



WATER LANE, ANGMERING

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

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RSK GENERAL NOTES

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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

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Office: Hemel Hempstead

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Signature

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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
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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 13.34 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 1.3 against potential buoyancy forces.

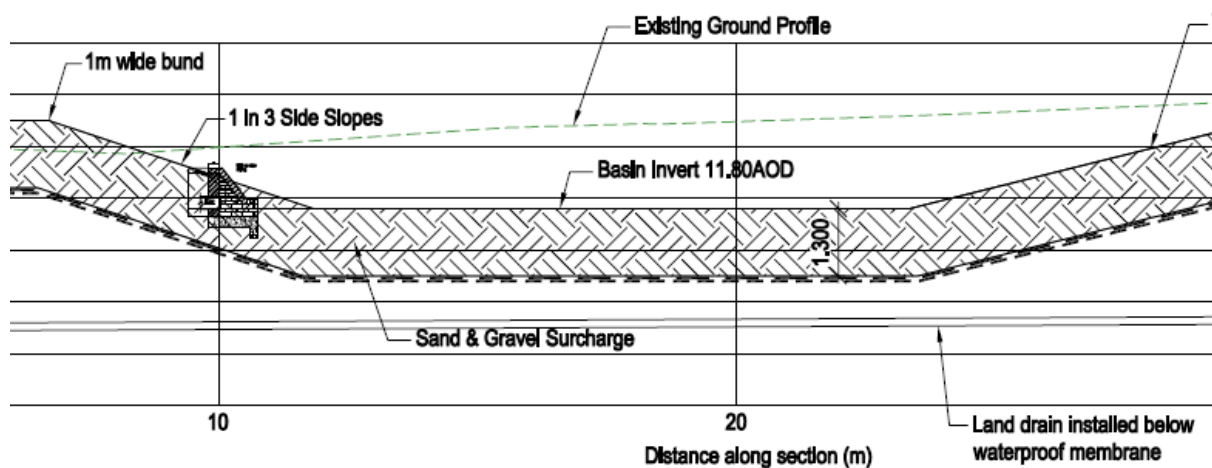


Figure -1 – Cross Section of the Attenuation basin

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 4065 m³ of groundwater would be displaced by the impermeable liner, as shown in the figure – 2 below.

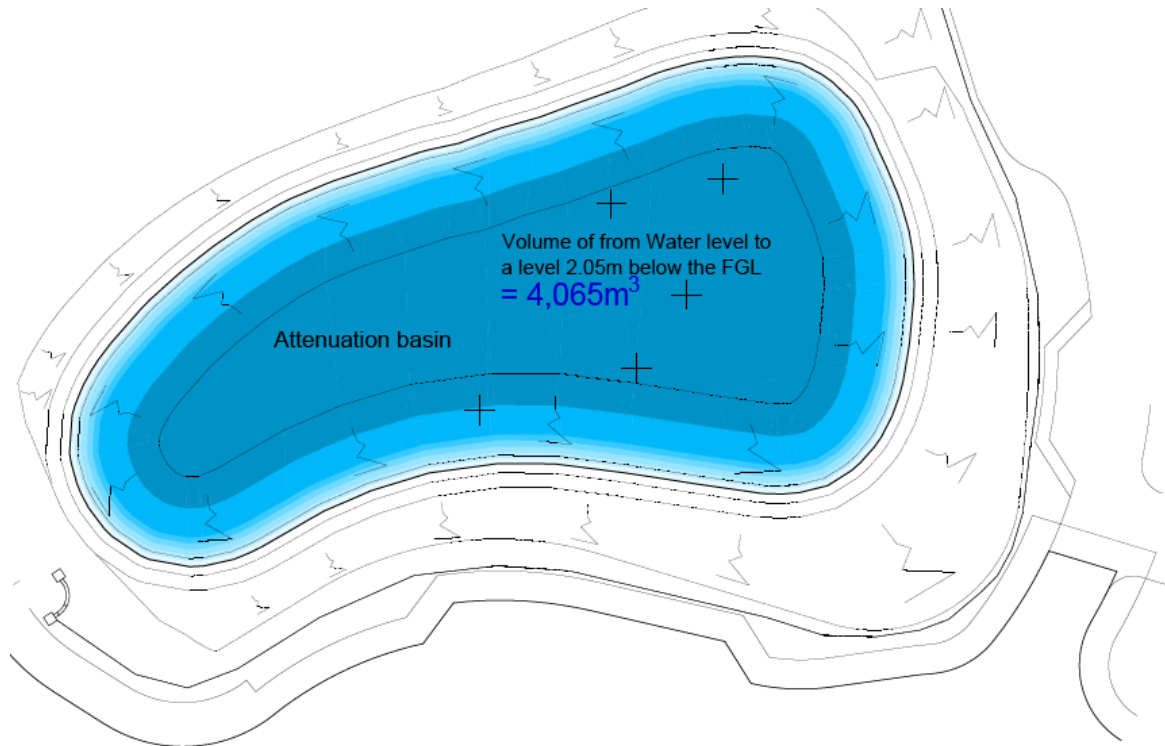


Figure -2 – Volume of groundwater that would be displaced by the impermeable liner when the ground water level is 13.34m.

3. SURCHARGE LOAD ESTIMATION AND FACTOR OF SAFETY CALCULATION

It is proposed to surcharge using 2.05m 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 2696 m³ as shown in Figure-3 below.

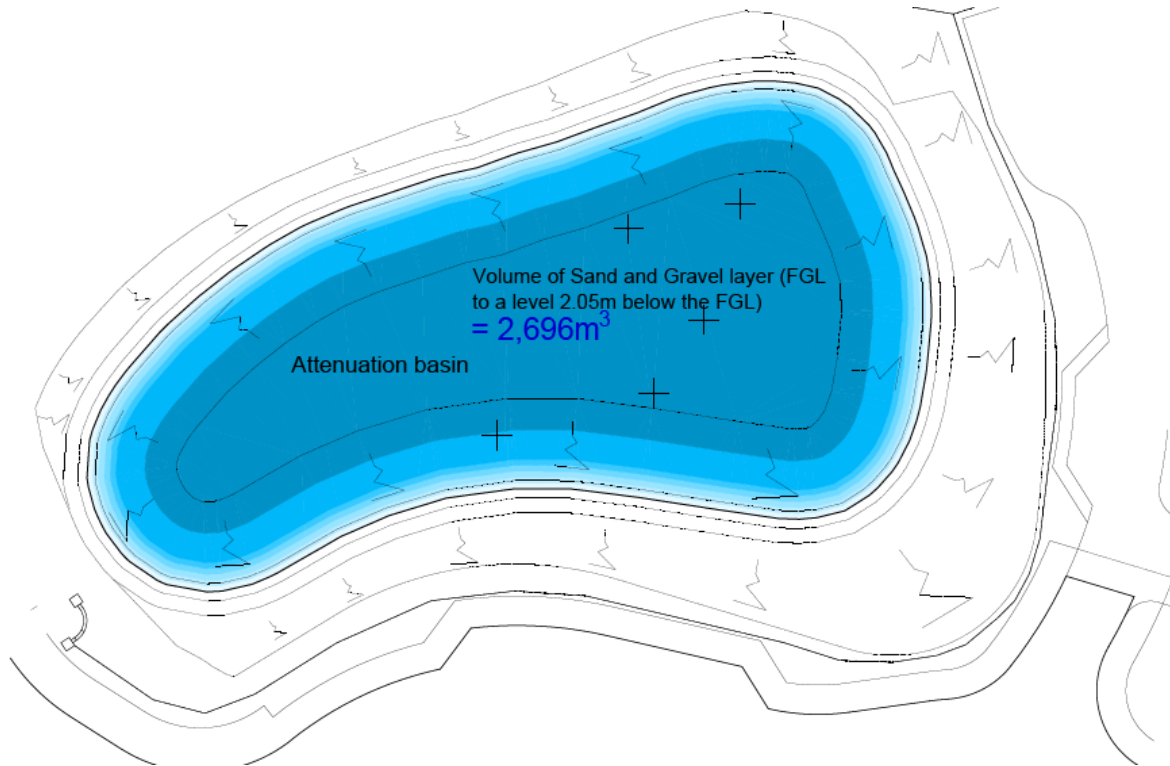


Figure -3 – Volume of sand and gravel provided above the waterproof layer to prevent floating of the layer due to buoyancy forces.

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 4065,000 kg; and
- Assuming a saturated density of 2000 kg/m³ for sand and gravel layer, the total mass of the sand and gravel layer is 5392,000 kg.
- Hence, the factor of safety against buoyancy = 1.33 (5392,000/ 4065, 000)

Based on the above assessment, it is recommended to surcharge the waterproofing layer using 2.05m thick sand and gravel layer.