The sandy gravelly nature of the underlying sub-soils and the results from the percolation and infiltration testing confirmed the well to moderate draining properties of the sub-soils.

Sewage Treatment
The soil percolation values are in the range 12-16.3 s/mm and therefore it is required to provide secondary treatment prior to discharge.

A PSTP with a minimum 3,750-litre capacity is required for each 4-bedroom house with a population, PE = 6.

Foul Water Discharge
A sub-surface stone-filled soakaway (infiltration system) is considered suitable for the discharge of foul waters from a PSTP directly to the ground. The soakaway should comply with the Domestic Technical Handbook (para. 3.9.2) which sets out guidance on design in accordance with the requirements of SEPA Regulatory Method (WAT-RM-04) Indirect Sewage Discharges to Groundwater.

SuDS & Surface Water Disposal
The disposal of surface waters from the development needs to be assessed in terms of both the quantity and the quality of the discharge for Building Regulations and SEPA.

It is proposed to install a surface water infiltration trench for disposal to the ground. Using the SIA tool, the land use run-off quality has been determined, see following summary table: -

Land Use Type	**Residential Roofing**	**Residential Parking & Driveway**
Pollution Hazard Level	**Very Low**	**Low**
Pollution Hazard Indices		
TSS	0.2	0.5
Metals	0.2	0.4
Hydrocarbons	0.05	0.4
SuDS Component Proposed		
Component 1	**None (not discharging to watercourse)**	
Groundwater Protection Type	**Infiltration Trench** **Additional Silt Traps for access road and parking areas for TSS - Minimum 300mm permeable gravel finish**	
Pollution Mitigation Indices		
TSS	0.4	0.4
Metals	0.4	0.4
Hydrocarbons	0.4	0.4
Combined Pollution Mitigation Indices		
TSS	0.4	0.4
Metals	0.4	0.4
Hydrocarbons	0.4	0.4
Acceptability of Pollution Mitigation		
TSS	**Sufficient**	**Sufficient**
Metals	**Sufficient**	**Sufficient**
Hydrocarbons	**Sufficient**	**Sufficient**

The SIA assessment confirms that the installation of infiltration trenches provides sufficient mitigation for the surface water run-off from the roof areas and access roads and permeable driveways/parking areas for the proposed development prior to disposal to the ground.

The designed and installed infiltrations are considered to be suitable for all weather conditions and not detrimental to the water environment and private water supplies.

DRAINAGE RECOMMENDATIONS

Foul Water Discharge

To comply with the Domestic Technical Handbook (para. 3.9.2) which sets out guidance on how proposals may meet the Building Standards set out in the Building (Scotland) Regulations 2004, an infiltration system must be designed and constructed in accordance with the requirements of SEPA.

Where the average soil percolation value, Vp is between 15-120 s/mm in accordance with the regulations the minimum base area, A, is derived from ***A = Vp x PE x 0.25 , or a minimum base area of 25m^2,*** see the following table: -

Proposed Development	**Population Equivalent, PE** (as defined in BW COP:18.11/14)	**Min. Base Area (m^2) Using a PSTP only**
Each New Dwellinghouse	**6** (4-bedroom)	**25**

Full details of the proposed sewage treatment system will be made available to the Building Standards Officer once it has been determined after consultation with suppliers which models are the most suitable for the proposed development and the potential population equivalent of the dwellinghouse.

SEPA

The final installed sewage treatment system and discharge will require to be registered with SEPA under CAR.

Surface Water Disposal

The sizes of the proposed surface water infiltration trench systems are based on the impermeable surface areas of the development i.e., the house roof, access road and driveways areas.

Using the lowest soil infiltration rate the calculated optimum dimensions for the surface water infiltration trenches are shown on the following table: -

Stone-Filled Infiltration Trench

Impermeable Areas (m²)	**Length (m)**	**Width (m)**	**Storage depth (m)**	**Half Empty Time (hrs)**
Each New Dwellinghouse & Garage Roof Areas up to **200m²**	**1.00** 2.00 3.00 **4.00**	**16.20** 9.60 6.60 **5.00**	1.70	0.47 0.82 1.03 1.10

These dimensions are based on a 1 in 200-year storm event with +Climate Change Peak Rainfall Intensity Allowance of +39% for the Tay Region of Scotland and out in accordance with BRE Digest 365.

Proposed Drainage
The proposed drainage layout is shown on Fig 3. with indicative soakaway installation shown on Figs. 4 and 5 along with certificates all in Appendix A.

SYSTEM MAINTENANCE

Soakaways
The soakaways are designed for the life time of the proposed development if they are not allowed to silt up nor the pipework to be blocked.

If a soakaway fails to due blockages or silting it should be excavated and reconstructed with fresh clean stone, new pipework and renewed terram.

During the development of the site, and the excavation of the soakaways, should any field drains be found within 10m of the soakaway they should be realigned or relocated accordingly.

REGULATIONS

SEPA and Building Regulations require that infiltration systems (soakaways) are located at least: -

- 50m from any spring, well or borehole used as drinking water supply
- 10m horizontally from any water course (including any inland or coastal waters), permeable drain (including culvert), road or railway
- 5m from all buildings
- 5m from boundaries *(reduced distance to boundaries may also be subject to agreement from adjacent land owners where the soakaway is considered not to be detrimental to the adjacent property)*

FOUNDATION RECOMMENDATIONS

Safe Bearing Capacity
It is recommended that the foundations should be taken down through the topsoil and any made or disturbed ground rest on the medium dense sands and gravels at a minimum depth of below 0.60m, allowing for frost cover, below existing ground levels.

A safe bearing capacity of 130kN/m^2 can be applied for foundation design.

Excavations
Due to the depth of the topsoil some excavation and replacement with suitable compacted up-fill may be required to form the foundations.

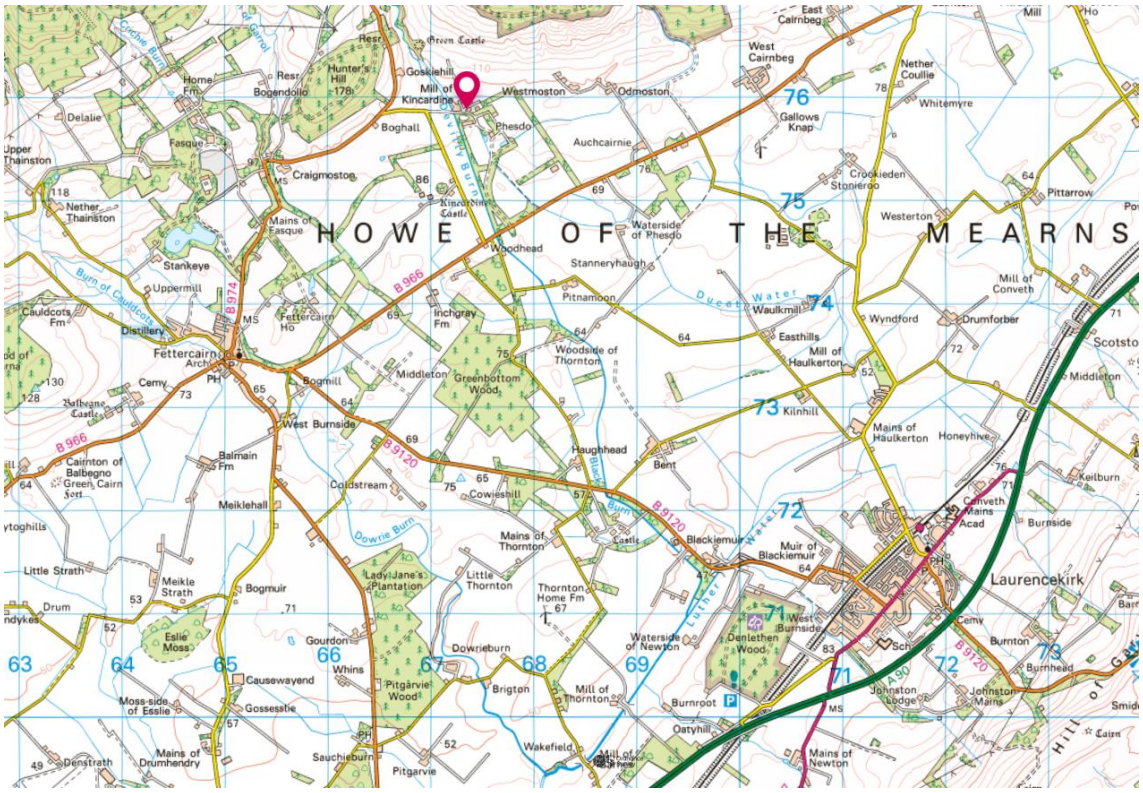
Settlement
It is considered that the generally granular nature of the sub-soils will provide settlement within tolerable design limits.

De-Watering
It is not anticipated that de-watering of excavations will be required during construction.

APPENDIX A

Site Plans	Fig. 1. General & Site Location Plans
	Fig. 2. Test Location Plan
Trial Pit Logs	TP 1-4
Drainage	Fig. 3. Proposed Drainage Layout
	Fig. 4. Indicative Foul Water Soakaway Construction
	Fig. 5. Indicative Storm Cell Installation
Certificate	Foul Water Discharges
	Surface Water Disposal

Fig. 1. GENERAL & SITE LOCATION PLANS



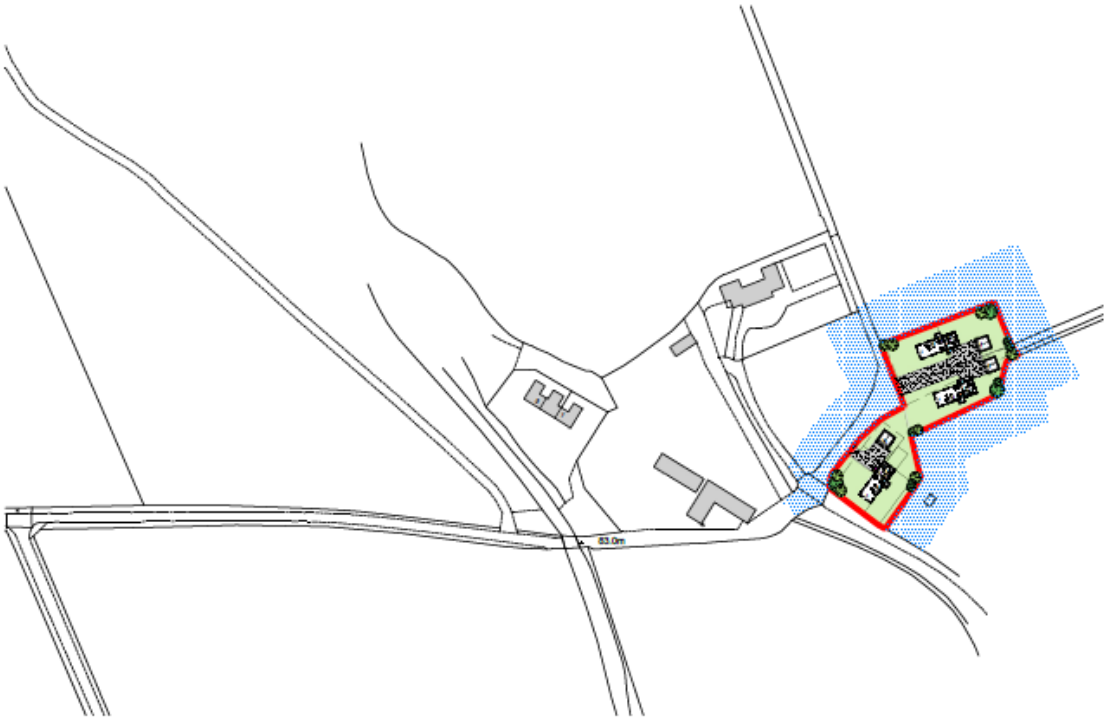


Fig. 2. TEST LOCATION PLAN

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GEOTECHNICAL & ENVIRONMENTAL ONSITE SERVICES

Excavation Method Tracked excavator with 0.90m bucket	**Dimensions** 0.90 x 2.00	**Ground Level (mOD)**	**Site** Mill of Kincardine, Fettercairn
	Location	**Dates** 26/05/2023	**Client** Tulloch Farms
			Architect A.B Roger & Young

Trial Pit Number TP1

Job Number 3386/23

Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	MADE GROUND - reworked topsoil		
					0.60			
					(0.60)	Original TOPSOIL		
1.20-1.65	SPT(C) N=20		4,4/4,5,5,6		1.20			
					(0.30)	Loose grey silty clayey SAND and GRAVEL		
			Percolation testing at 1.50m		1.50			
					(1.00)	Medium dense pink, orange brown slightly silty SAND and GRAVEL with rounded cobbles		
			No groundwater ingress		2.50	Complete at 2.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:20	SAM	3386/23.TP1

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GEOTECHNICAL & ENVIRONMENTAL ONSITE SERVICES

Excavation Method Tracked excavator with 0.90m bucket	**Dimensions** 0.90 x 1.80	**Ground Level (mOD)**	**Site** Mill of Kincardine, Fettercairn
	Location	**Dates** 26/05/2023	**Client** Tulloch Farms
			Architect A.B Roger & Young

Trial Pit Number TP2

Job Number 3386/23

Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND - compacted gravels		
					0.30	TOPSOIL		
					(0.30)			
					0.60	Medium dense red brown silty SAND and GRAVEL with occasional cobbles		
0.70-1.15	SPT(C) N=19		3,4/4,5,5,5					
			Infiltration test zone 1.00-2.00					
					(1.40)			
						...Less sitly more cobbly below 1.50m		
			No groundwater ingress		2.00	Complete at 2.00m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:20	SAM	3386/23.TP2

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Site Mill of Kincardine, Fettercairn			**Trial Pit Number** TP3
Excavation Method Tracked excavator with 0.90m bucket	**Dimensions** 0.90 x 1.90	**Ground Level (mOD)**	**Client** Tulloch Farms	**Job Number** 3386/23
	Location	**Dates** 26/05/2023	**Architect** A.B Roger & Young	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25) 0.25	MADE GROUND - compacted gravels		
					(0.35) 0.60	Loose red brown grey silty SAND and GRAVEL		
0.60-1.05	SPT(C) N=20		5,5/5,5,5,5			Medium dense red brown SAND and GRAVEL		
			Percolation testing at 1.00m			...Less sandy and very cobbly below 1.20m		
					(1.40) 2.00			
			No groundwater ingress			Complete at 2.00m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:20	SAM	3386/23.TP3

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GEOTECHNICAL & ENVIRONMENTAL ONSITE SERVICES

Site Mill of Kincardine, Fettercairn			**Trial Pit Number** TP4
Excavation Method Tracked excavator with 0.90m bucket	**Dimensions** 0.90 x 2.00	**Ground Level (mOD)**	**Client** Tulloch Farms	**Job Number** 3386/23
	Location	**Dates** 26/05/2023	**Architect** A.B Roger & Young	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.35) 0.35	TOPSOIL		
						Medium dense dark orange brown very silty SAND and GRAVEL with some cobbles		
0.60-1.05	SPT(C) N=21		4,5/4,6,5,6		(0.60) 0.95			
			Infiltration test zone 1.00-2.00m			Medium dense red brown SAND and GRAVEL with many rounded cobbles		
					(1.05)	...Becoming less sandy below 1.50m		
			No groundwater ingress		2.00	Complete at 2.00m		

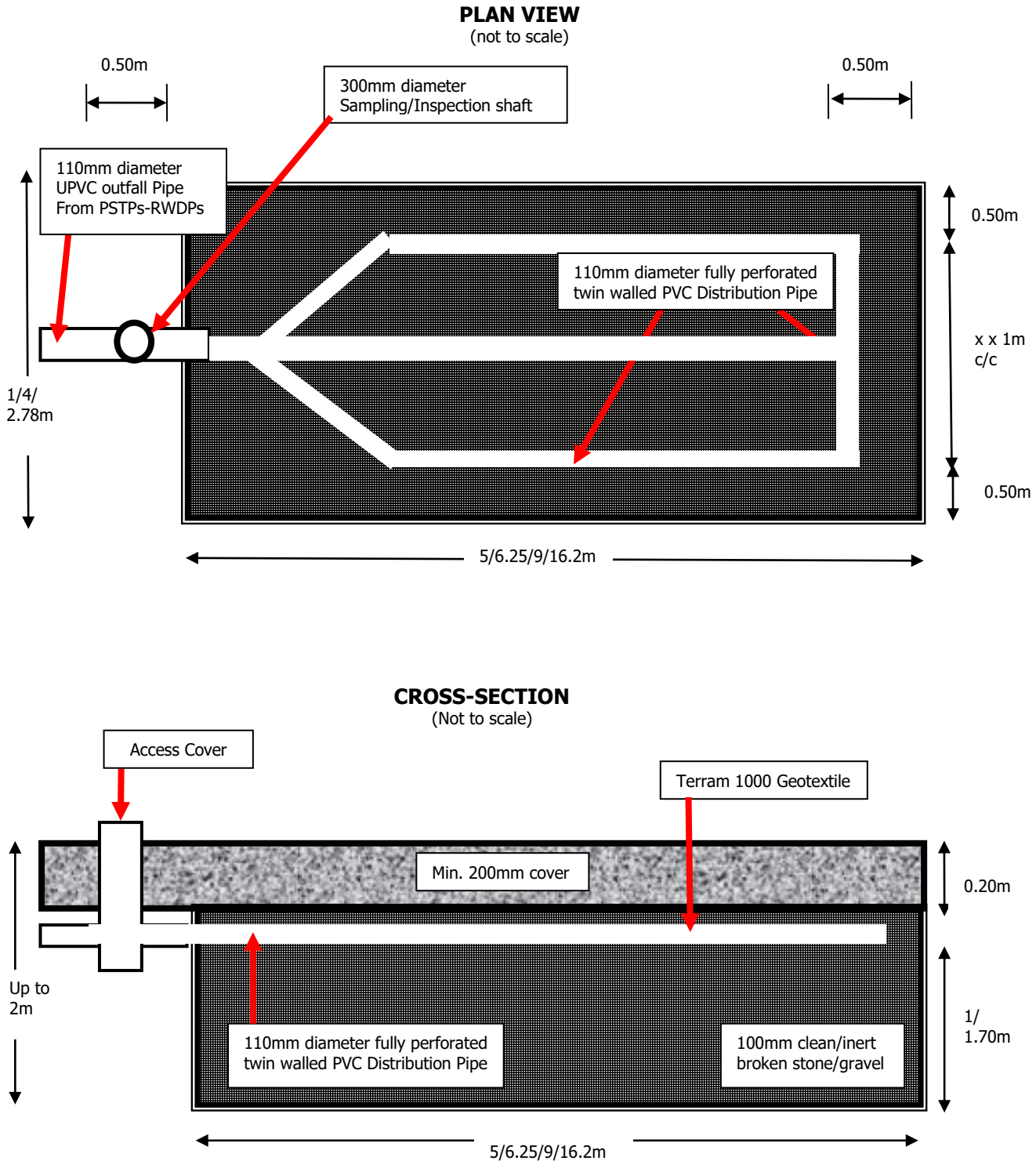
Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:20	SAM	3386/23.TP4

Fig. 3. PROPOSED DRAINAGE LAYOUT

Fig. 4. INDICATIVE CONSTRUCTION (sketch only, not to scale)



CERTIFICATE FOR PROPOSED FOUL WATER SUB-SURFACE DISCHARGE

Two tests are normally required to demonstrate the suitability of the proposed drainage scheme:

1. A trial pit must be excavated to a depth of 1 metre below the proposed invert of the drain to establish whether the water table will interfere with the operation of the soakaway

and

2. A percolation test must be carried out to determine the area of the ground required.

Applicants: Tulloch Farm

Address: A.B Roger & Young Ltd

Site Address: Mill of Kincardine, Fettercairn, Laurencekirk, Aberdeenshire, AB30 1HA

Date of Test: 26th May 2023 **Time:** from 10am **Weather:** Dry and sunny

Encountered Ground Conditions

Made Ground and Topsoil: The majority of the site is overlain by made ground, 250-600mm in thickness consisting of reworked topsoils and compacted gravels. Topsoil was encountered beneath the made ground, 300-600mm in thickness to approximately 1.20m below ground level. Only TP4 was overlain by topsoil 350mm in thickness.

Natural Sub-Soils: The natural underlying sub-soils have an upper mantle of loose to medium dense red brown silty sand and gravel becoming medium dense red brown sand and gravel with rounded cobbles below 1.50m and proved to the maximum investigated depth of 2.50m.

Bedrock: Bedrock was not encountered during this investigation.

Groundwater Observations

No groundwater ingress was encountered during the investigation. There were no visual (no seepages or discoloration) indications of the seasonally high or fluctuating ground water table seen in the strata above 2.50m.

Wells: no known wells used for supply of potable water within 50m of site.

Percolation Tests

Development	**TP1**	**TP3**
Average time taken, seconds	2445	1800
Soil Percolation Values, Vp, s/mm	>2.50	
Population Equivalent, PE	**6 (All 4-bedroom)**	
Minimum Soakaway Base Area m^2	**25**	

*** secondary treatment (PSTP) recommended**

I hereby certify that I have carried out the above assessment in accordance with procedures specified within the Domestic Scottish Building Standards Technical Handbook (Environmental Standard 3.9 Infiltration Systems) and SEPA A WAT-RM-04, the results of which are tabulated above, and that the proposed drainage scheme detailed on the attached plans and report has been designed considering the recommendations in the standards and regulatory standards.

Signed … [redacted] …… Date…21 June 2023

Name / Company S. A. McGregor

Address Serenje, Kingsford Steadings, Alford, Aberdeenshire, AB33 8HN

Qualification B.Eng (Civil Engineering).

CERTIFICATE FOR PROPOSED SURFACE WATER DISPOSAL

Applicants: Tulloch Farm

Address: A.B Roger & Young Ltd

Site Address: Mill of Kincardine, Fettercairn, Laurencekirk, Aberdeenshire, AB30 1HA

Date of Test: 26th May 2023 **Time:** from 10am **Weather:** Dry and sunny

Encountered Ground Conditions

Made Ground and Topsoil: The majority of the site is overlain by made ground, 250-600mm in thickness consisting of reworked topsoils and compacted gravels. Topsoil was encountered beneath the made ground, 300-600mm in thickness to approximately 1.20m below ground level. Only TP4 was overlain by topsoil 350mm in thickness.
Natural Sub-Soils: The natural underlying sub-soils have an upper mantle of loose to medium dense red brown silty sand and gravel becoming medium dense red brown sand and gravel with rounded cobbles below 1.50m and proved to the maximum investigated depth of 2.50m.
Bedrock: Bedrock was not encountered during this investigation.

Groundwater Observations

No groundwater ingress was encountered during the investigation. There were no visual (no seepages or discoloration) indications of the seasonally high or fluctuating ground water table seen in the strata above 2.50m.

Wells: no known wells used for supply of potable water within 50m of site.

Infiltration Test	**TP2**	**TP4**
Infiltration Test Zone (m)	1.00-2.00	1.00-2.00
Soil Infiltration Rate, *f* (m/s)	8.37×10^{-5}	2.77×10^{-4}
Surface Area of Development	up to **200m²**	

Recommendation: -

Surface Water Infiltration Trenches

Plot 1 – 4m x 5m)
) each with 1.70m storage depth
Plots 2 and 3 – 1m x 16m)

I hereby certify that I have carried out the above tests and calculations in accordance with BRE Digest 365 and in conjunction with the full requirements set out within the Domestic Scottish Building Standards Technical Handbook. The results of which are tabulated above, and that the proposed drainage scheme detailed within this report has been designed considering the recommendations in the standards.

Signed [redacted] Date…21 June 2023
Name / Company S. A. McGregor
Address Serenje, Kingsford Steadings, Alford, Aberdeenshire, AB33 8HN
Qualification B.Eng (Civil Engineering).