

S.A. MCGREGOR



GROUND ASSESSMENT
&
DRAINAGE RECOMMENDATION REPORT

PROPOSED NEW DWELLINGHOUSE
CROSSPOLES
NORTHWATER BRIDGE
LAURENCEKIRK
ABERDEENSHIRE
AB30 1PQ

Client:

High Avon Developments

Agents:

A B Roger & Young Ltd.
Brechin

Contract No:

2884/21

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&
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NORTHWATER BRIDGE
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AB30 1PQ

INTRODUCTION

At the request of the Architects A B Roger and Young Ltd., on behalf of High Avon Developments this report is presented for the new planning application on the site.

The original ground assessment was undertaken by S A McGregor in August 2021. There have been no changes to the site that would affect the following ground assessment and drainage design.

It is proposed to erect a new dwellinghouse on the site.

The ground investigation determined the nature of the materials underlying the site and undertook the following: -

Percolation Testing to assess the suitability of the underground strata for the disposal of effluent from the septic tank to the ground via a designed sub-surface soakaway system.

Infiltration Testing for rain/surface-water disposal system design.

Assessment of the safe bearing capacity of the sub-soils for foundation design.

SITE LOCATION & BRIEF DESCRIPTION

The proposed development site is located on land at adjacent to Kirk House, Crosspoles, south-west of Laurencekirk access off the A90, OS NGR NO 67082 67657, see Fig. 1. General & Site Location Plans.

The site is unoccupied, except for a garage in the northern corner. The remainder of the site is unoccupied and overlain by rough vegetation. The site is generally level with the access road forming the western boundary.

The site is currently un-serviced however electricity, mains water and telephone are nearby; there is no mains drainage; all nearby properties are served by private sewage treatment systems.

There are no known wells within 50m of the site.

There are no watercourses within 10m of the site. A surface water drain is located at the southern corner of the site connected to further surface water drains join the Burn of Balmakelly to the south.

SITE WORK

Trial Pits

On the 31st August 2021 a tracked excavator with a 0.60m bucket excavated trial pits to order to assess the underlying ground conditions and to carry out percolation and infiltration testing in the areas of the potential foul water and the surface water sub-surface soakaways.

The locations of the trial pits are indicated on Fig. 2. Trial Pit & Test Location Plan in Appendix A.

Percolation Testing

Percolation testing was carried out in test holes adjacent to observation trial pits TP1 (FW1 and FW2) in accordance with Section 3.9 of the Scottish Building Standards Technical Handbook (Domestic) and SEPA WAT-RM-04. The test results are shown on the following table: -

Date of Testing 31/08/21	FW1 Sub-soil	FW2 Topsoil
Average time taken for water to drain 3 times in each sump hole (middle 150mm)	>18000	3450
Depth of Water Table below Ground Level (m)	>2.40m	
Soil Percolation Values, Vp, s/mm	>120	23.0

Infiltration Testing

Infiltration tests were carried out in trial pit TP2 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	0.60 – 1.20	1.20 – 2.20	Open	2.77×10^{-6}

GROUND ASSESSMENT

Published Geology

The British Geological Survey 1:50,000 Quaternary and Solid maps indicate that the site is overlain by Till Devensian (Diamicton) Superficial deposits formed up to 2 million years ago in the Quaternary Period. The site is underlain by Cromlix Mudstone Formation (Mudstone) Sedimentary bedrock formed approximately 393 to 408 million years ago in the Devonian Period.

Encountered Ground Conditions

Topsoil: Overlain by 260-300mm of topsoil.

Natural Sub-Soils: The sub-soils have an upper mantle of stiff orange brown sandy, gravelly clay with some cobbles becoming stiff to hard dark red brown slightly gravelly clay with many cobbles and some boulder below 1.10m and proved to the maximum investigated depth of 2.40m.

Bedrock: Bedrock was not encountered during this investigation.

Groundwater Observations

Groundwater was not encountered during the investigation nor observed during the monitoring period. No visual (no seepages or discoloration) indication of the seasonally high or fluctuating ground water table was seen in the strata above the encountered depths of 2.40m.

DISCUSSION

Sub-Soils

The clayey nature of the sub-soils and the water ingress confirmed the very poor drainage properties of the underlying sub-soils.

The investigation carried out concludes that the underlying strata are not considered suitable for the construction of a 'standard' sub-surface stone-filled soakaway system for the discharge of foul waters from a septic tank or treatment plant.

Topsoil Percolation Testing

Further percolation testing was carried out in the topsoil to ascertain its suitability for an alternative discharge system.

The topsoil percolation has an average $V_p = 23s/mm$.

The alternatively and appropriately designed and constructed discharge system should be designed which will be effective in all-weather conditions and are not pose a risk to local water supplies and the ground water.

DRAINAGE RECOMMENDATIONS

Foul Water Discharge

PSTP to a 'Puraflo Treatment Systems' and Discharge to the Ground

The 'Puraflo Wastewater Treatment System' is an extremely effective, cost-efficient system that uses bio-fibrous peat, housed in modules to treat wastewater which sit above a soakaway in the topsoil strata and has been developed where the ground conditions present the following problems:

Sub-Soil Percolation Value is very poor, i.e. $V_p > 120s/mm$.

High Ground water table i.e. $<2.00m$ begl.

Shallow depth to bedrock i.e. $<2.0m$ begl.

This system has been widely used under these circumstances and is generally acceptable with Building Standards Officers in many regions and with SEPA. This system is also easier to maintain and service.

The average topsoil percolation value, $V_p = 23s/mm$. Therefore, in accordance with the regulations the minimum base area, A, for the soakaway located directly below the modules is derived from $A = V_p \times PE \times 0.25$, see the following table: -

Proposed Development	Population Equivalent (as defined in BW COP:18.11/14)	Soakaway Min. Base Area (m ²) With PSTP + Puraflo Modules
New Dwellinghouse	5 (3-bedroom)	28.8

SEPA

The following table indicates the required treatment standard for the discharge from the treatment system prior to discharge: -

	BOD (mg/l)	SS (mg/l)	NH4-N (mg/l)
Treatment / Standard Required by SEPA	20	30	≤5

It is recommended to install a package sewage treatment plant (PSTP) tested and certified to EN12566 Part 3. It is recommended that for up to a 3-bedroom dwelling house package sewage treatment plant (PSTP) with a minimum capacity of 3,000-litres is installed.

SuDS & Surface Water Disposal

The disposal of surface waters from the dwellinghouse needs to be assessed in terms of both the quantity and the quality of the discharge for Building Regulations and SEPA. Using the SIA tool, the land use run-off quality has been determined as 'Very Low', see following table: -

Land Use Type	Residential Roofing (& permeable gravel hardstanding)
Pollution Hazard Level	Very Low
Pollution Hazard Indices	TSS 0.2 Metals 0.2 Hydrocarbons 0.05
Surface Water Protection (SuDS) 1 Component	Filter Drain (discharge to waterbody)
SuDS Pollution Mitigation Indices	TSS 0.4 Metals 0.4 Hydrocarbons 0.4
Groundwater Protection Type	No discharge to ground
Combined Pollution Mitigation Indices	TSS 0.4 Metals 0.4 Hydrocarbons 0.4
Acceptability of Pollution Mitigation	TSS Sufficient Metals Sufficient Hydrocarbons Sufficient

The assessment carried out concludes that the development is suitable for discharge of the surface waters from the dwellinghouse to the surface water drain.

Surface Water Disposal

The quantity of the discharge must also be controlled to ensure that the proposed development does not increase the pre-development flow of the watercourse.

The size of the proposed filter drain prior to discharge to the surface water drain is based on the impermeable surface area of the development i.e. the roof areas of the new house, see table below: -

Impermeable Area (m ²)	Filter Drain Width x Length (m)	Discharge
New House Roof Areas Up to 220m ²	1.50 x 14.00 With 500mm filter stone	100mm diameter outlet drain to the watercourse.

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

Proposed Drainage

The proposed drainage layout is shown on Fig 3. with indicative drainage installations shown on Figs. 4 and 5. Flowed by the discharge certificates all in Appendix A.

SYSTEM MAINTENANCE

Sewage Treatment System

The sewage treatment system should be fully maintained in accordance with the manufacturer's literature, should be regularly inspected by the house owner and 'desludged' (emptied) when appropriate to ensure solids and silts do not 'clog' the soakaway.

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.

Silt traps should be installed before surface waters enter the soakaway where there are large paved/tarmac covered impermeable areas. The silt traps should be regularly inspected and emptied. 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 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 a building
- 5m from a boundary (*unless the adjacent land owner under certain circumstances may legally agree to the soakaway being within 5m if it is not detrimental to the neighbouring property*)

FOUNDATION RECOMMENDATIONS

Safe Bearing Capacity

All footing excavations should be taken down through the topsoil with footings resting on the natural underlying stiff clays which have a safe bearing capacity of 150kN/m² for foundation design of standard 600mm strip footings.

Excavations

Due to the clayey nature of the sub-soils all excavations, if left exposed, should be protected by a blinding layer to maintain the soils strength.

Settlement

It is considered that the generally stiff nature of the sub-soils will result in settlement within tolerable design limits.

De-Watering

It is not anticipated that de-watering will be required during excavation works.

APPENDIX A

Site Plans	Fig. 1. General & Site Location Plans Fig. 2. Trial Pit & Test Location Plan
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Fig. 1. GENERAL & SITE LOCATION PLANS

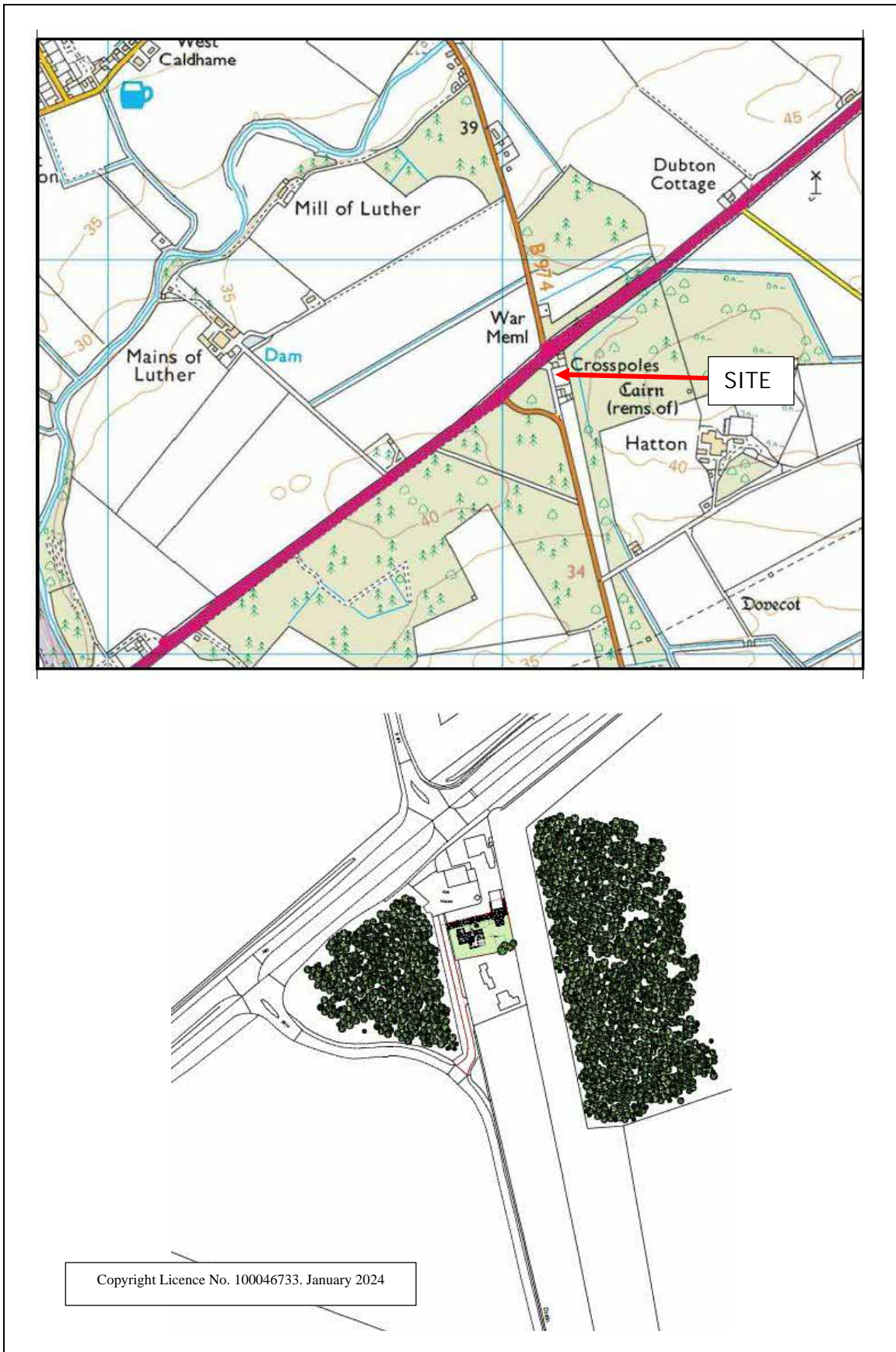
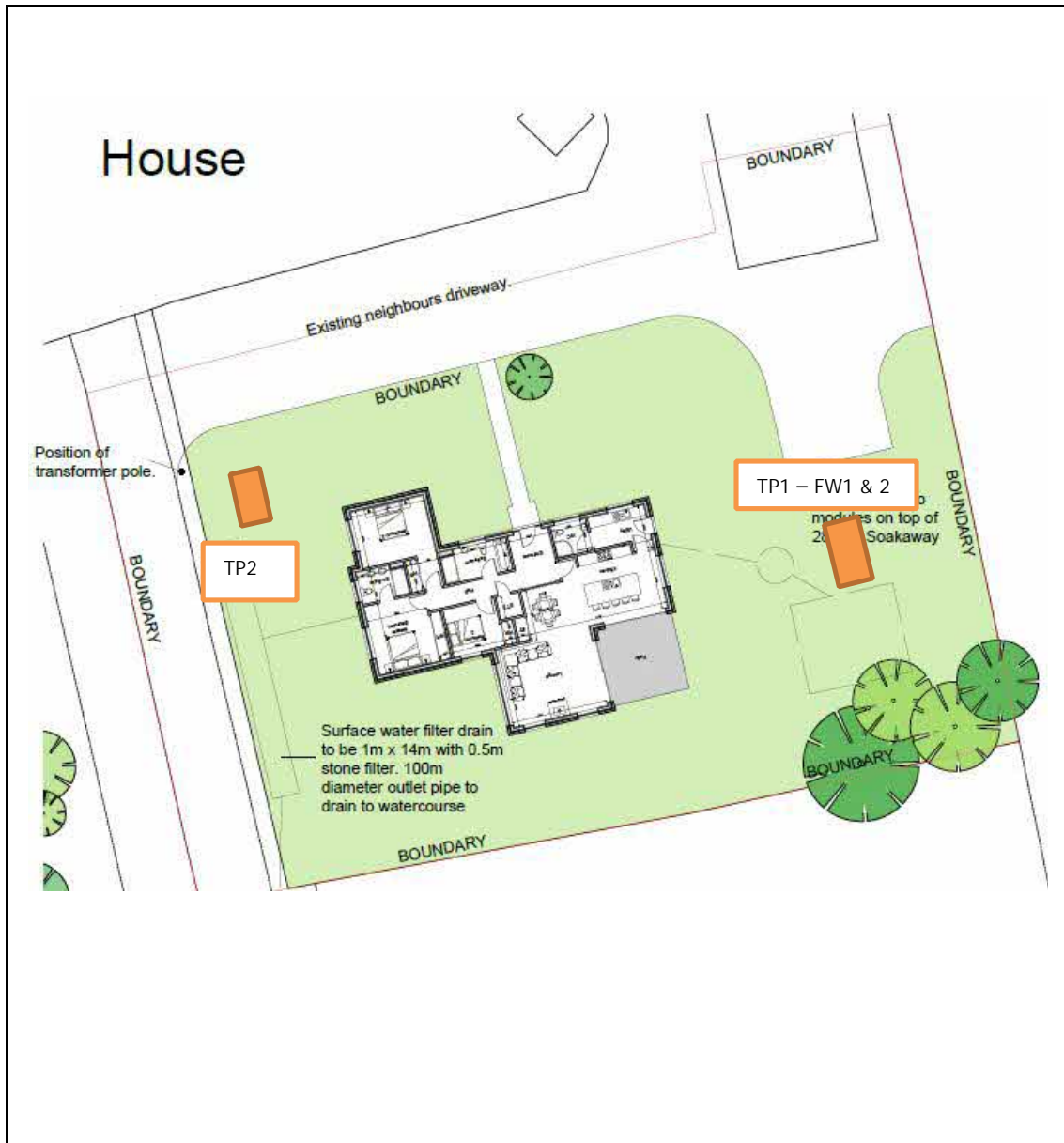






Fig. 2. TRIAL PIT & TEST LOCATION PLAN



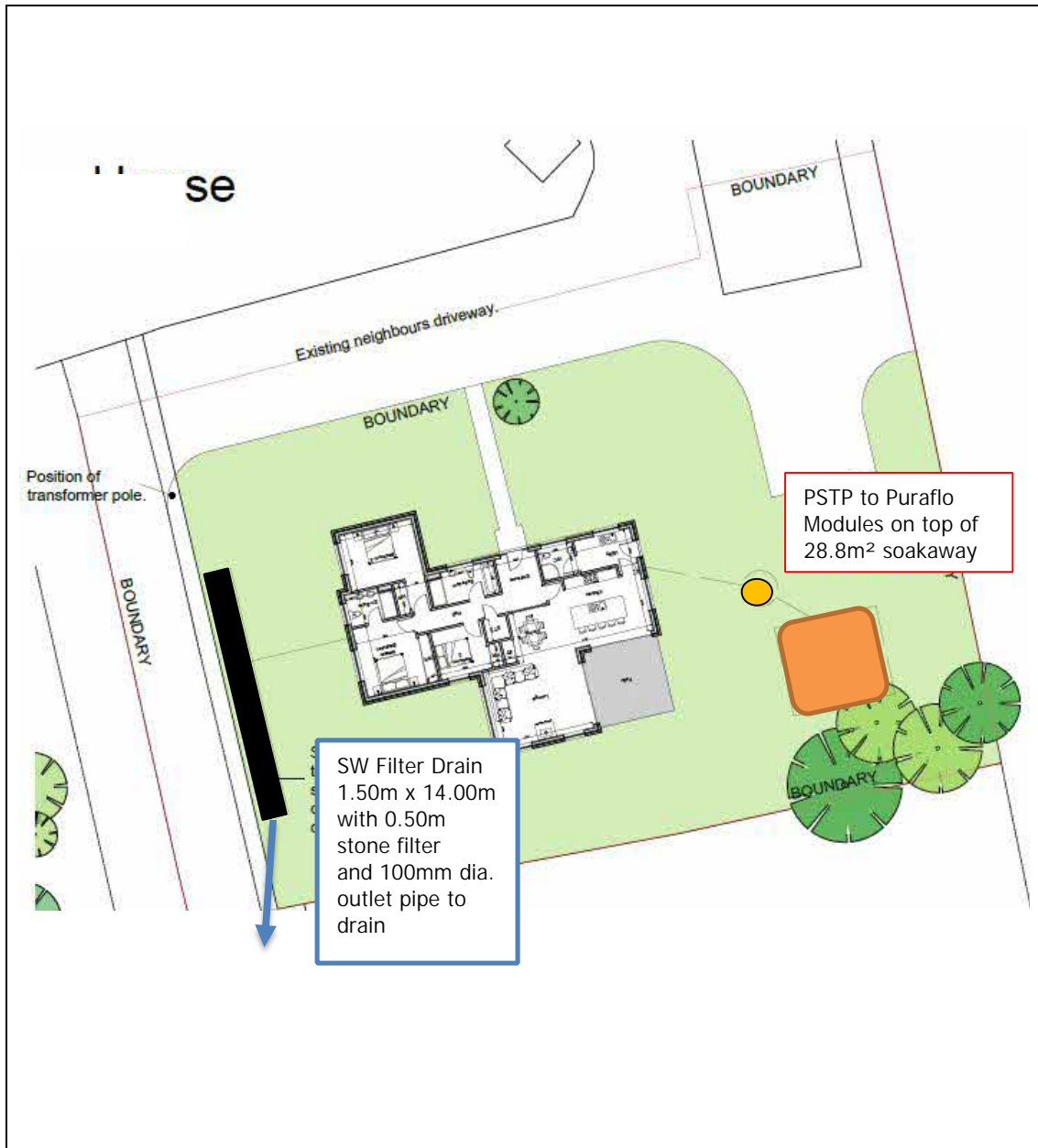
Depth (m)		Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				Percolation testing at 1.00m		(0.26)	TOPSOIL		
						0.26	Stiff orange brown sandy, gravelly CLAY with some cobbles		
						(0.84)			
				No Groundwater ingress		1.10	Stiff to hard dark red brown slightly sandy slightly gravelly CLAY with many cobbles and some boulders		
						(1.30)			
						2.40	Complete at 2.40m		
Plan					Remarks				
. .					. .				
			Scale (approx)		Logged By		Figure No.		
			1:20		SAM		2884/21.TP1		

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 S.A. MCGREGOR <small>GEOTECHNICAL & ENVIRONMENTAL GROUND SERVICES</small>				Site Crosspoles		Trial Pit Number TP2		
Excavation Method Tracked excavator with 0.60m bucket		Dimensions 0.60 x 1.20		Ground Level (mOD)		Client Mr Young		
		Location		Dates 31/08/2021		Agent Crawford Architecture Ltd		
						Job Number 2884/21		
						Sheet 1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.30	TOPSOIL		
					0.30	Firm to Stiff orange brown very sandy, gravelly CLAY with lenses light grey brown sand		
			Infiltration test zone 1.20 - 2.20m		(1.30)			
					1.60some water seepages below 1.50m		
					(0.60)	Firm red brown and orange brown very sandy very gravelly CLAY		
			Groundwater table not present		2.20	Complete at 2.20m		
Plan						Remarks		
. .						. .		
						Scale (approx) 1:20	Logged By SAM	Figure No. 2884/21.TP2

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Fig. 3. PROPOSED DRAINAGE LAYOUT



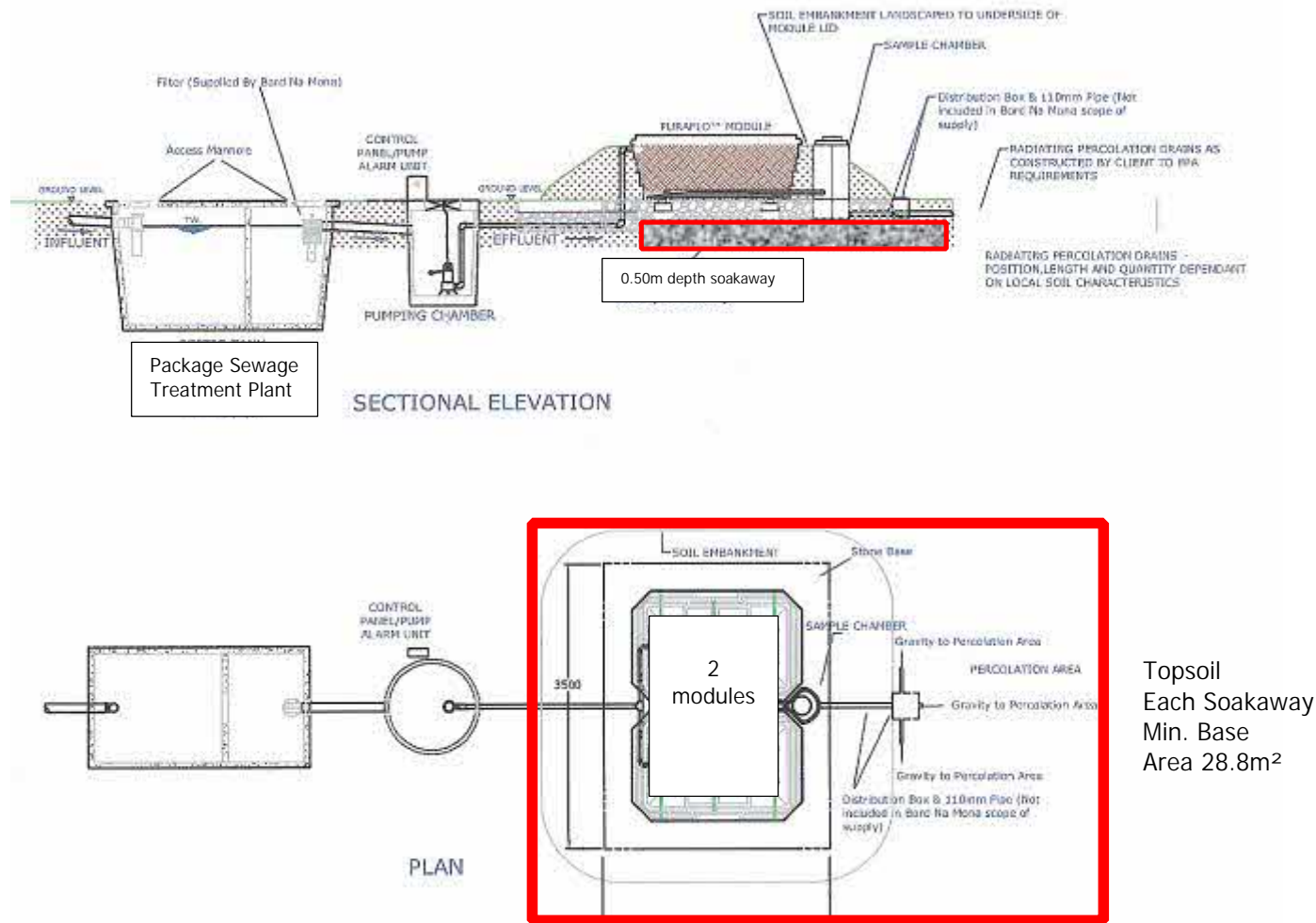
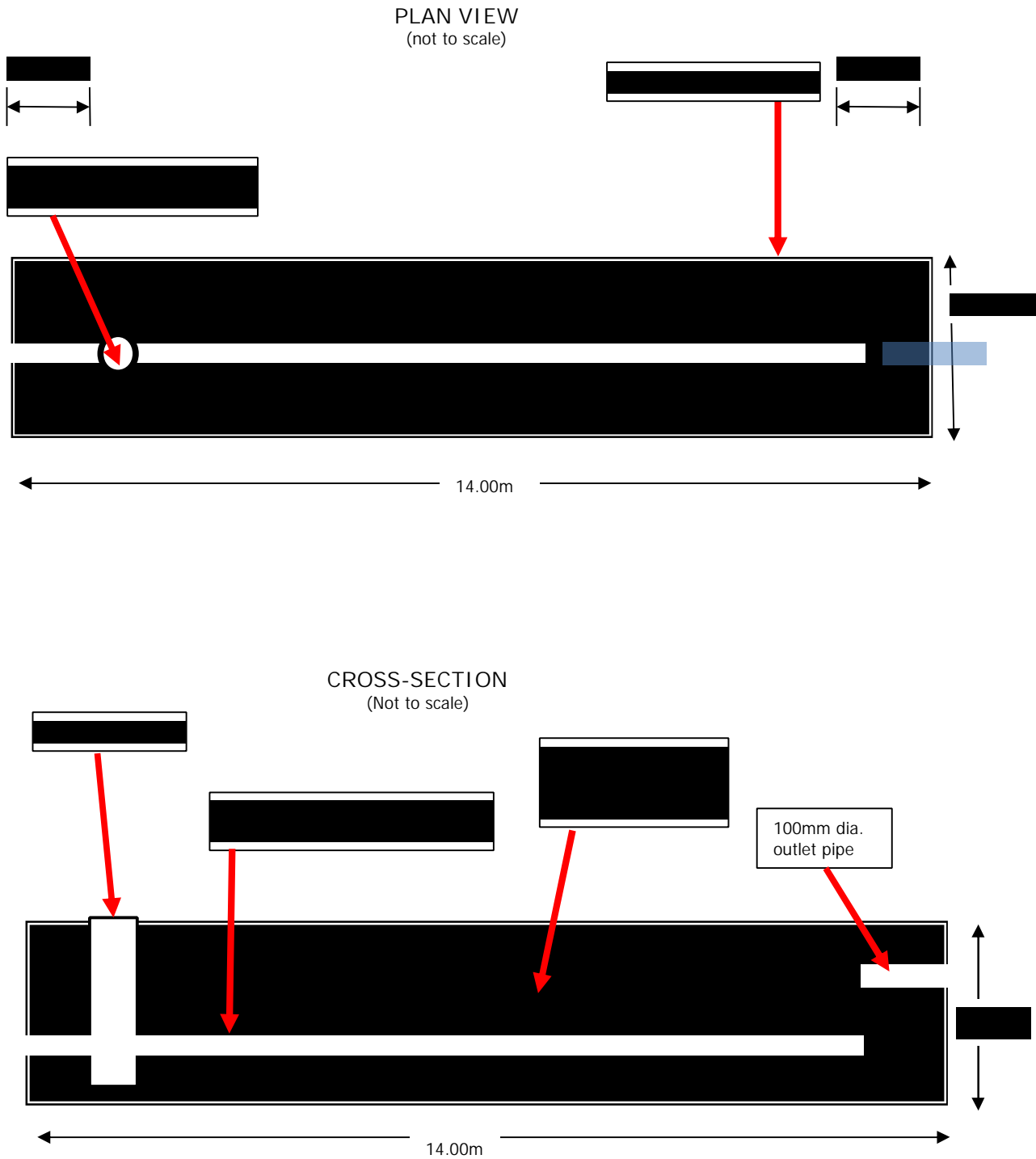
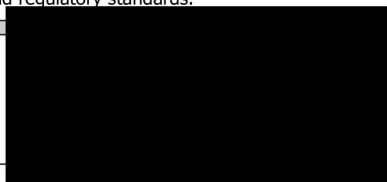
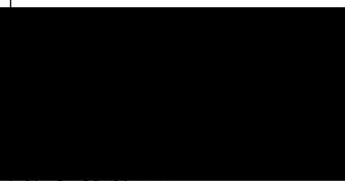


FIG. 4 SCHEMATIC OF PROPOSED WASTE WATER TREATMENT SYSTEM & FOUL WATER DISCHARGE (NOT TO SCALE)

Fig. 5. FILTER DRAIN INDICATIVE CONSTRUCTION (sketch only, not to scale)



CERTIFICATE FOR PROPOSED FOUL WATER DISCHARGE		
Applicants Name	High Avon Developments	
Agent	A B Roger & Young Ltd.	
Site Address	Land Adjacent to Kirk House, Crosspoles, AB30 1PQ	
Date of Assessments	August 2021 & March 2024	
Weather Conditions	Dry & Sunny	
Encountered Ground Conditions		
<p>Topsoil: Overlain by 260-300mm of topsoil. Natural Sub-Soils: The sub-soils have an upper mantle of stiff orange brown sandy, gravelly clay with some cobbles becoming stiff to hard dark red brown slightly gravelly clay with many cobbles and some boulder below 1.10m and proved to the maximum investigated depth of 2.40m. Bedrock: Bedrock was not encountered during this investigation.</p>		
Groundwater Observations: Not encountered during the ground investigation		
Wells / Boreholes: No known potable water supply wells/boreholes within 50m of the proposed infiltration fields		
Percolation Testing	FW1 (sub-soils)	FW2 (Topsoil)
Average time taken, seconds	>18,000	3450
Soil Percolation Value, Vp, s/mm	>120	23
Discharge Design	Puraflo Modules and Underlying Topsoil Soakaway	
Proposed Development	New Dwellinghouse	
Population Equivalent, PE	5 (3-bedroom)	
Sewage Treatment Type	PSTP only	Minimum 3,000-litre Capacity
Minimum Base Area, m ²	28.8	
<p>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.</p>		
Signed		Date 11 March 2024
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 Name	High Avon Developments		
Agent	A B Roger & Young Ltd.		
Site Address	Land Adjacent to Kirk House, Crosspoles, AB30 1PQ		
Date of Assessments	August 2021 & March 2024		
Weather Conditions	Dry & Sunny		
Encountered Ground Conditions			
<p>Topsoil: Overlain by 260-300mm of topsoil. Natural Sub-Soils: The sub-soils have an upper mantle of stiff orange brown sandy, gravelly clay with some cobbles becoming stiff to hard dark red brown slightly gravelly clay with many cobbles and some boulder below 1.10m and proved to the maximum investigated depth of 2.40m. Bedrock: Bedrock was not encountered during this investigation.</p>			
Groundwater Observations: Not encountered during the ground investigation			
Wells / Boreholes: No known potable water supply wells/boreholes within 50m of the proposed infiltration fields			
Infiltration Testing	TP2		
Infiltration Test Zone, mbegl	1.20 - 2.20		
Soil Infiltration Rate, f, m/s	2.77 x 10⁻⁶		
SuDS Design	Filter Drain and discharge to existing surface water drain		
Proposed Development	New Dwellinghouse		
Impermeable Areas	Dwellinghouse Roof Areas	All up to 220 m²	
Design Dimensions, L x W	1.50m	14.00m	0.50 filter stone depth
<p>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.</p>			
Signed			Date 11 March 2024
Name / Company	S. A. McGregor		
Address	Serenje, Kingsford Steadings, Alford, Aberdeenshire, AB33 8HN		
Qualification	B.Eng (Civil Engineering)		