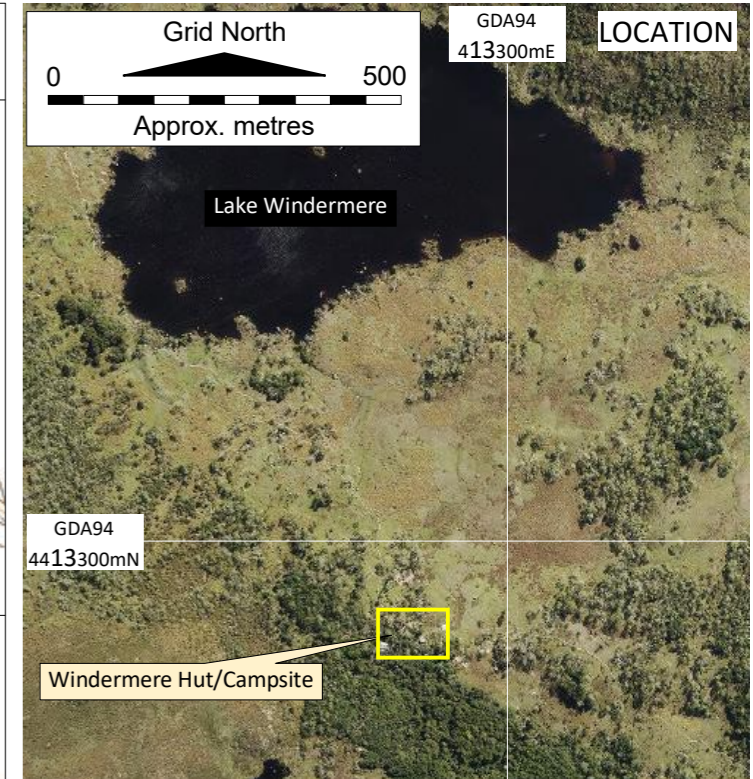
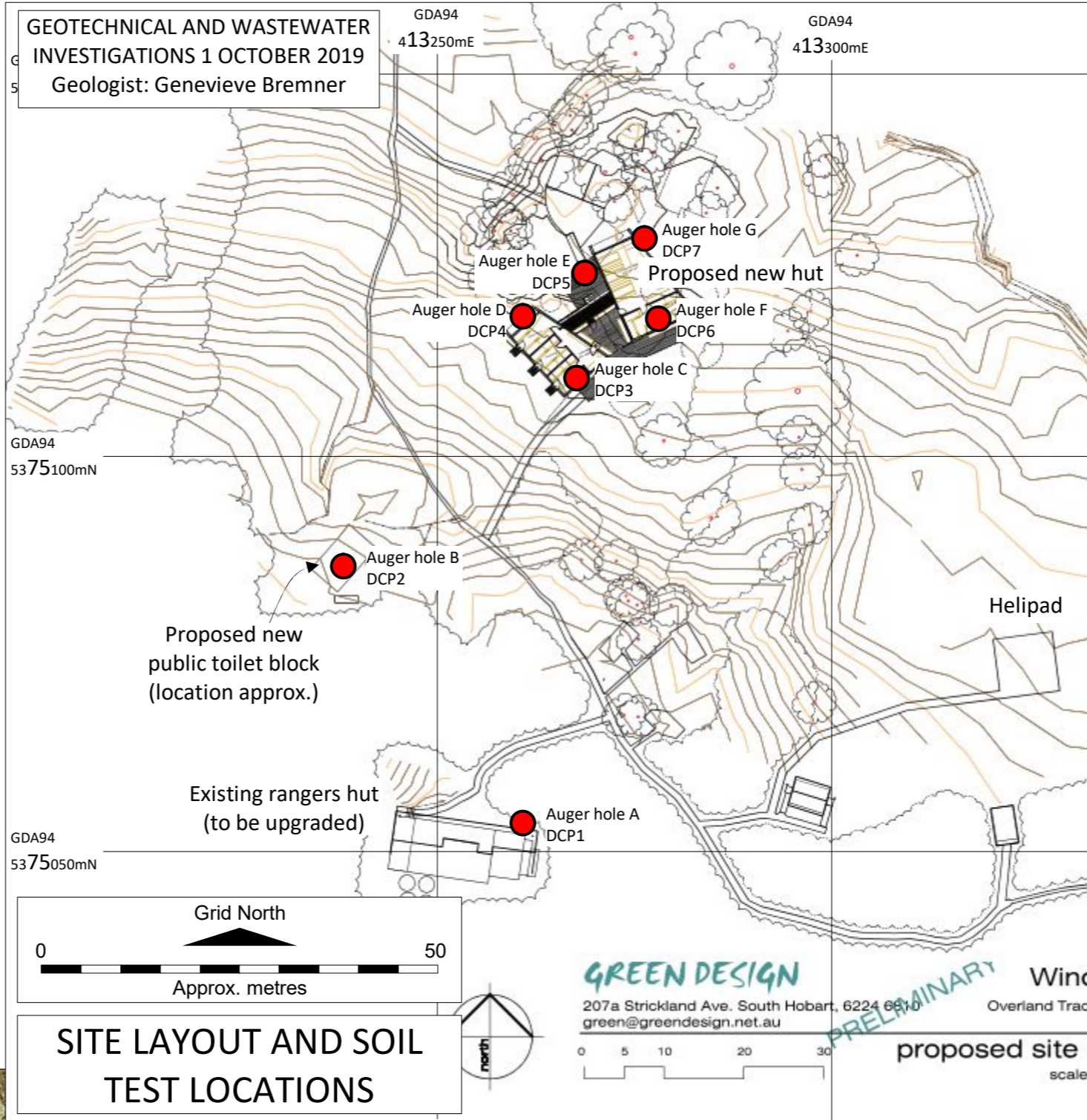


**SUMMARY LOGS OF AUGER HOLES**

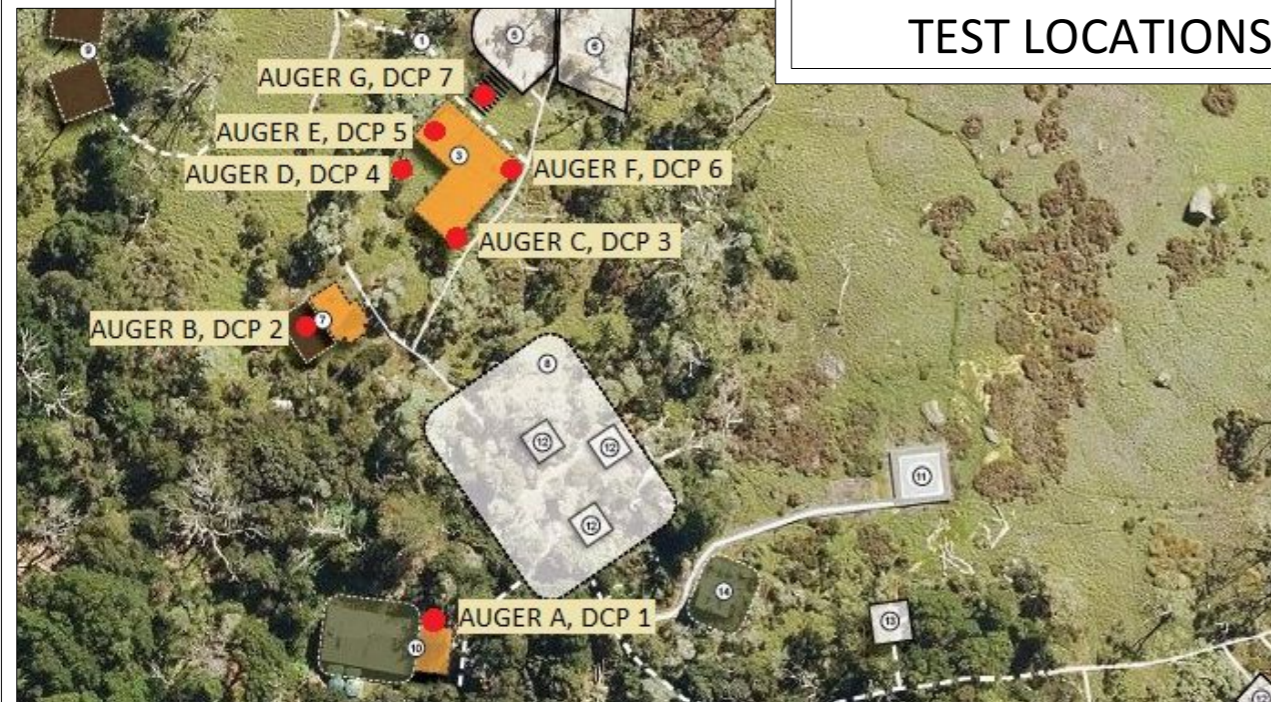
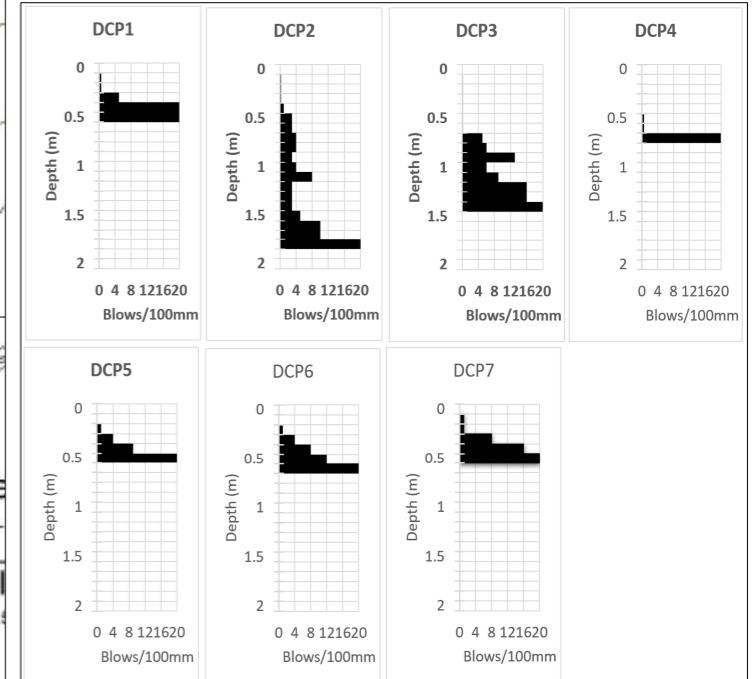
Test Pit		A	B	C	D	E	F	G
Depth dug (m)		0.4	0.85	0.7	0.65	0.3	0.3	0.3
Easting (GDA94)		413262	413238	413267	413262	413268	413277	413276
Northing (GDA94)		5375054	5375087	5375110	5375118	5375123	5375118	5375128
Water Table (m)		Ground saturated						

No.	Layer	Details	USCS	Interp	Figures are depths to top and bottom of layer, in metres							
1	Clayey SILT	Black-dark brown; abundant organic matter including moss/scrubs, leaf litter and plant roots; spongy texture; moisture => plastic limit; low plasticity; very soft-soft consistency.	SM - CL	Organic/peaty soil	0-0.1m	0-0.3m	0-0.05m	0-0.1m	0-0.05m	0-0.05m		
2	Clayey SILT to Sandy silty CLAY	Black; some organic matter; spongy texture; trace gravel; moisture > plastic limit; low to moderate plasticity; very soft-soft consistency; some holes; soil is saturated.	SM - CL	Peat	0.1-0.4m	0.3-0.5m	0.05-0.4m	0.1-0.2m	0.05-0.2m	0.05-0.2m		
3	Sandy gravelly clayey SILT	Black-dark brown; some organic matter including moss/scrubs, leaf litter and plant roots; spongy texture; moisture < plastic limit; low plasticity; very soft-soft consistency.	SM - CL	Moss and organic rich soil (A hor/zone?)	0-0.2m							
4	Sandy gravelly clayey SILT	Brown-orange; some organics; ~15% quartzite/schist pebbles-cobbles to 5cm; moisture => plastic limit (variable moisture content); low plasticity; soft consistency.	SM - CL	Moraine deposits?	0.2-0.35m		0.4-0.5m					
5	Clayey SILT to Sandy silty GRAVEL	Brown-yellow; minor organic matter; abundant quartzite/schist pebbles-cobbles; moisture =< plastic limit; low plasticity; friable; loose to medium dense.	SM - GW	Moraine deposits	0.35-0.4m refusal on cobble?		0.5-0.65m refusal on cobble?	0.2-0.3m refusal on cobble?	0.2-0.3m refusal on cobble?	0.2-0.3m refusal on cobble?		
6	Sandy silty CLAY to Clayey silty SILT	Dark grey to orange-brown downhole; minor gravel; moderate to high plasticity; soft consistency.	SM - SW	Moraine deposits		0.4-0.65m	0.5-0.65m					
7	Silty clayey gravelly SAND to Sandy GRAVEL	Orange-brown; coarse grained sand with abundant quartzite gravel to 3cm and interstitial clay and silt; low plasticity (locally moderate to high); loose to medium dense	SW - GW	Moraine deposits		0.65-0.85m refusal on cobble?	0.65-0.7m refusal on cobble?					

**GEOTECHNICAL AND WASTEWATER INVESTIGATIONS 1 OCTOBER 2019**  
Geologist: Genevieve Bremner



**DYNAMIC CONE PENETROMETER (DCP) PROFILES**



**AS2870 SITE CLASSIFICATION FOR BUILDINGS**  
In terms of AS2870 Residential slabs and footings (2011), the site of the new Windermere Hut and the proposed new public toilet block are Class P. The reason for this classification is the saturated ground conditions at the time of investigation. From the DCP profiles, footings for both sites should extend to material of adequate bearing capacity (blows/100mm > about 4 or 5) beneath peat and low strength clayey sandy silt, at approx. depths in the 0.4m – 0.6m range for both sites.

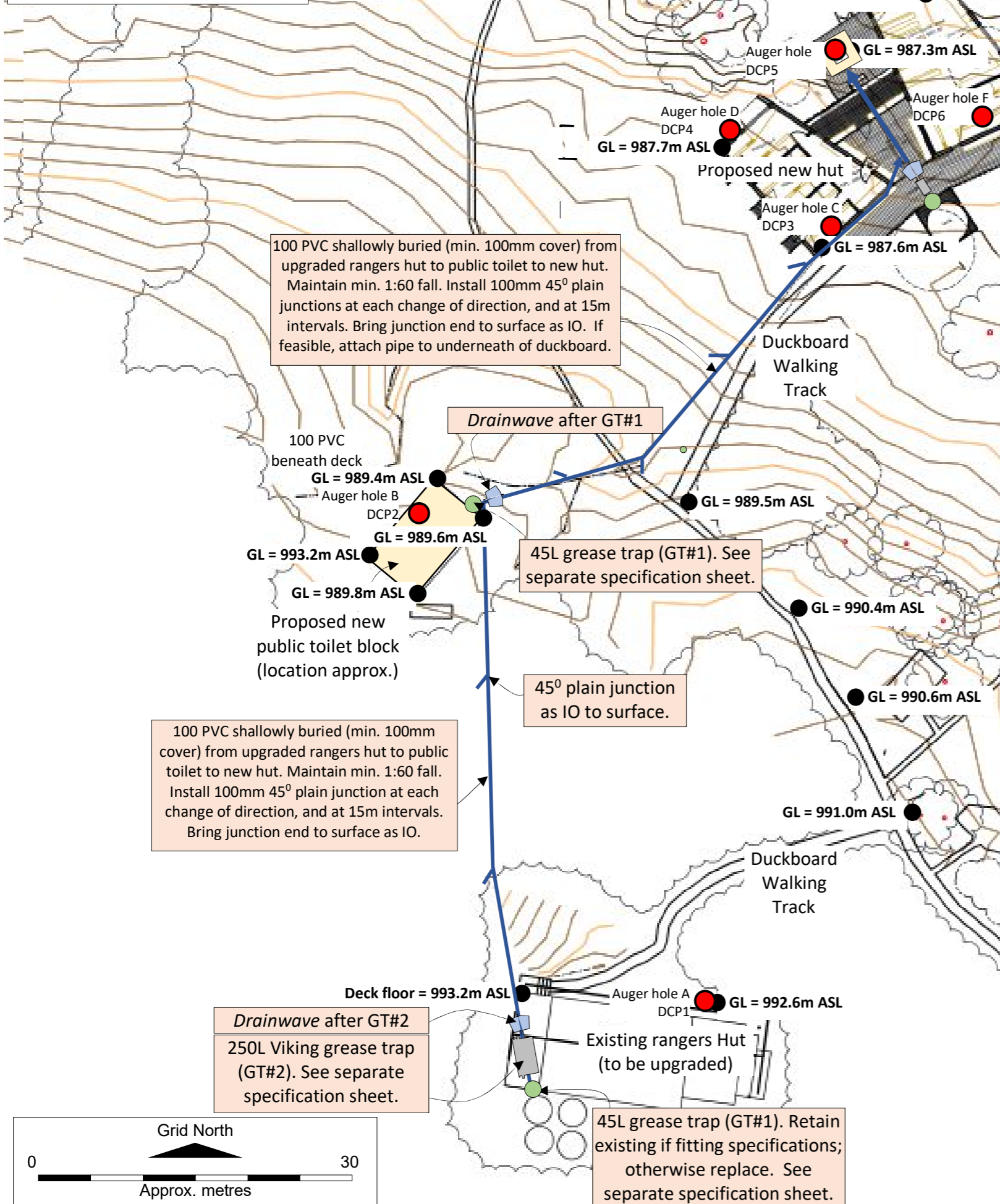
**NOTES FOR GREYWATER MANAGEMENT**  
In terms of AS/NZS1547 On-site domestic wastewater management (2012), the soils are Category 6 because of the seasonally high water table and likely limiting layer beneath surface peat. An appropriate design for greywater treatment is an above-ground system. A bottomless sand filter (BSF) is recommended.

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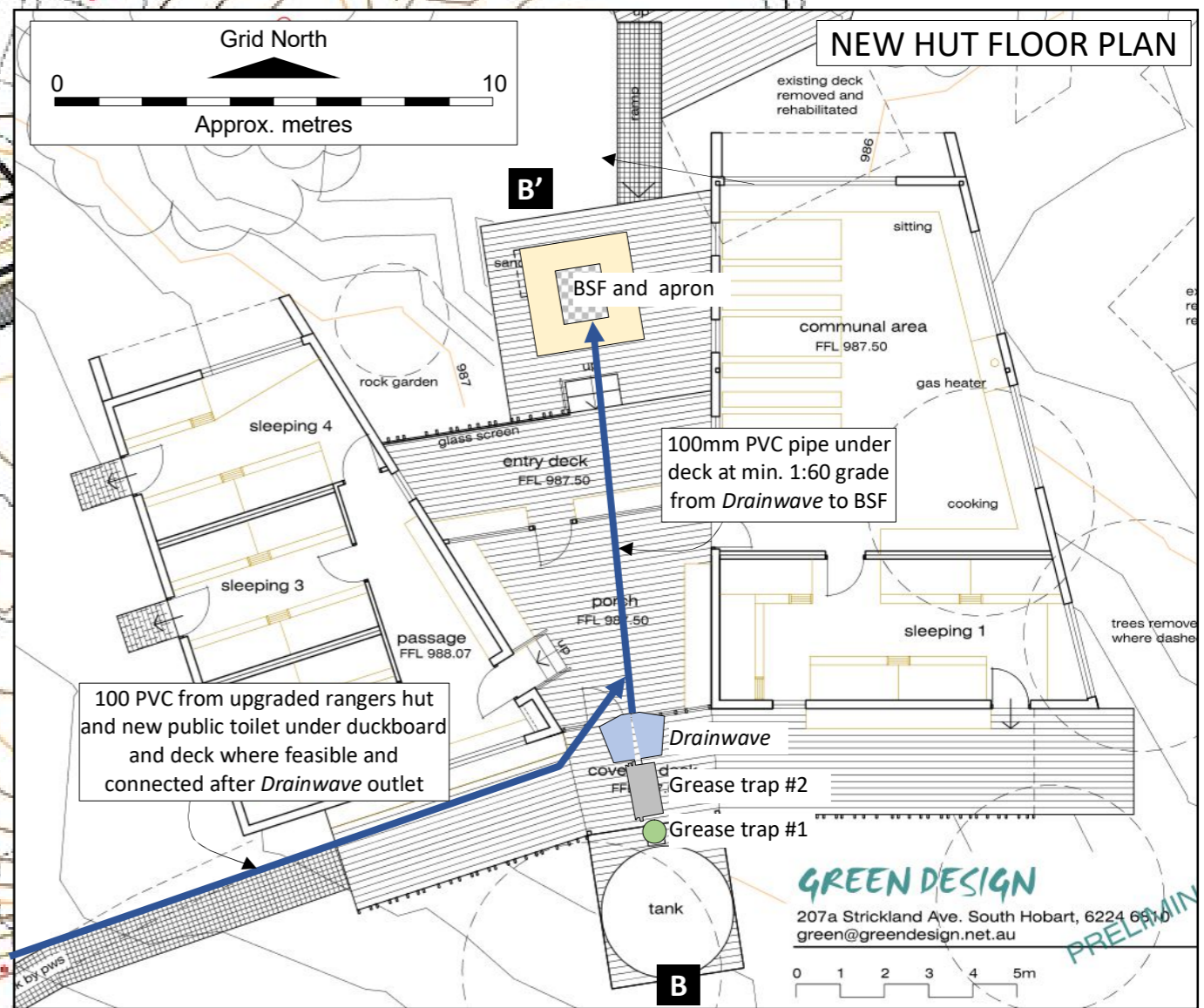
William C Cromer Pty Ltd  
Consulting engineering, environmental and groundwater geologists  
Parks & Wildlife Service  
Windermere Hut  
Greywater Design Upgrade

Geologist: Genevieve Bremner

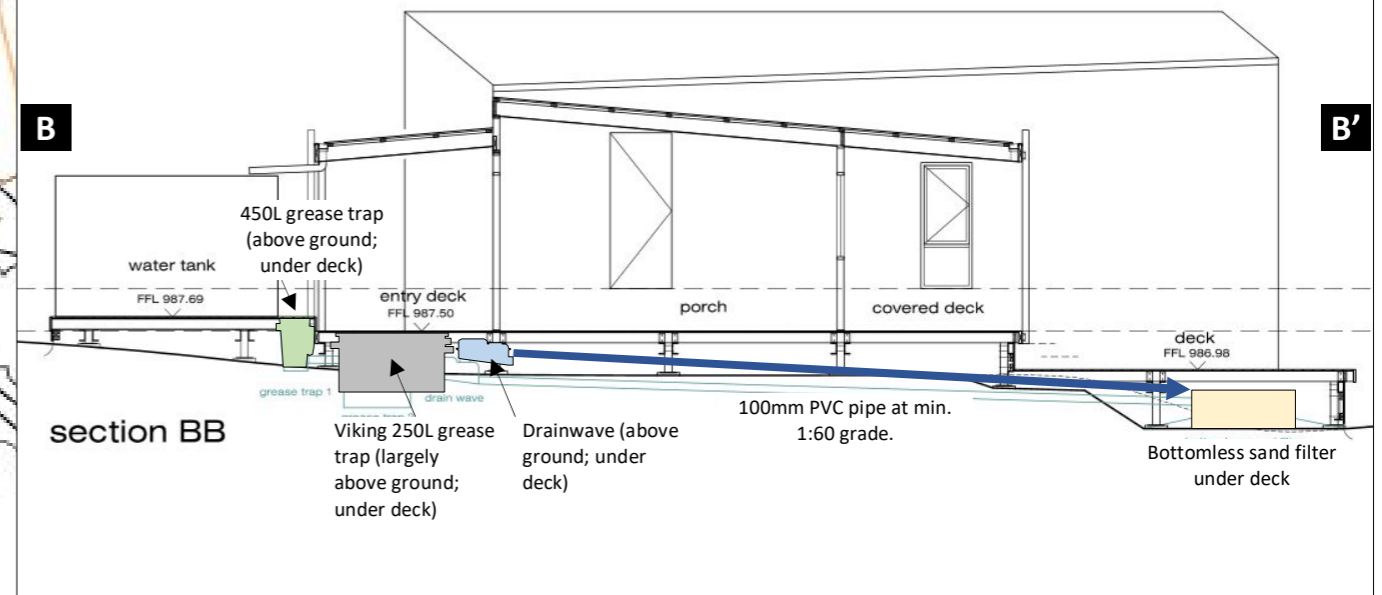
● Hand-augered hole and dynamic cone penetrometer (DCP) test



**SCHEMATIC LAYOUT OF GREYWATER SYSTEM**



**NEW HUT SECTION BB'**

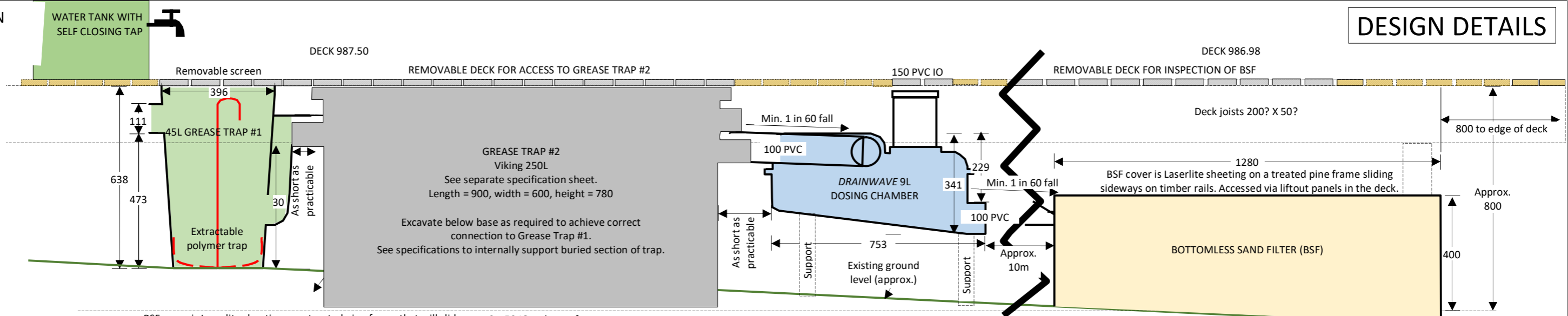


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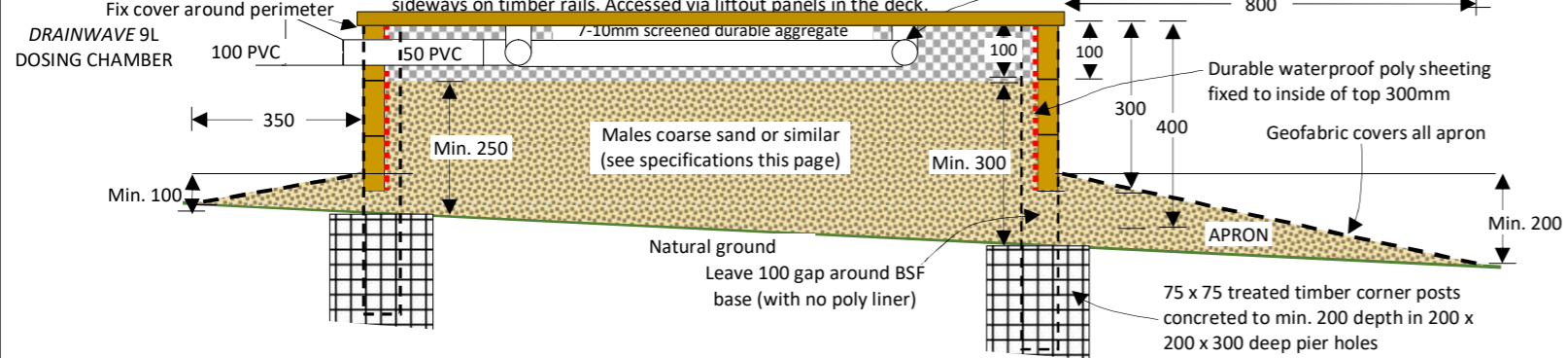
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Windermere Hut  
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SECTION

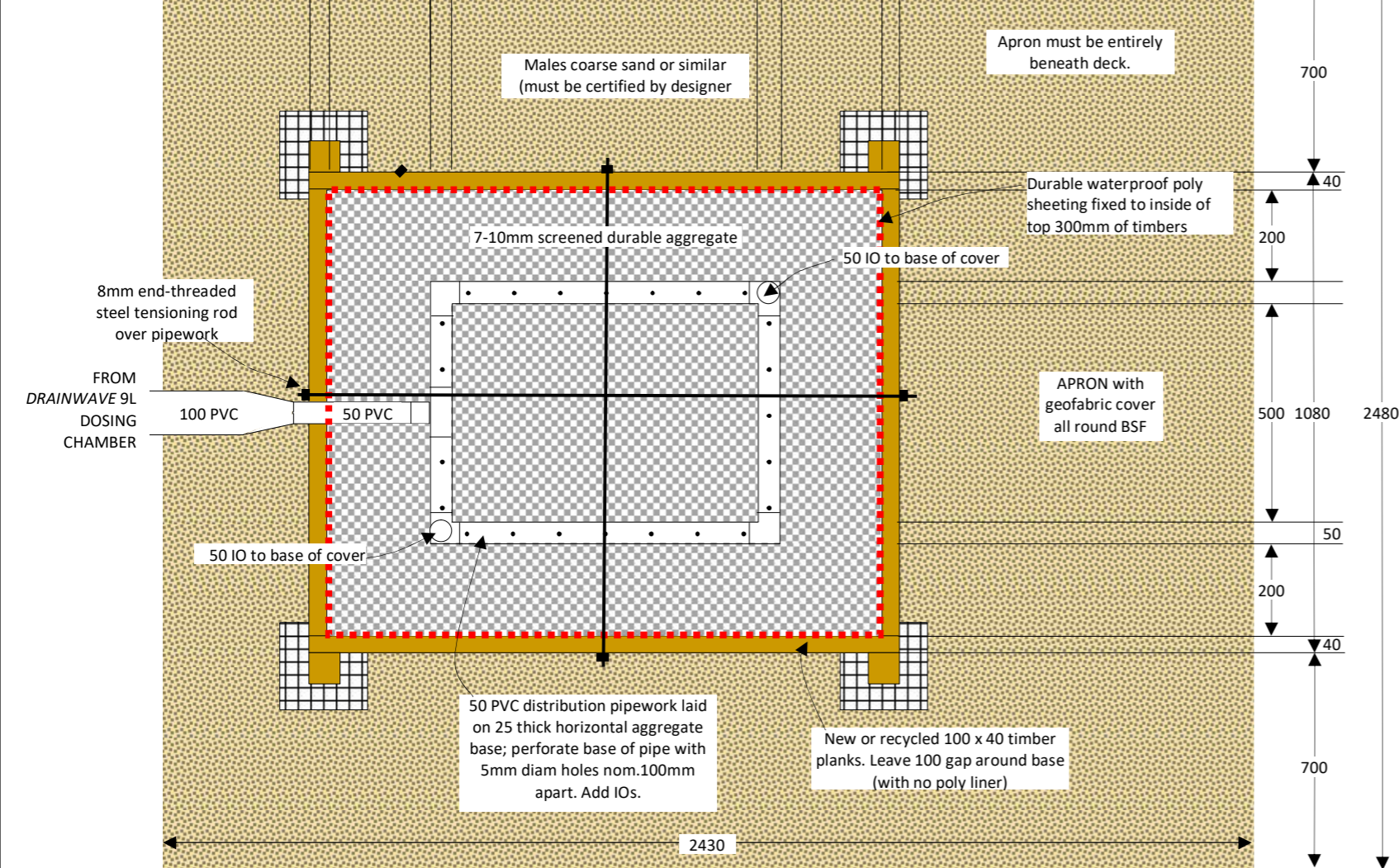
DESIGN DETAILS



BSF SECTION



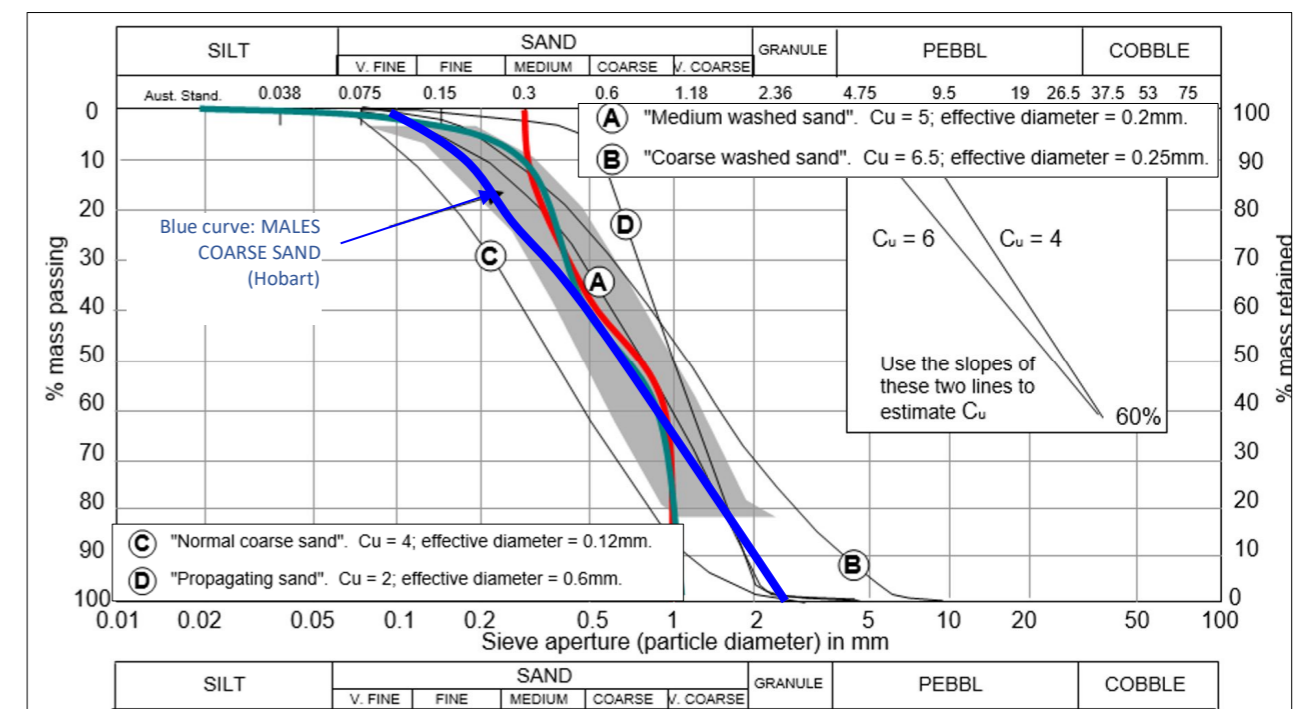
BSF PLAN



**IMPORTANT**  
Sand for the BSF and its apron must be imported, clean, screened and washed COARSE SAND with grain size distribution as per Males Coarse Sand (see graph and sieve analysis below), or sufficiently similar. **Installer must collect and submit (for certification) to Bill Cromer (0408 122 127) a 2kg subsample from the sand proposed and set aside to be used.**  
Est. sand volume required for BSF and apron = 0.9m<sup>3</sup>.

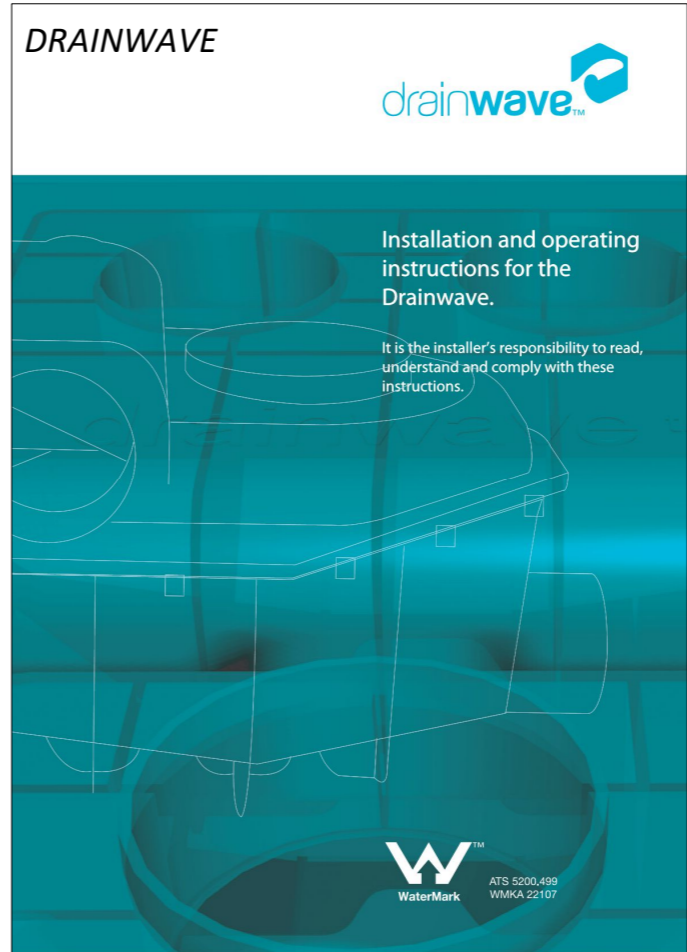
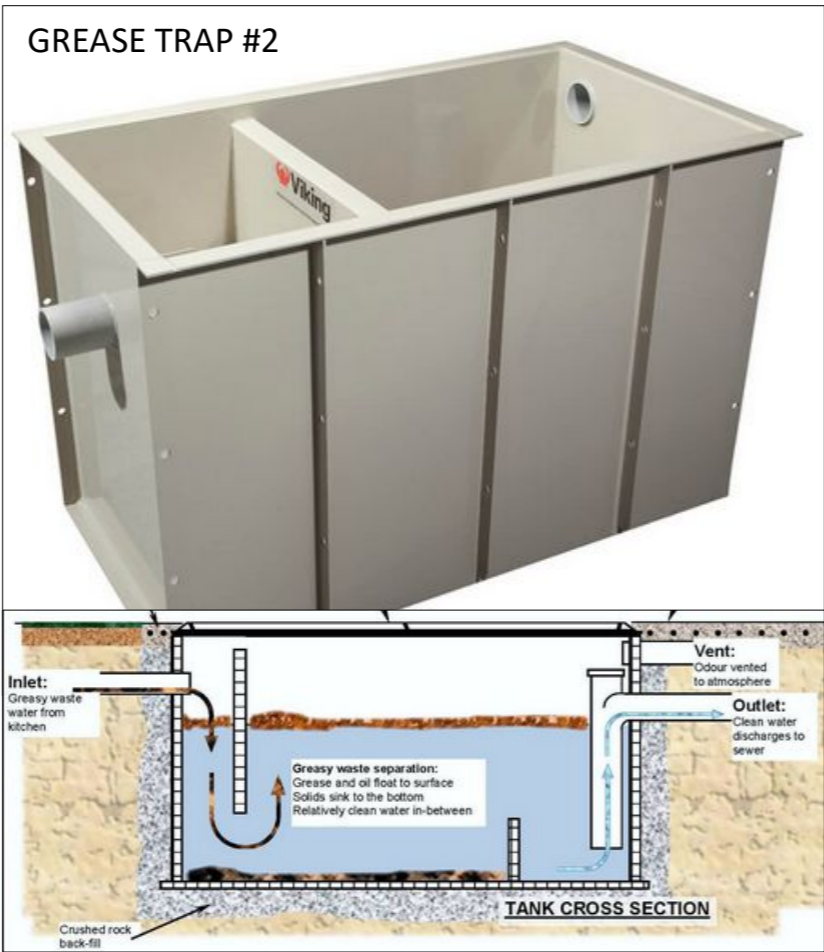
Sieve analysis	
Typical Males coarse sand	
Sieve size (microns)	% retained by weight
500	60
425	8
300	8
250	7
180	8
106	7
90	1
63	0.4
45	0.4
<45	0.2
<b>Total</b>	<b>100</b>

**GREYWATER VOLUME AND BSF SIZING**  
Estimates provided by Green Design  
Design visitations: 40 bushwalkers/day  
Design greywater use:  
2L/day/bushwalker = 80L/day  
5L/day/warden = 5L/day  
7L/day/ranger = 5L/day  
Total (say) = 100L/day  
Design greywater loading rate for BSF = 80L/day/m<sup>2</sup>  
Design wetted area for BSF = 100L/day divided by 80L/day/m<sup>2</sup> = 1.25m<sup>2</sup>  
BSF design = 1m wide and 1.25m long.  
Perimeter = 4.5m.  
Resulting linear loading rate = 80L/day/m<sup>2</sup> divided by 4.5m = 18L/day/m.



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# GENERAL NOTES



At the upgraded rangers hut, replace or re-use the existing 45L grease trap (#1). At the new hut and new public toilet, install an identical new grease trap (#1).

At the upgraded rangers hut, install a Viking 250L grease trap (#2) after grease trap (#1). At the new hut, install a Viking 250L grease trap (#2) after grease trap (#1). Installers must read, understand and comply with the instructions for installing grease traps #1 and #2. See specification sheets accompanying this Design.

Installers must read, understand and comply with the instructions for installing and operating the *Drainwave*. To download a copy, Google "drainwave installation and operating instructions" and click on [pdf]drainwave\_inst manual\_O2c – Ecomerchant. These are generalized Notes.

Installers must read and understand the Notes for installing Bottomless Sand Filters at <http://www.williamccromer.com/content/uploads/2013/12/20131201-Bottomless-sand-filters-design-notes-1-Dec-2013.pdf> These are generalized Notes.

## GENERAL NOTES Before construction

This is a desktop assessment supported by site inspection and soil investigation. The designs shown here are in general accordance with the *Building Act 2016*, the *Building Regulations 2016*, and (where applicable) the following:  
 AS/NZS1547 (2012). *On-site domestic wastewater management*  
 Director's Guidelines for *On-site Wastewater Management Systems* (Dec 2016)  
 Guide to *Domestic Greywater Re-Use* (June 2017)  
 Director's Determination: *Accreditation and Maintenance of Plumbing Installations* (Dec 2016)

It is expected that this document will form the basis of a Plumbing Permit (if required). The plumbing contractor shall be familiar with the design, operation and installation details of all components of the greywater system. Guidance, references and specification sheets are provided.

## During construction

The plumbing contractor is advised that variations to the designs in this document are permissible provided they do not compromise acceptable greywater treatment, or regulations. Ground conditions are difficult and transport of materials to the job will be mostly by helicopter. The plumbing contractor shall liaise with William C Cromer Pty Ltd about any issues requiring clarification, and the stages of the job which may need to be inspected for final certification (if any). Key issues for installation are: all components are under decks; all components are accessible from removable openings in the decks; the apron of the BSF is completely covered by geofabric and is also completely under the deck; the BSF cover is Laserlite sheeting on a treated pine frame that will slide sideways on timber rails. Access the BSF via liftout panels in the deck. Although the minimum specified PVC pipe gradient is 1:60, and space under the decks is limited, wherever possible gradients shall be maximised to reduce the chances of grease and fat accumulation.

## Maintenance after construction

The intent of this greywater design is to treat greywater to secondary level in the BSF from both the Windermere Hut and separate public toilet block, and the upgraded Rangers Hut. Food scraps and grease should be prevented from entering the system (including the 100mm PVC pipework and BSF). Grease trap #1 at all three sites is intended to capture most food scraps and other matter washed or wiped from utensils, plates, cups, etc. Grease removal is expected to be limited. The extractable poly trap shall be emptied by staff by hand (whenever necessary: eg 2 or 3 times per week) directly to the available composting toilets, or into a larger, sealed bin, for later removal to the composting toilets. This grease trap must have a high-level outlet as shown above. Grease trap #2 of 250L with high-level outlet as shown above is designed to retain all remaining heavy solids and grease. It should be inspected as regularly as necessary, and emptied when too full to work properly. The *Drainwave* accumulates greywater from the two grease traps and discharges it in 9L amounts to the BSF. This enhances even distribution through the pipework on the BSF, and enhanced treatment through the sand filter. The *Drainwave* shall be inspected for overflow grease/fat accumulation each time the grease traps are inspected. The BSF is designed to discharge secondary-treated greywater vertically to its base and then horizontally through its apron onto surrounding ground. It should require little maintenance. Inspections after removing its cover shall be done as frequently as necessary to ensure that no clogging layer is developing on the surface of the sand filter. If so, it means that grease traps #1 and #2 may not be working properly, or are not being cleaned out regularly enough. This is a critical aspect of system operation, since clogged BSF filter sand may need to be replaced.

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