



WATER LANE, ANGMERING

Attenuation Basin - Design Calculation for mitigation measures against buoyancy force acting on waterproof liner

RSK Reference 134123-R01

APRIL 2021





RSK GENERAL NOTES

Project No.: 134123

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Title: Attenuation Basin - Design Calculation for mitigation measures against buoyancy force acting on waterproof liner

Client: Barratt David Wilson, Southern Counties

Date: April 2021

Office: Hemel Hempstead

Status: Environmental Agency Issue

Designer Sabesan Siva

Signature

Date: 26.04.2021

Technical reviewer

Vasi Vaseekaran

Signature

Date: 26.04.2021

RSK Land & Development Engineering Ltd. (RSK) has prepared these calculations for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The calculations may not be relied upon by any other party without the express agreement of the client and RSK.

This work has been undertaken in accordance with the quality management system of RSK Land & Development Engineering Ltd.

Water Lane, Angmering
Attenuation Basin - Design Calculation Report
134123-R01 (Rev 0)

1. INTRODUCTION

It is required to provide an attenuation basin at the above site as part of the surface water drainage system. The minimum invert level of the attenuation basin is proposed at 11.8m level AOD. Based on the site investigation works carried out by RSK, a worst case ground water level of 12.31 AOD recorded at the proposed site. Due to the worst case ground water level higher than the proposed basin level, there is a potential for buoyant force act on the waterproofing liner which will be provided at a depth below the basin. The design calculation provided herewith are to determine the minimum depth surcharge required on top of the waterproof layer to achieve a minimum factor of safety of 1.35 against potential buoyancy forces.

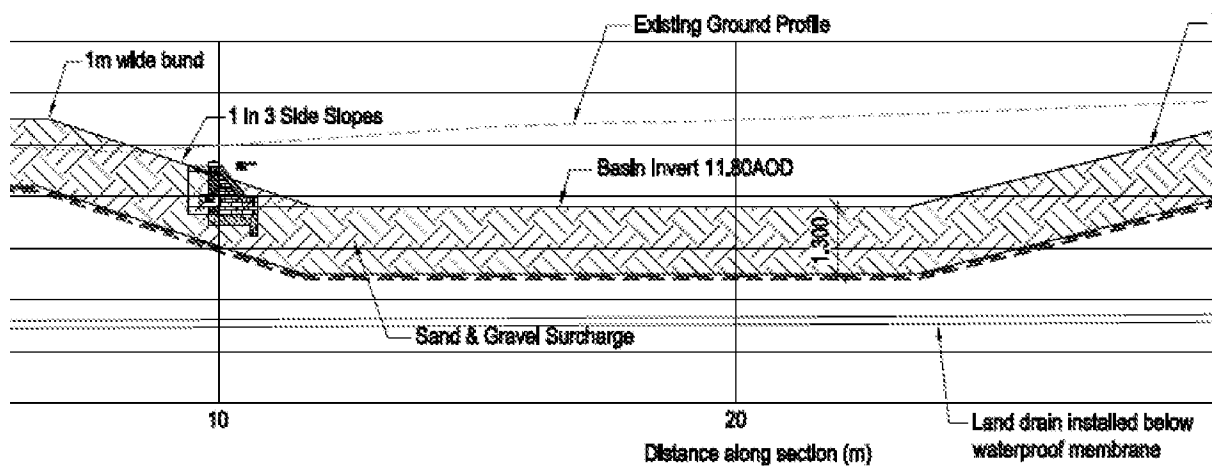


Figure -1 – Cross Section of the Attenuation basin

2. BUOYANCY FORCE ESTIMATION

The proposed waterproof impermeable barrier will be provided at a depth 1.3m below the basin level. As such, it is estimated that a 1285 m³ of groundwater would be displaced by the impermeable liner, as shown in the figure – 2 below.

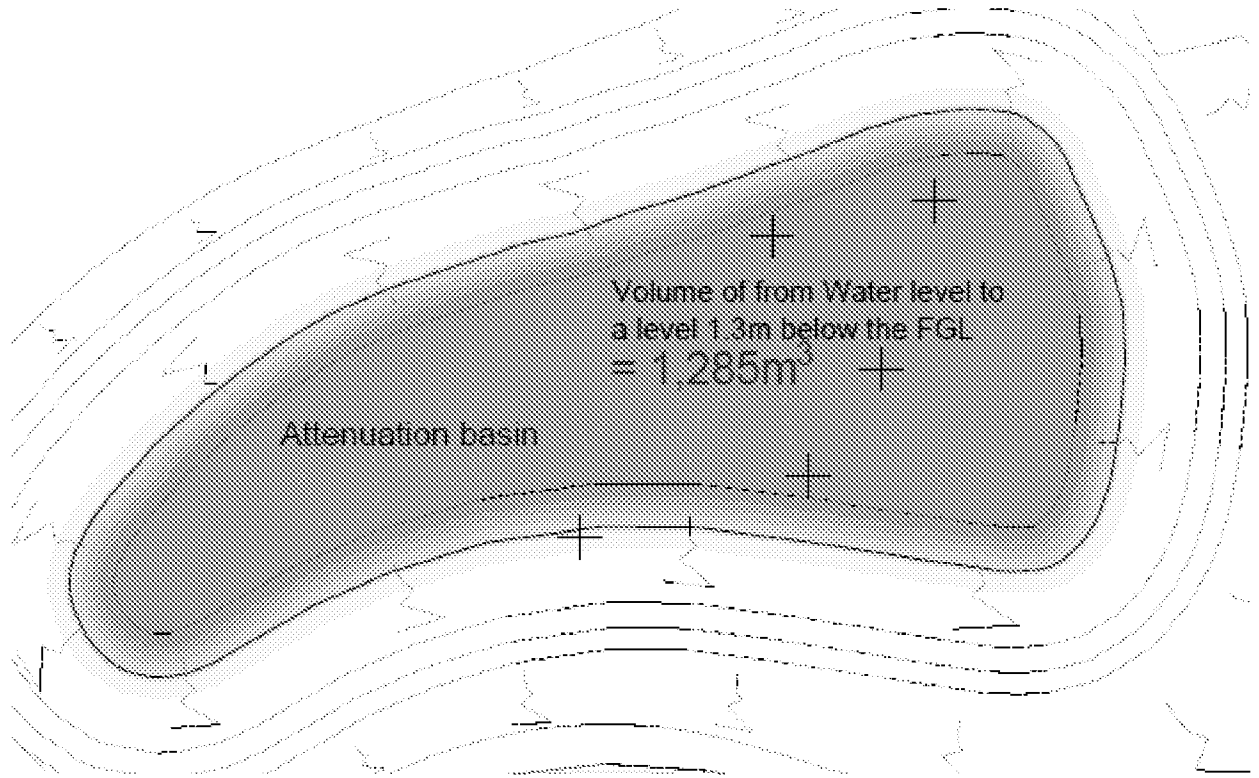


Figure -2 – Volume of groundwater that would be displaced by the impermeable liner when the ground water level is 12.31m.

3. SURCHARGE LOAD ESTIMATION AND FACTOR OF SAFETY CALCULATION

It is proposed to surcharge using 1.3m deep sand and gravel layer on top of the waterproof impermeable barrier in order to prevent the waterproof layer lifted off due to buoyancy forces. The volume of sand and gravel layer provided above the waterproof layer is 968 m³ as shown in Figure-3 below.

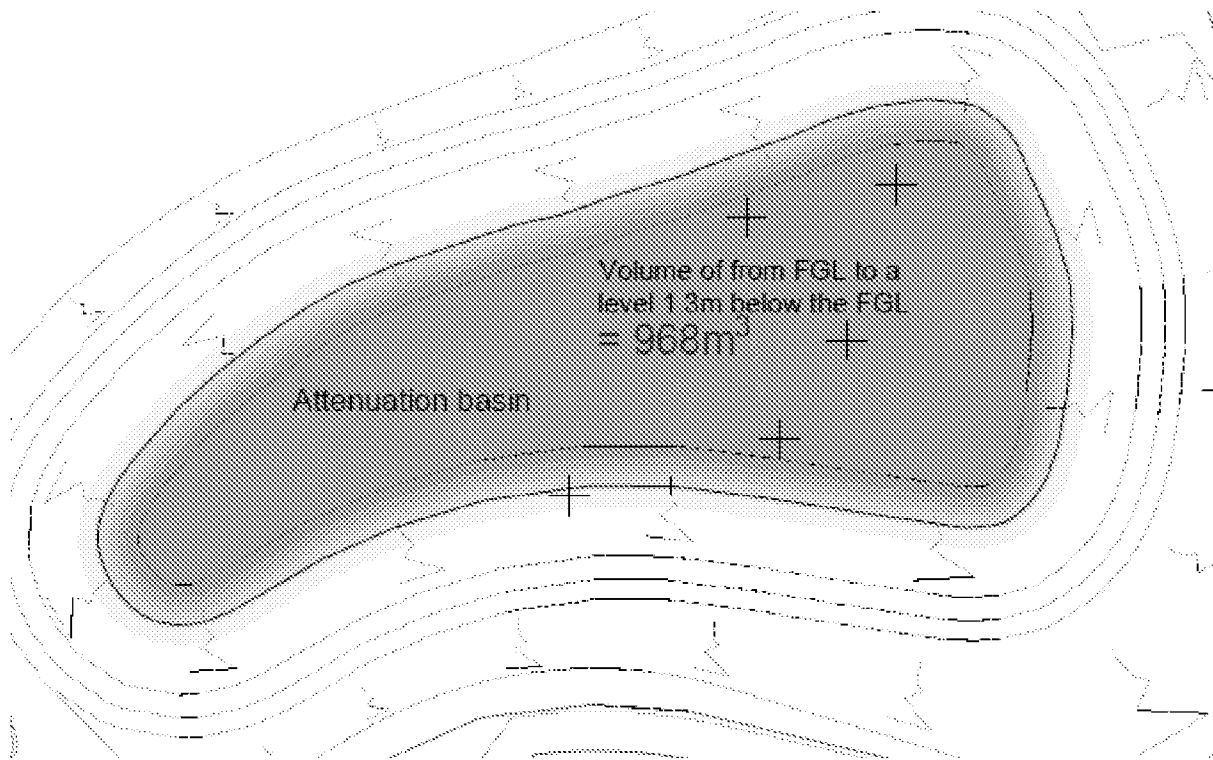
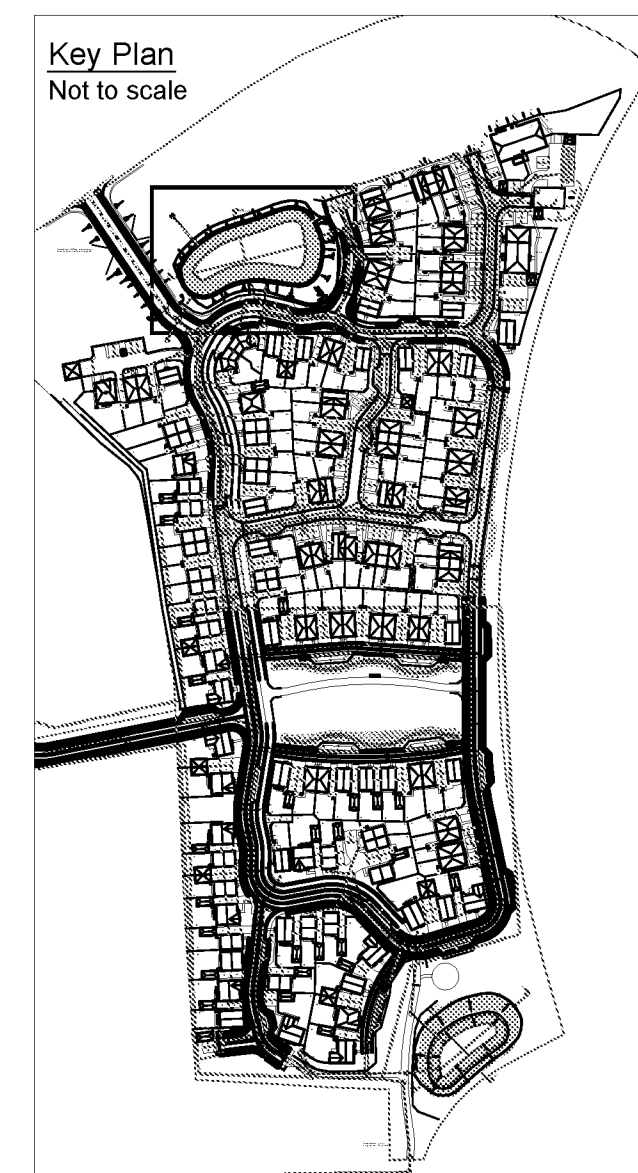
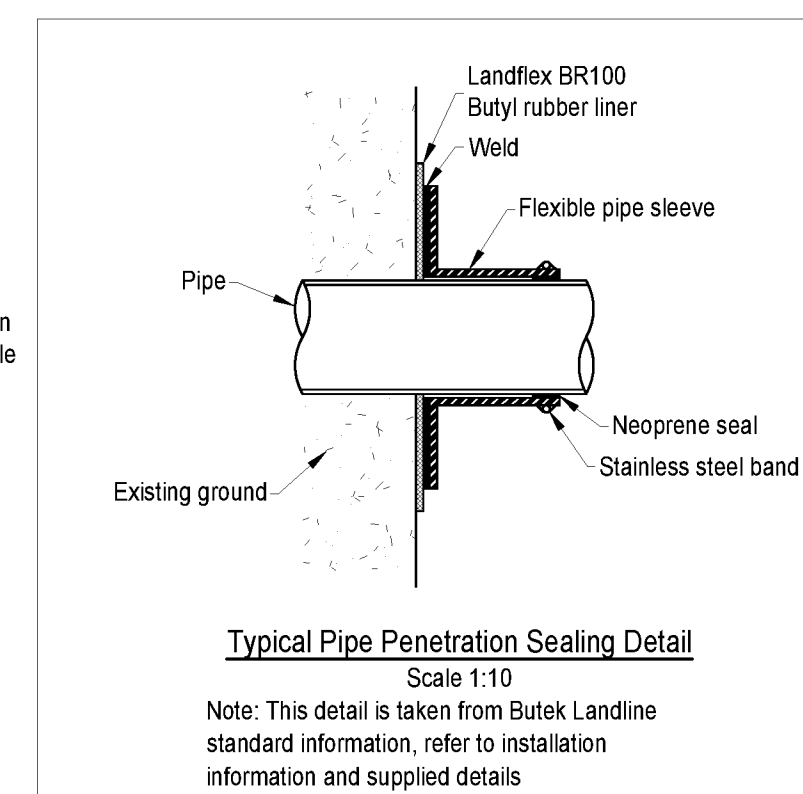
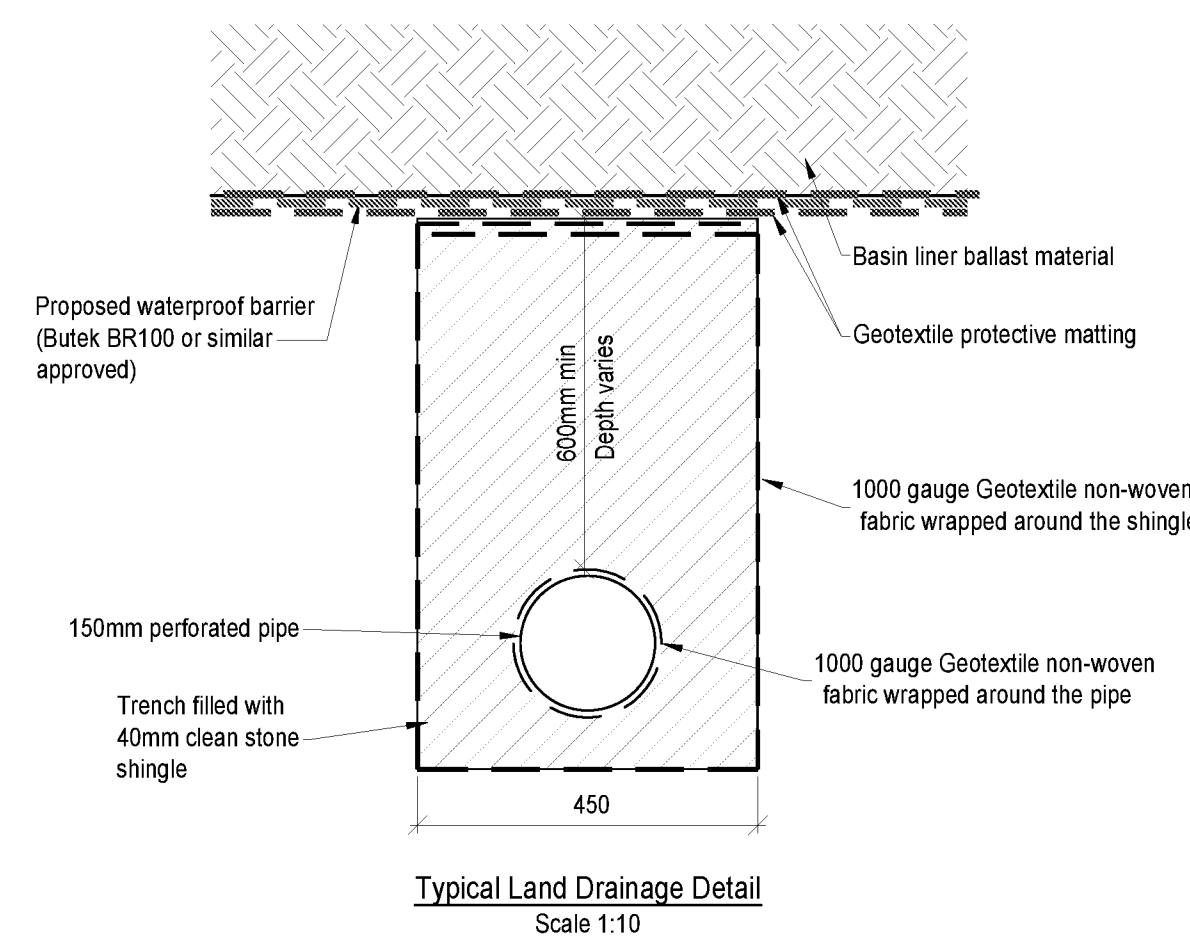
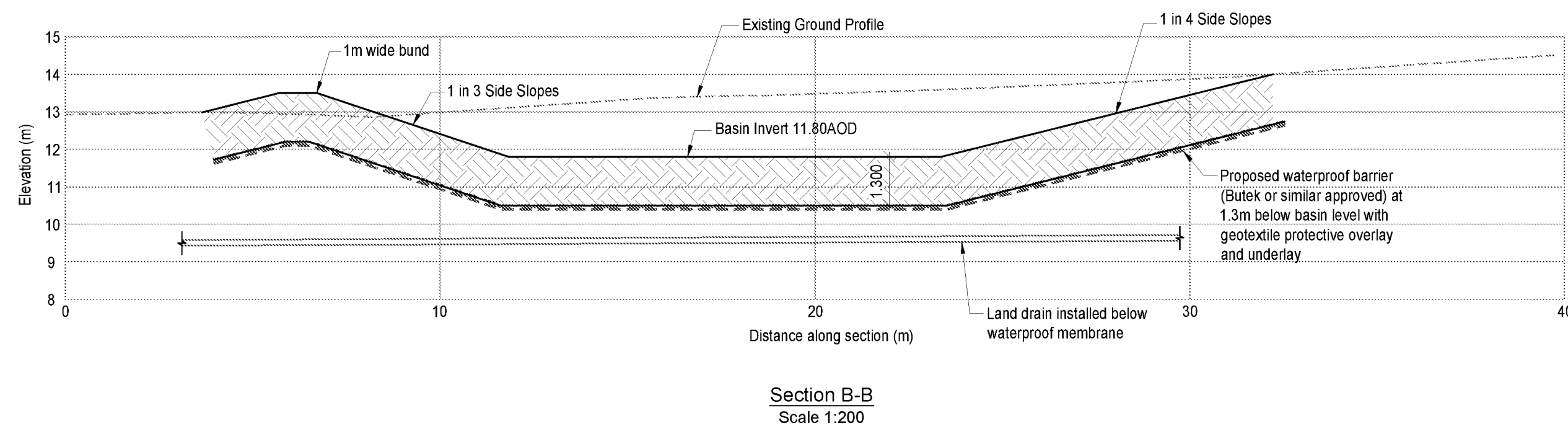
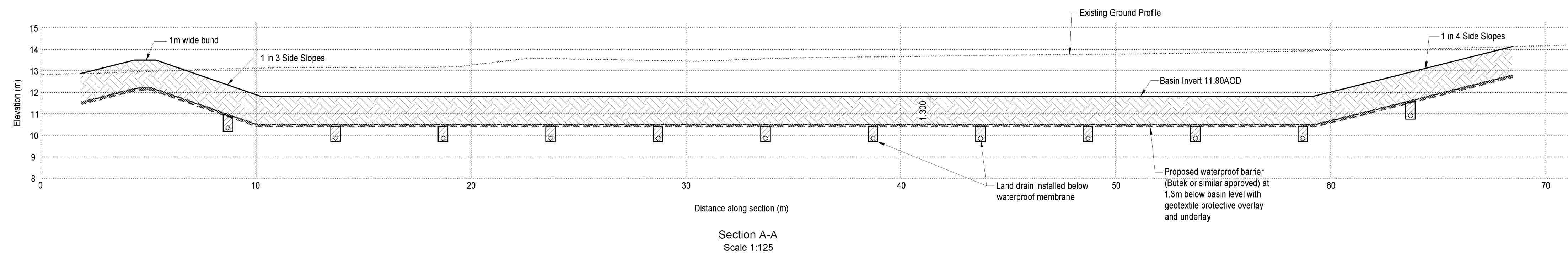
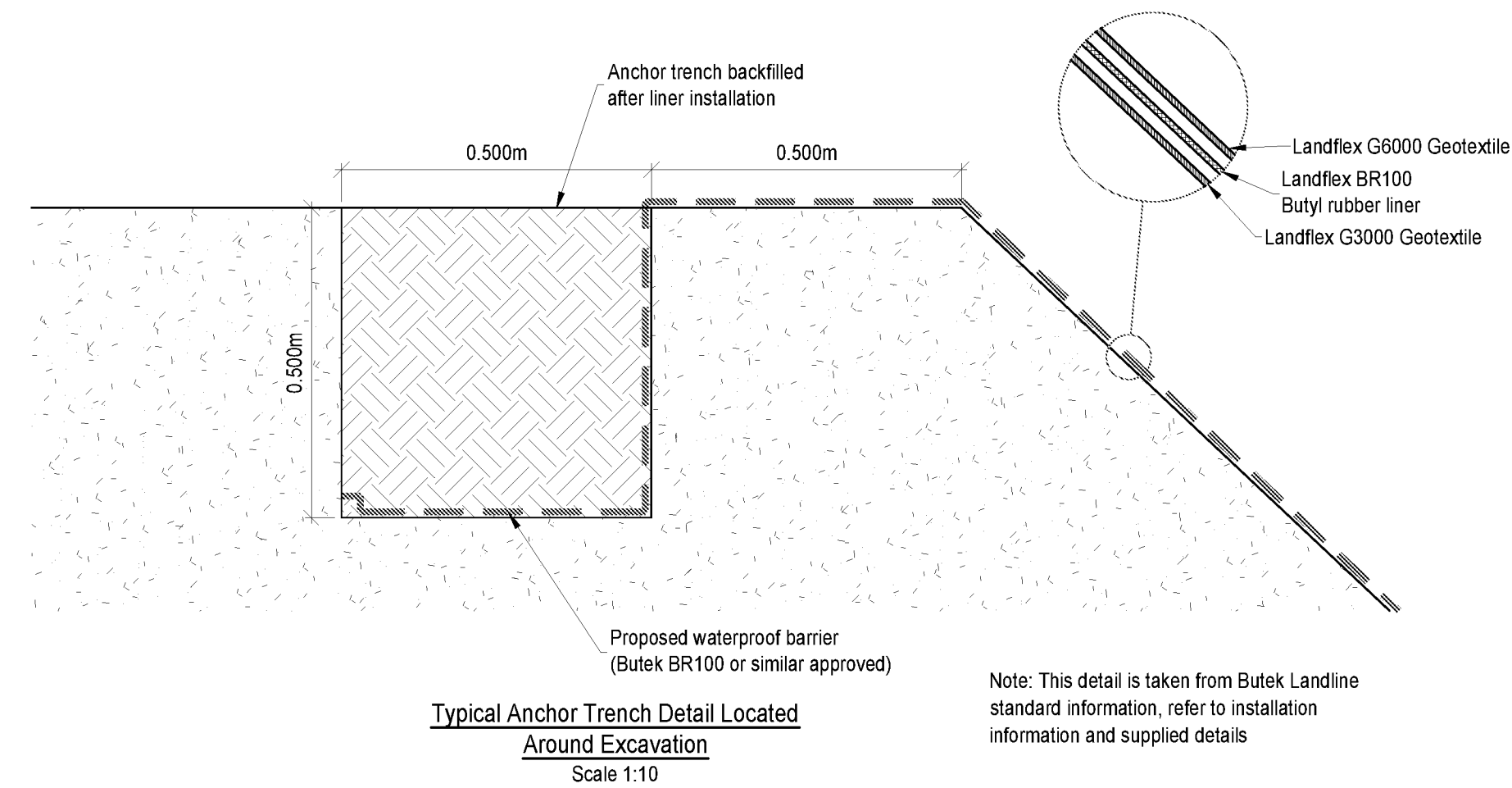
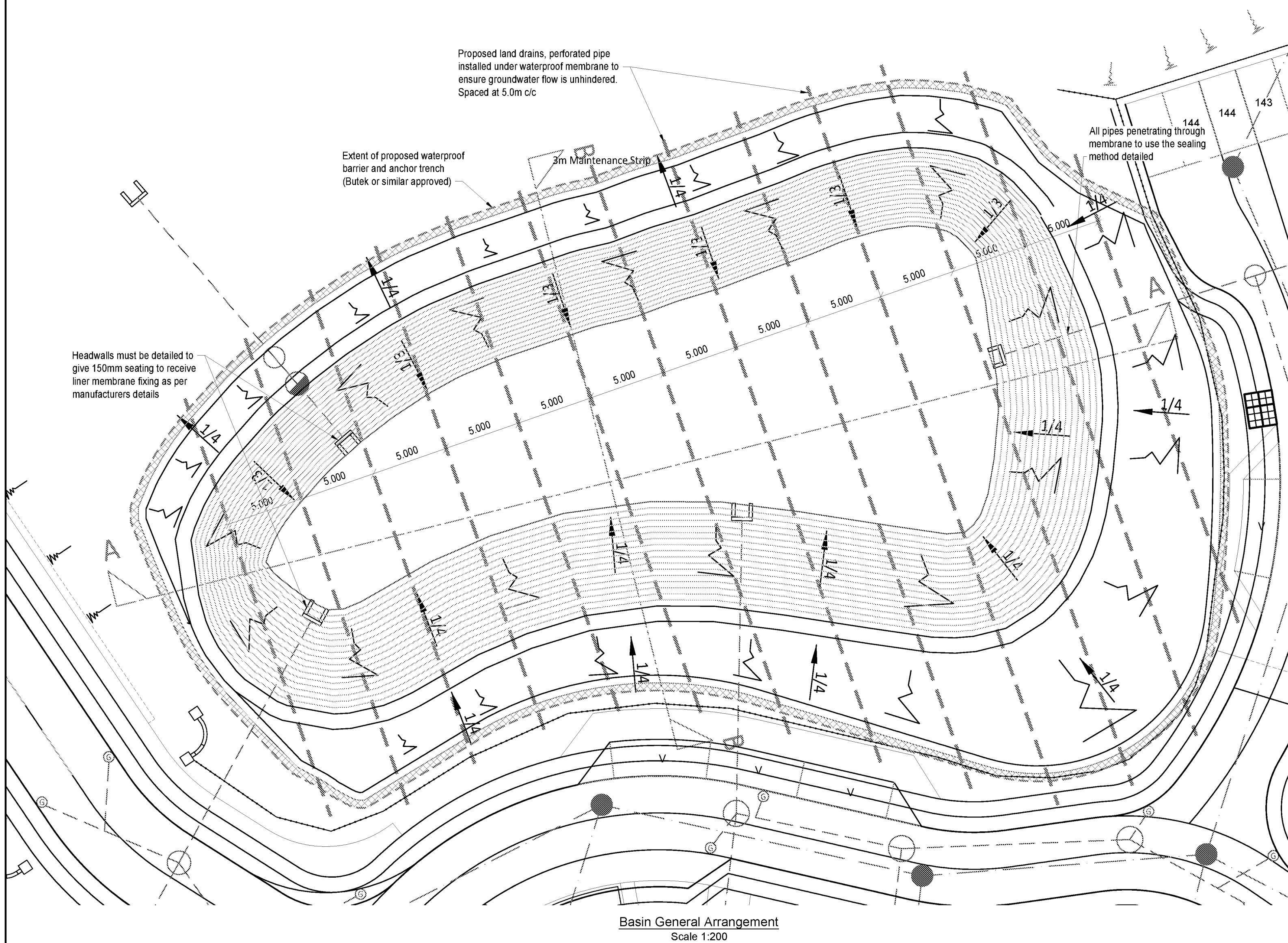


Figure -3 – Volume of sand and gravel provided above the waterproof layer to prevent floating of the layer due to buoyancy forces.

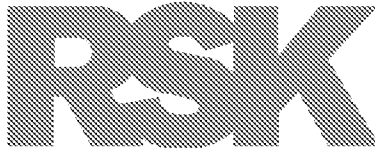
Calculations for FoS against Buoyancy force:

- Assuming the density of water as 1000 kg/m³ the mass of water displaced by the liner would be 1285,000 kg; and
- Assuming a minimum density of 1800 kg/m³ for sand and gravel layer, the total mass of the sand and gravel layer is 1742,400 kg.
- Hence, the factor of safety against buoyancy = 1.36 (1742,400/ 1285, 000)

Based on the above assessment, it is recommended to surcharge the waterproofing layer using 1.3m thick sand and gravel layer.



CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT	
Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are :-	
RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing. Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.	
<u>Notes:</u> 1. This drawing is to be read in conjunction with Architect's and Civil Engineers drawings and specifications. 2. RSK are not responsible for the site layout and pond arrangement. This is to be provided by other's. Refer to latest information. 3. All works are currently indicative and are not for construction.	

P1	26.04.21	Preliminary Issue		SAY	VV GTS
Rev.	Date	Amendment		Drawn	Chkd. Appd.
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Client					
BARRATT SOUTHERN COUNTIES					
Project Title					
WATER LANE ANGMERING					
Status					
PRELIMINARY					
Drawing Title					
NORTH ATTENUATION BASIN LINER ARRANGEMENT AND DETAILS					
Drawn	Date	Checked	Date	Approved	Date
SAY	04.21	VV	04.21	GTS	04.21
Scale		Orig Size		Dimensions	
AS SHOWN		A1		Metres	
Project No.			Drawing File		
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