Surface Water Drainage Assessment

Cherry Lodge Golf Club Planning Submission
Woodland Environmental
August 2011

WOODLAND
GOLF BUILD SPECIALISTS
shaping a future in golf

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CONTENTS

1.0	Introduction	2
2.0	Swales	3
3.0	Range Building Soakaway	5
4.0	Herringbone Sub-Surface Drainage System	6
5.0	Infiltration Pond	10

1.0 INTRODUCTION

1.1 There are no surface stream lines on the site, presumably because of the high surface permeability and the fact that it is close to a drainage divide as illustrated in Figure 5, Table 3 of the submitted FRA.

1.2 It follows that nothing within the development will alter surface runoff into local streams, since there are none.

1.3 The site is affected in parts by standing water, as there are no significant man-made drainage systems across the course. Highly irregularly for such a facility therefore, it is assumed that the course relies solely on natural drainage.

1.4 During consultations concerning the FRA with the Environment Agency, one of the concerns expressed was that the development should not result in changes in the surface water runoff into local watercourses.

1.5 The changes that could lead to increased run off into local watercourses can be summarised as:

1. Steepening of slopes locally, which could increase the rate of runoff;
2. Roof drainage from the new range building;
3. Overtopping of the proposed pond.

1.6 This report attempts to elaborate on the submitted FRA describing the measures Woodland Environmental are going to take in order to control surface water run off from the remodelled gradients, and improve surface water drainage across the course through a mixture of herringbone sub-surface drainage systems, soakaways, swales and an infiltration pond.

2.0 SWALES

2.1 The FRA recommends that swales should be employed at the base of slopes adjacent to the site boundary. These swales will attenuate excess surface runoff, allowing it to infiltrate freely into the surface. In this way, there is expected to be little or no change to the sub-surface drainage resulting from this proposed development.

2.2 The FRA suggests swales to the eastern and southern boundaries due to the lie of the land and potential runoff effects from remodelled contours. These are shown on page 16 of the FRA.

2.3 Following the request from Bromley for further clarification concerning drainage, it can be confirmed that the swales will be implemented in the positions shown on the Drainage Plan 100.11 Rev C.

2.4 The two swales to the south boundary will remain in the positions recommended by Hydro-Logic. The swale alongside the new contouring to the 14th Hole will however be shifted in towards the site, to lie at the toe of the proposed remodelling. In this way, the existing woodland block will not be affected by excavation.

2.5 As stated in the FRA, the net runoff generated for a 100 year storm has been calculated per metre of trench, and 3m wide swales with an average depth of 0.3 cbm were reccomended, giving a factor of safety of two to contain any runoff from the slopes within the swale.

2.6 The FRA calculates the required capacities of each swale as follows:

- Runoff coefficient of 30%. This is higher than the SPRHOST of 5.5 implies but is used to reflect the fact that imported soils may be less permeable.
- Design storm of 1 hour (depth of 54.3 mm for 100 year return period, see Figure 11), with an increase of 30% as an allowance for climate change this would be some 71mm.
- Depth of swale of about 0.3m.

2.7 Taking a 20 m long slope, the net runoff generated for the 100 year design storm is calculated, per metre of trench, as follows:

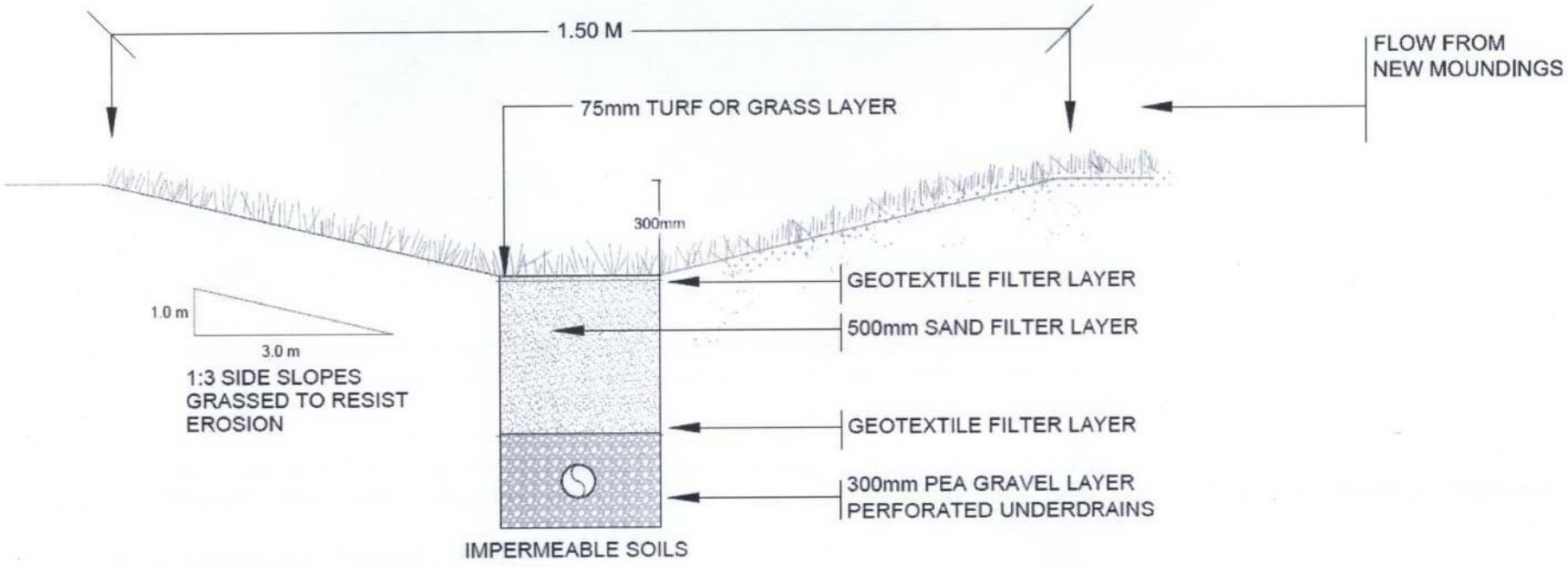
0.071 m rainfall x 20 m2 slope area x 0.3 runoff coefficient = 0.43 m3

2.8 A 3 m wide swale with an average depth of 0.3 m would have a storage capacity of 0.9 m3 per metre of trench, giving a factor of

safety of two to contain any runoff from the slopes within the swale. These dimensions, or any other combination of width and depth that would achieve the same cross-sectional area, are proposed as suitable mitigation against the risk of flooding beneath slopes of these dimensions.

2.9 Following a review FRA we found that that the recommended cross-sectional area can be achieved with a 1.5m x 0.6m swale, which halves the recommended width with a compensation through double the recommended depth.

2.10 **Cross Section of Proposed Swale**



3.0 RANGE BUILDING SOAKAWAY

3.1 In order to mitigate runoff from the 150 m2 roof area of the new range building, it is proposed that roof drainage should be routed into a soakaway. The FRA suggests that, given the very high permeability of the underlying chalk, a rectangular soakaway with gravel fill would be sufficient to control runoff.

3.2 The FRAs calculations assume an infiltration rate of 0.1 m/hr, which is conservative for chalk. The proposed rectangular soakaway of dimensions 3m x 2m with gravel fill, would have a porosity of 30%. Under these circumstances, the critical storm duration is 6 hours, with the water level rising to a maximum of 0.63 metres depth.

3.3 The FRA recommends that an infiltration coefficient is confirmed on site using a soakaway test and if the value is found to be significantly less than 0.1 m/hr, that the soakaway dimensions are revised accordingly.

4.0 HERRINGBONE SUB-SURFACE DRAINAGE SYSTEM

4.1 Sub surface drainage for the driving range, 14th Hole and Short Game Area will comprise herringbone type drainage systems which capitalise on the natural lie of the land to provide enhanced percolation and dispersal of surface water.

4.2 Draiange Plan 100.10 shows the natural topographies which indicate the direction of surface water on the site.

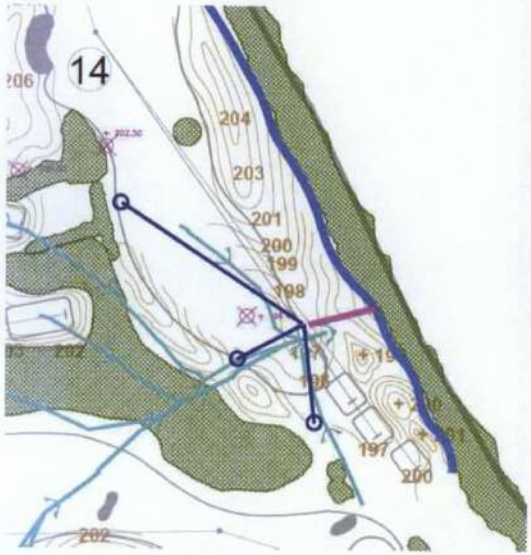
4.3 The driving range will utilise the natural drainage pattern running alongside hole 18 and through hole 1, with a herringbone sub-surface drainage system directing percolated surface water into this area.

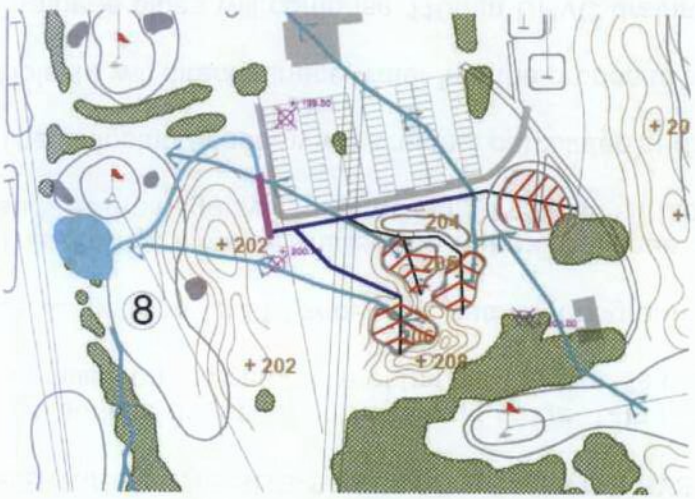
4.4 The Chipping Academy will channel percolated surface water into the proposed infiltration pond.

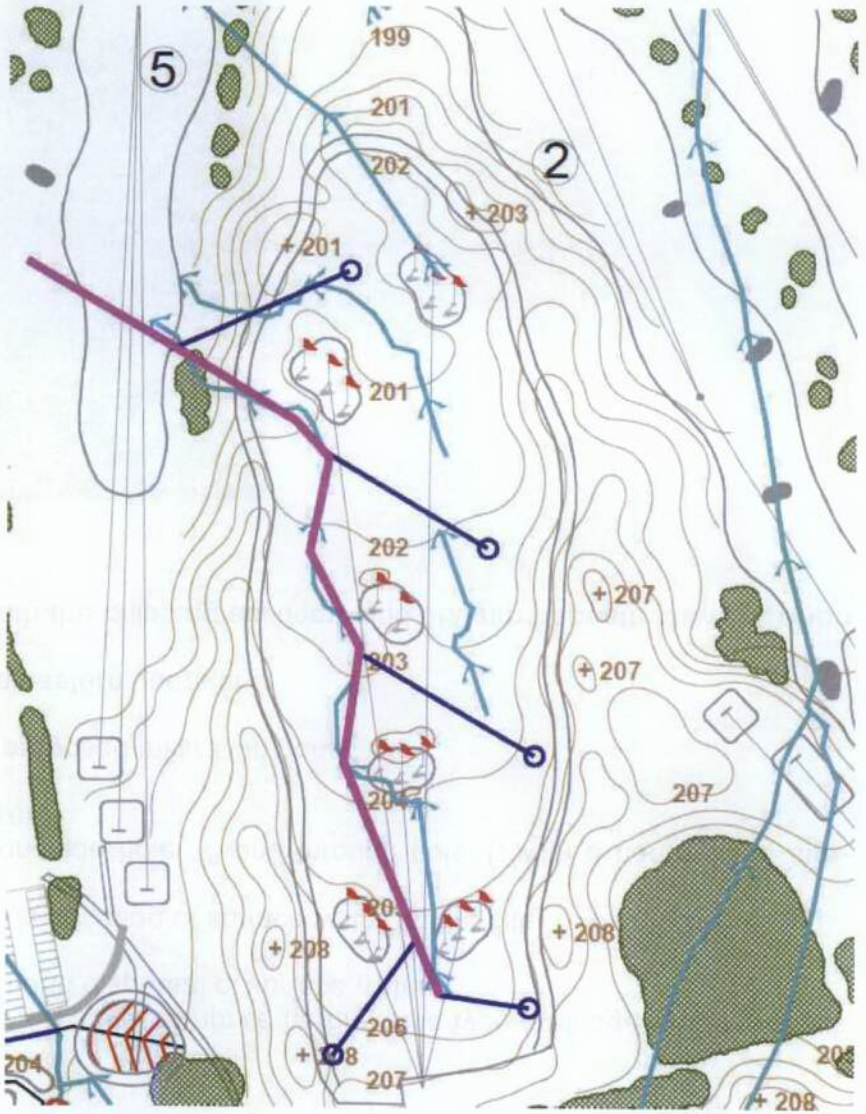
4.5 Hole 14 will direct surface water into the proposed swale alongside the eastern boundary.

4.6 Drainage pipes will comprise 110mm UPVC drainage pipes underneath the chipping academy and 160mm beneath fairways or on the range, terminating into a larger 200mm pipe.

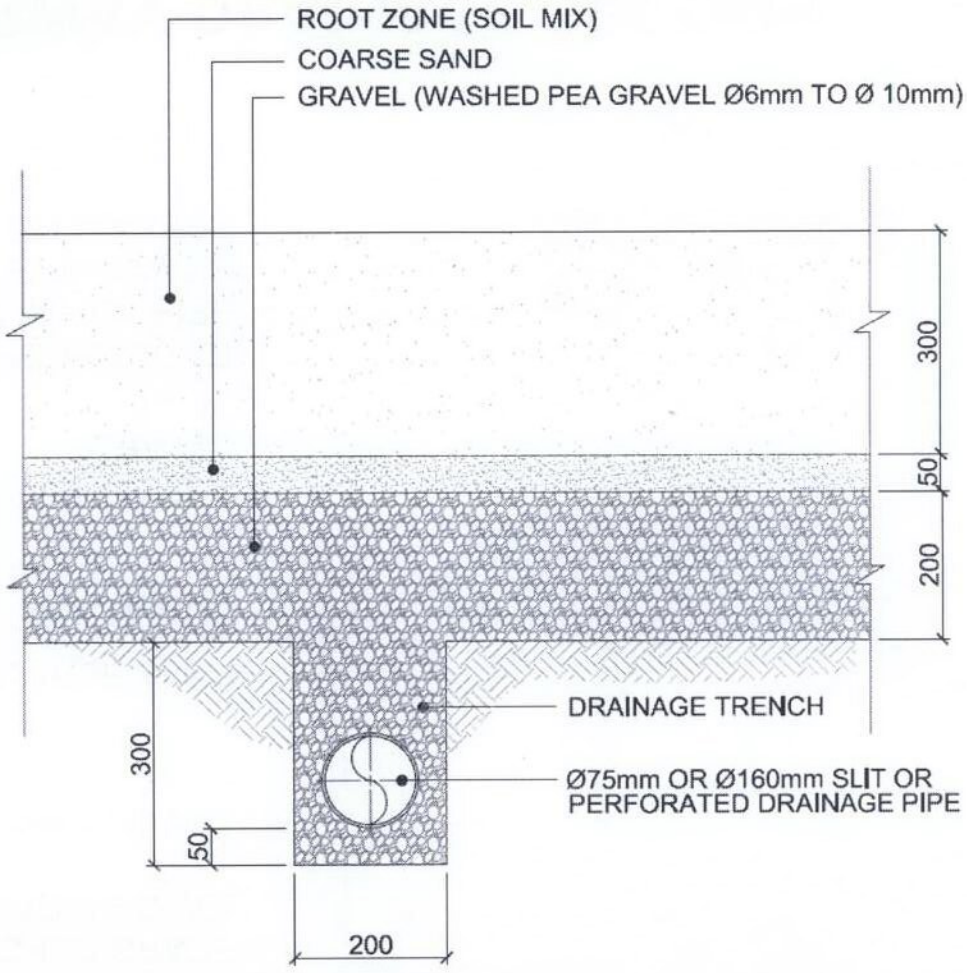
4.7 Location of Herring bone sub-surface drainage systems





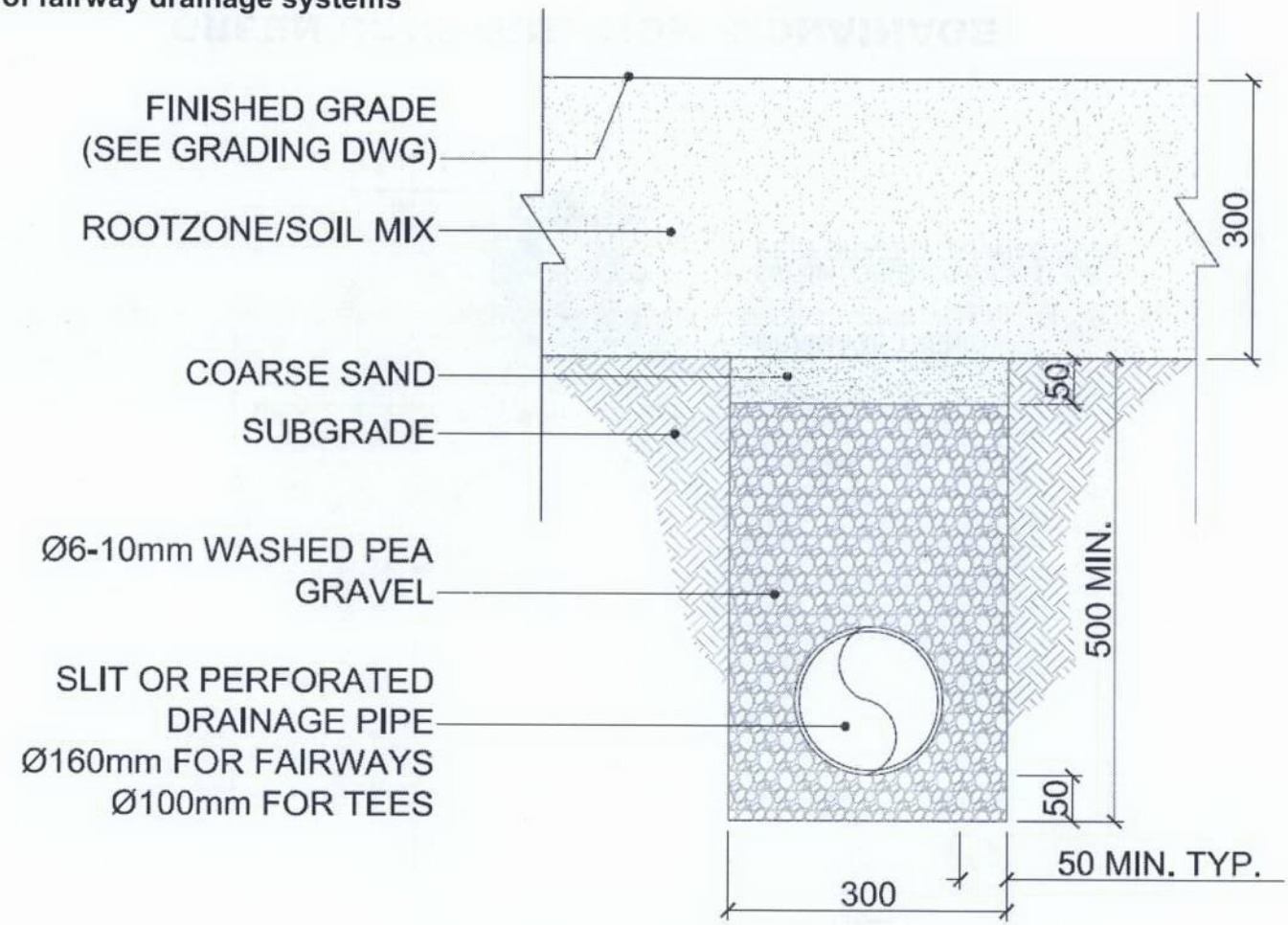


4.8 Specification of Short Game Area drainage system



GREEN CONSTRUCTION & DRAINAGE

4.9 Specification of fairway drainage systems



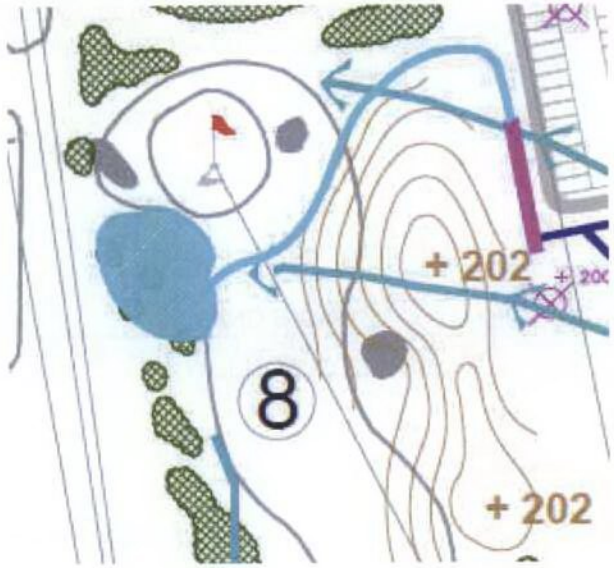
FAIRWAY DRAINAGE SECTION

N.T.S

5.0 INFILTRATION POND

5.1 The infiltration pond will contain surface water run off from the proposed chipping academy which will be routed through the herringbone sub-surface drainage system.

5.2 The SUD design manual (CIRIA, 2002) states that the pond should comprise typically 3-7% of the upstream catchment area. The pond has been designed at 350sqm in area with this in mind with 1m of dry storage capacity, which is more than adequate to cope with a 100 year storm event.



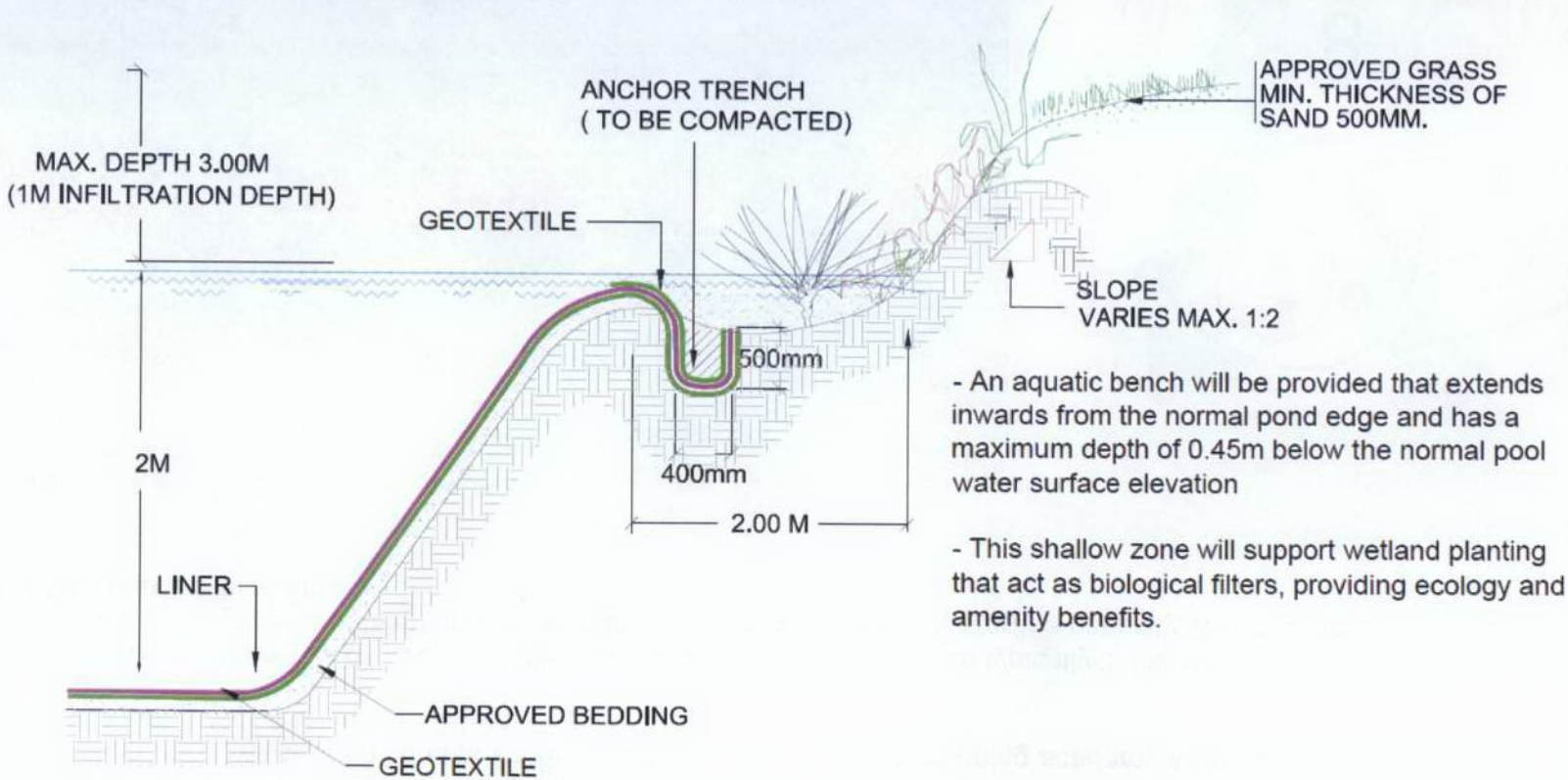
Indicative photograph of pond and location on 8th Hole

INFILTRATION POND DETAIL

- The permanent water level for the pond shall be around 2m, however the maximum depth to the invert level of the outlet structure is 3m. This additional depth provides adequate volume for the discharge of surrounding sub-surface drainage.

- The ponds area has been designed in accordance with the SUDs Manual, allowing 3 - 7% of the upstream catchment area.

- Depth of permanent pool should not exceed 2 metres to avoid stratification and anoxic conditions



- An aquatic bench will be provided that extends inwards from the normal pond edge and has a maximum depth of 0.45m below the normal pool water surface elevation

- This shallow zone will support wetland planting that act as biological filters, providing ecology and amenity benefits.