

**S.A. MCGREGOR**



GROUND ASSESSMENT &  
DRAINAGE RECOMMENDATION REPORT

PROPOSED REPLACEMENT DWELLINGHOUSE  
BOGENTORY COTTAGE  
WESTHILL  
ABERDEENSHIRE  
AB32 7EN

*Agent:* Norman P Lawie Ltd

*Client:* Mr Euan Stewart

*Contract No.* 3491/23

*Report Issued:* 11 December 2023

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## INTRODUCTION

At the request of Norman P. Lawie Ltd, on behalf of Mr Euan Stewart, this report is presented for the new planning application for the proposed replacement dwellinghouse at Bogentory Cottage, Westhill, Aberdeenshire.

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 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.

to assess the sub-soils for foundation design.

## SITE LOCATION & BRIEF DESCRIPTION

Bogentory Cottage is located west of Westhill in Aberdeenshire with access from the A944, B977 and local roads, OS NGR NJ 75550 09726, see Fig.1. General Location Plan.

The site is occupied by the existing cottage and sheds to the rear. The area is generally level with the proposed new infiltration areas overlain by grass.

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

There are no watercourses within 10m of the proposed infiltration fields.

## SITE WORK

### *Trial Pits*

On the 28<sup>th</sup> October 2023, a site and ground assessment were undertaken at the site. A tracked excavator with a 0.30m & 0.90m bucket excavated trial pits to carry out an assessment of the underlying ground conditions, to carry out percolation and infiltration testing in the areas of the potential sub-surface soakaways.

The locations of the trial pits were decided on site and are indicated on Fig. 2. Proposed Site Layout & Test Location Plan in Appendix A.

### *Percolation Testing*

Percolation testing was carried out in test holes adjacent to observation trial pits FW1 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 28/10/2023	FW1 A	FW1 B
Average time taken for water to drain 3 times in each sump hole (middle 150mm)	5880	6210
Depth of Water Table below Ground Level (m)	>2.00	
Soil Percolation Values, Vp, s/mm	39.2	41.4
Average Soil Percolation Values, Vp, s/mm	40.3	

### *Infiltration Testing*

Infiltration tests were carried out in trial pit SW1 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)
SW1	0.80 x 1.20	1.00 – 2.00	Open	$4.70 \times 10^{-5}$

## GROUND ASSESSMENT

### *Published Geology*

The British Geological Survey 1:50,000 Quaternary and Solid maps indicate that the site is overlain by Banchory Till Formation, (Diamicton - sand, gravel, silt and clay) sedimentary superficial deposits formed between 116 and 11.8 thousand years ago during the Quaternary Period and underlain by the Crathes Pluton – Granodiorite. Igneous bedrock formed between 443.8 and 393.3 million years ago during the Silurian and Devonian Periods.

### *Encountered Ground Conditions*

Made Ground and Topsoil: The site is overlain by 250-500mm thickness of made ground consisting of gravels. The original topsoil was encountered beneath the made ground 500-600mm in thickness.

Natural Sub-Soils: The natural underlying sub-soils have an upper mantle of loose dark brown silty sand becoming medium dense light brown silty gravelly coarse sand (completely weathered rock) below 1.05m to 1.70m. Beneath the silty sand the strata then becomes medium dense light brown sand with angular gravel (highly weathered rock) and proved to the investigated depth of 2.00m.

Bedrock: Completely and highly weathered rock was encountered below 1.05m and proved to 2.00m.

### *Groundwater Observations*

Groundwater was not encountered during the investigation.

## DISCUSSION

### *Sub-Soils*

The silty sandy nature of the underlying strata and the results from the percolation and infiltration testing confirmed the moderate draining properties of the sub-soils.

### *Sewage Treatment*

The soil percolation value,  $V_p = 40.3 \text{ s/mm}$  and therefore a standard septic tank is suitable for the development. It is recommended to install septic tank with a minimum 3,750-litre capacity is required for a 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 septic tank 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*

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, 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	None	
Component 1	(not discharging to watercourse)	
SuDS Pollution Mitigation Indices		
TSS	0.4	0.4
Metals	0.4	0.4
Hydrocarbons	0.4	0.4
Groundwater Protection Type	Infiltration Trench	Silt Trap for TSS Minimum 300mm permeable gravel finish
Combined Pollution Mitigation Indices		
TSS	0.4	0.4
Metals	0.4	0.4
Hydrocarbons		
Acceptability of Pollution Mitigation		
TSS	Sufficient	Sufficient
Metals	Sufficient	Sufficient
Hydrocarbons	Sufficient	Sufficient

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

The design is to be effective in all-weather conditions and are not considered to pose a risk to local water supplies and the water environment.

## 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,  $V_p$  is between 15-120 s/mm in accordance with the regulations the minimum base area,  $A$ , is derived from  $A = V_p \times PE \times 0.25$ , 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)	Ave. Percolation Value, $V_p$ (s/mm)	Min. Base Area ( $m^2$ )
New Dwellinghouse	6 (4-bedroom)	40.3	61

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 size of the proposed surface water soakaway is based on the impermeable surface areas of the development i.e. the house and garage roof areas.

Using the soil infiltration rate,  $f = 4.70 \times 10^{-5} m/s$  in the optimum dimensions for the surface water infiltration trench (soakaway) are shown on the following table: -

### *Stone-filled Soakaway*

Impermeable Area ( $m^2$ )	Width (m)	Length (m)	Storage depth (m)	Half Empty Time (hrs)
New Dwellinghouse Roof Areas Up to $200m^2$	1.00	29.60	1.70	1.08
	2.00	16.30		2.10
	3.00	11.30		2.66
	4.00	8.50		3.05
	5.00	6.80		3.23

These dimensions include for a 1 in 200-year storm event and SEPA +Climate Change Peak Rainfall Intensity Allowance of +37% for the North East Region of Scotland and in accordance with BRE Digest 365.

Alternatively, storm cells may be used: -

*Storm Cells (preferred option)*

Impermeable Areas	Storage Volume Required (m <sup>3</sup> )	L x W x D	No. Cells Based on each cell 1m x 0.5m x 0.5m
New Dwellinghouse Roof Areas Up to 200m <sup>2</sup>	15.0	5m x 2.00m x 1.50m	60 [5(1.00) x 4(0.50) x 3(0.50)]

These dimensions include for a 1 in 200-year storm event and SEPA +Climate Change Peak Rainfall Intensity Allowance of +37% for the North East Region of Scotland and in accordance with BRE Digest 365.

*Proposed Drainage Layout*

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

SYSTEM MAINTENANCE

*Sewage Treatment System*

All servicing and maintenance should be undertaken in full accordance with the manufacturer's literature or by a responsible qualified person. The septic tank should be regularly inspected and 'desludged' (emptied) when appropriate to ensure solids and silts do not 'clog' the soakaway or make their way to the discharge outlet.

*Soakaways*

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

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.

All the drainage and associated soakaways will remain private, to be maintained by the home owners in general accordance with maintenance activities as listed in the following table: -

Operation & Maintenance for Soakaway		
Monitoring	Inspect all associated silt traps and inspection chambers and note rate of sediment accumulation	Monthly within the first year after installation, 6 monthly thereafter unless accumulation rate indicated more frequent emptying
	Check soakaway to ensure emptying is occurring, especially after prolonged rainfall events	6 monthly
Regular Maintenance	Carry out inspection for sediment and debris in the inspection chamber, rodding eyes, and any directional change chambers	6 monthly
	Clean out all gutters and downpipes (leaves, pine needles etc.) and any filters present	Annually, especially in the autumn after leaf fall (or as required)
	Ensure no root migration encroaches soakaway and trim back when required	Annually (or as required)
Remedial Actions	If performance deteriorates or soakaway fails reconstruct the soakaway and/or replace stone fill	As required
	When necessary, replace clogged geotextile	As required

## 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 landowners 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 to rest on the sandy silts/silty sands at a minimum depth of below 0.60m below existing ground levels.

A safe bearing capacity of 125kN/m<sup>2</sup> at 0.60m may be applied for the design of the foundations.

### *Excavations*

Due to the silty nature of the sub-soils all excavations, if left exposed, should be protected from rain and run-off waters to maintain the soils strength.

### *Settlement*

It is considered that the generally firm/medium dense 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. Proposed Site Layout & Test Location Plan
Trial Pit Logs	FW1 & SW1
Drainage	Fig. 3. Proposed Drainage Layout Fig. 4. Indicative Sub-Surface Soakaway Installation Fig. 5. Indicative Storm Cell Installation
Certificates	Foul Water Discharge Surface Water Disposal

Fig. 1. GENERAL & SITE LOCATION PLANS

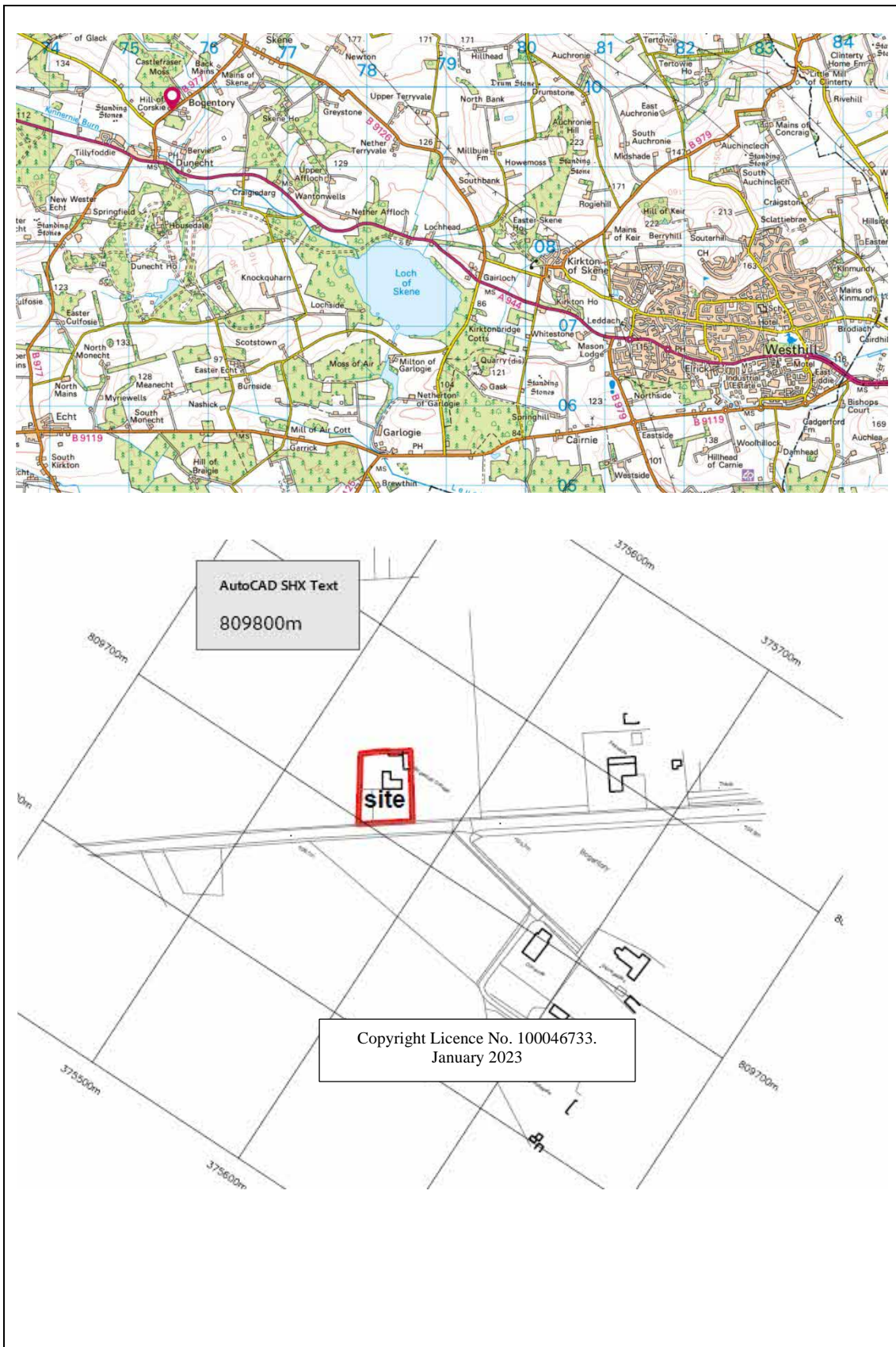


Fig. 2. PROPOSED SITE LAYOUT & TEST LOCATION PLAN



FW1 Log

Excavation Method		Dimensions		Ground Level (mOD)		Site		Trial Pit Number			
Tracked excavator 0.30m & 0.90m bucket		1.00 x 1.80				Bogentory Cottage, Dunecht		FW1			
		Location		Dates		Client		Job Number			
				28/10/2023		Euan Stewart		3491/23			
				Agent				Sheet			
				Norman P Lawie Ltd				1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water			
					0.25	MADE GROUND - gravels					
					0.25	Original TOPSOIL					
					0.50	Firm light yellow brown very sandy SILT					
					0.90	Medium dense light brown slightly silty slightly gravelly medium to coarse SAND					
			Percolation testing at 1.00m		(1.10)						
			No groundwater ingress		2.00	Complete at 2.00m					
<b>Plan</b>						<b>Remarks</b>					
						<b>Scale (approx)</b>		<b>Logged By</b>		<b>Figure No.</b>	
						1:20		SAM		3491/23 FW1	

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SW1 Log

Excavation Method		Dimensions	Ground Level (mOD)	Client	Trial Pit Number			
Tracked excavator 0.30m & 0.90m bucket		0.80 x 1.20		Euan Stewart	SW1			
Location		Dates	Agent	Job Number	Sheet			
		28/10/2023	Norman P Lawie Ltd	3491/23	1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Infiltration test zone 1.00-2.00m		0.50	MADE GROUND - gravels		
					0.50 (0.10)	Original TOPSOIL		
					0.60	Loose dark brown silty SAND		
					0.45			
					1.05	Medium dense light brown silty gravelly coarse SAND (completely weathered rock)		
					0.65			
					1.70	Medium dense light brown SAND with angular gravel (highly weathered rock)		
			No groundwater ingress		0.30			
					2.00	Complete at 2.00m		
<b>Plan</b>				<b>Remarks</b>				
				<p>Scale (approx) 1:20</p> <p>Logged By SAM</p> <p>Figure No. 3491/23 SW1</p>				

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Fig. 3. PROPOSED DRAINAGE LAYOUT

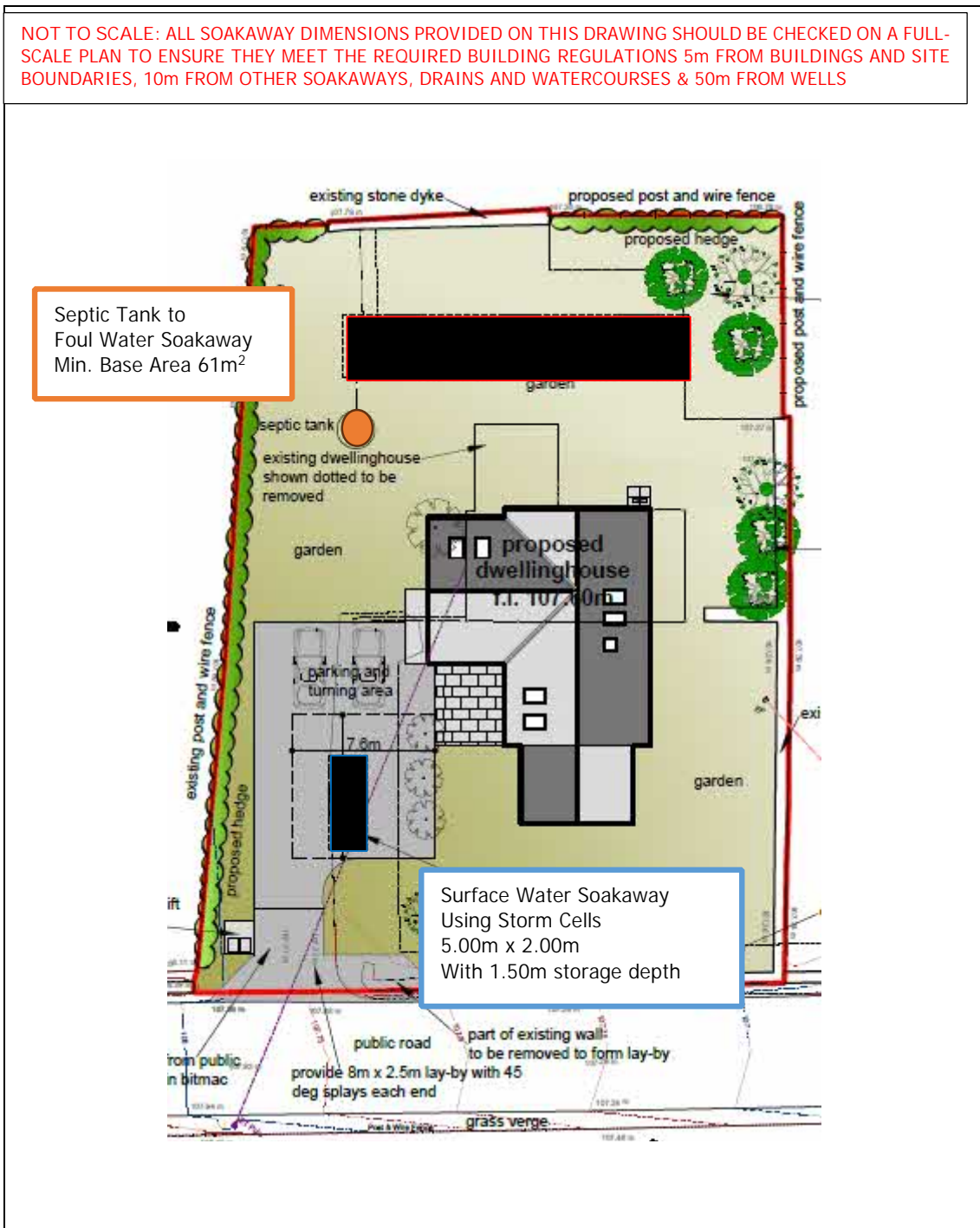


Fig. 4. INDICATIVE SOAKAWAY INSTALLATION  
(sketch only, not to scale)

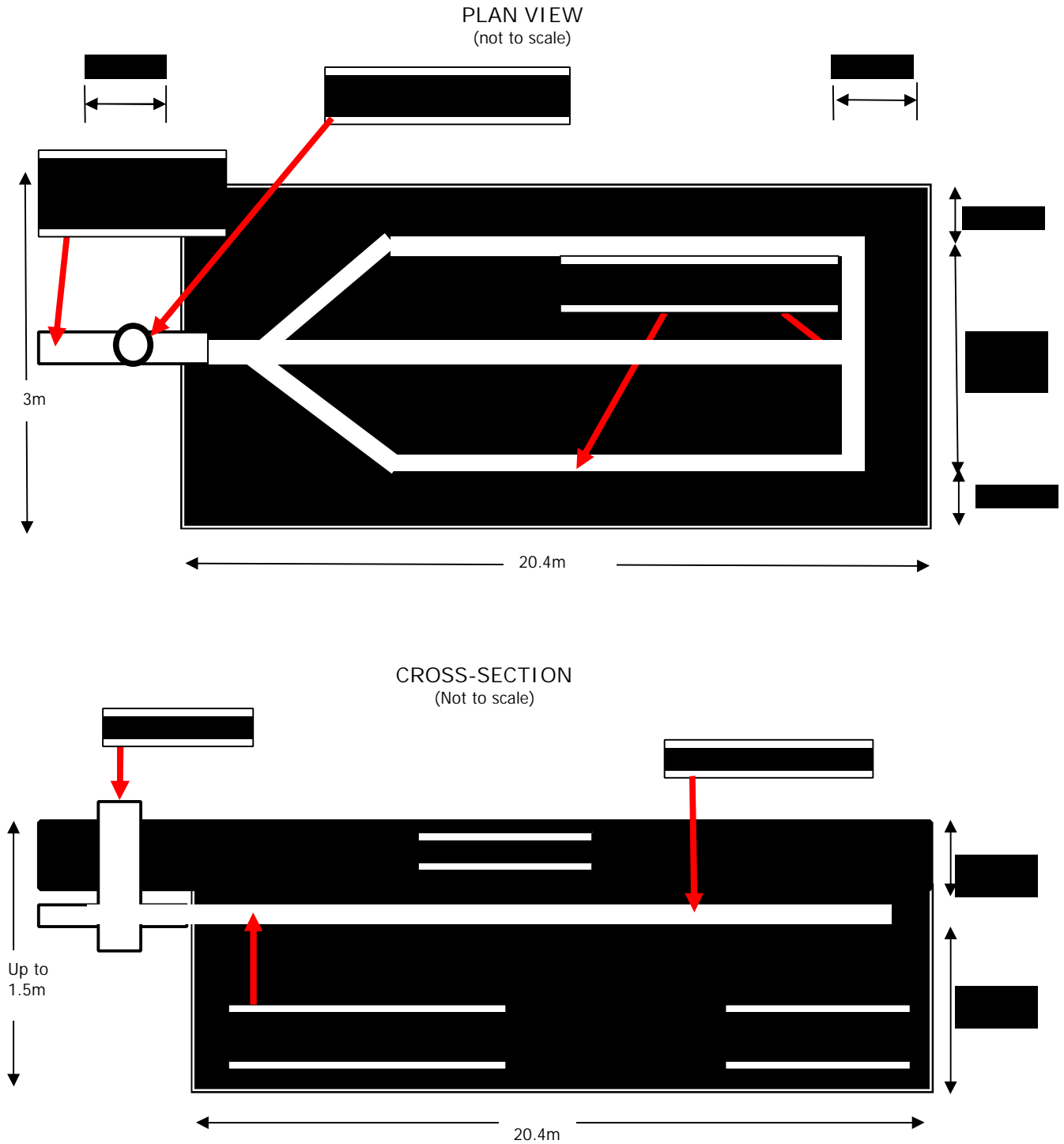
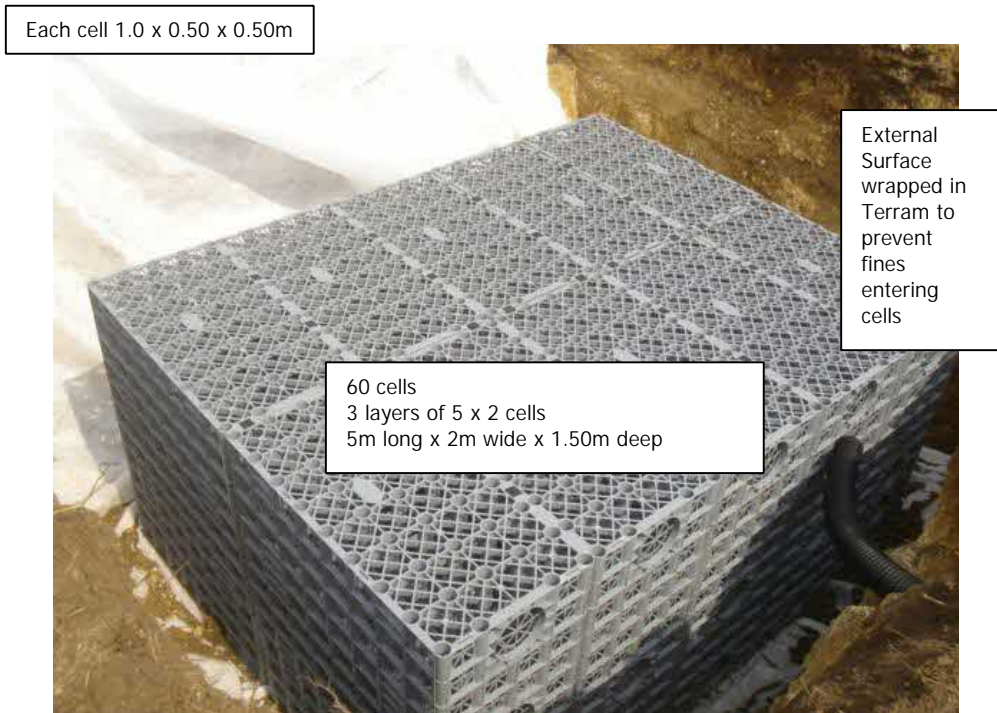
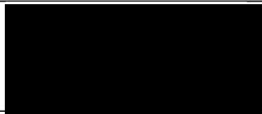



Fig. 5. STORM CELL INDICATIVE INSTALLATION (sketch only)





<b>CERTIFICATE FOR PROPOSED FOUL WATER SUB-SURFACE DISCHARGE</b>		
<b>Applicants Name</b>	Mr Euan Stewart	
<b>Agent</b>	Norman P Lawie Ltd	
<b>Site Address</b>	Bogentory Cottage, Westhill, Aberdeenshire, AB32 7EN	
Date & Time of Assessment	28 <sup>th</sup> October 2023	
Weather Conditions		
<b>Encountered Ground Conditions</b>	<p><b>Made Ground and Topsoil:</b> The site is overlain by 250-500mm thickness of made ground consisting of gravels. The original topsoil was encountered beneath the made ground 500-600mm in thickness.</p> <p><b>Natural Sub-Soils:</b> The natural underlying sub-soils have an upper mantle of loose dark brown silty sand becoming medium dense light brown silty gravelly coarse sand (completely weathered rock) below 1.05m to 1.70m. Beneath the silty sand the strata then becomes medium dense light brown sand with angular gravel (highly weathered rock) and proved to the investigated depth of 2.00m.</p> <p><b>Bedrock:</b> Completely and highly weathered rock was encountered below 1.05m and proved to 2.00m.</p>	
Groundwater Observations	Groundwater was not encountered during the investigation	
<b>Wells / Boreholes</b>	No known potable water supply wells/boreholes within 50m of the proposed infiltration fields	
<b>Percolation Testing</b>	FW1 (A and B)	At 1.00m
Average time taken	6045	seconds
Soil Percolation Values, Vp	<b>40.3</b>	s/mm
<b>Discharge Design</b>		
Proposed Development	New Dwellinghouse	
Population Equivalent, PE	6 (4 bedroom)	
Sewage Treatment Type	Septic Tank	Minimum 3,200-litre Capacity
Soakaway Base Area	61m <sup>2</sup>	Full Soakaway
<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>		
<b>Signed</b>		<b>Date</b> 11 December 2023
<b>Name / Company</b>	S. A. McGregor	
<b>Address</b>	Serenje, Kingsford Steadings, Alford, Aberdeenshire, AB33 8HN	
<b>Qualification</b>	B.Eng (Civil Engineering)	

<b>CERTIFICATE FOR PROPOSED SURFACE WATER DISPOSAL</b>			
<b>Applicants Name</b>	Mr Euan Stewart		
<b>Agent</b>	Norman P Lawie Ltd		
<b>Site Address</b>	Bogentory Cottage, Westhill, Aberdeenshire, AB32 7EN		
Date & Time of Assessment	28 <sup>th</sup> October 2023		
Weather Conditions			
<b>Encountered Ground Conditions</b>	<p><b>Made Ground and Topsoil:</b> The site is overlain by 250-500mm thickness of made ground consisting of gravels. The original topsoil was encountered beneath the made ground 500-600mm in thickness.</p> <p><b>Natural Sub-Soils:</b> The natural underlying sub-soils have an upper mantle of loose dark brown silty sand becoming medium dense light brown silty gravelly coarse sand (completely weathered rock) below 1.05m to 1.70m. Beneath the silty sand the strata then becomes medium dense light brown sand with angular gravel (highly weathered rock) and proved to the investigated depth of 2.00m.</p> <p><b>Bedrock:</b> Completely and highly weathered rock was encountered below 1.05m and proved to 2.00m.</p>		
Groundwater Observations	Groundwater was not encountered during the investigation		
<b>Wells / Boreholes</b>	No known potable water supply wells/boreholes within 50m of the proposed infiltration fields		
<b>Infiltration Testing</b>	SW1	Open	
Infiltration Test Zone	1.00-2.00	mbegl	
Soil Infiltration Rate, f	<b>4.70 x 10<sup>-5</sup></b>	m/s	
<b>SuDS Design</b>	Infiltration Trench using Storm Cells		
Proposed Development	New Dwellinghouse		
Impermeable Areas	Dwellinghouse Roof Areas	Up to 200m <sup>2</sup>	
Design Dimensions, L x W (m)	5.00	2.00	1.50m Stone Storage depth
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.			
<b>Signed</b>			<b>Date</b> 11 December 2023
<b>Name / Company</b>	S. A. McGregor		
<b>Address</b>	Serenje, Kingsford Steadings, Alford, Aberdeenshire, AB33 8HN		
<b>Qualification</b>	B.Eng (Civil Engineering)		