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REPORT ON
INVESTIGATION AND ASSESSMENT FOR ON-SITE EFFLUENT MANAGEMENT AT LOT 108 DP 12749, No. 11 FLORENCE TERRACE, SCOTLAND ISLAND

PREPARED FOR: MR. J. WISH
SUBMITTED TO: NORTHERN BEACHES COUNCIL – DA2024/1032

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1. INTRODUCTION

This report outlines the results of an investigation and assessment for on-site effluent management at Lot 108 DP 12749, No. 11 Florence Terrace, Scotland Island. The investigation was performed at the request of Mr. Wish. The report will be submitted to Northern Beaches Council to address their requirements as part of DA2024/1032 and their Return of Application letter to Shed Architects dated 1/8/24.

The unsewered property at a waterfront locality in the northeastern part of Scotland Island, which has an area of 734m^2, comprises an existing dwelling, boat shed with limited plumbing, small garden shed and associated features (Figure 1). There is a system for on-site effluent management which comprises the following components:

- 2 x 3000 litre Everhard polyethylene tanks for the dwelling. The first tank functions as a septic tank. The second tank accepts the primary treated liquid effluent and has a pump to transfer the material upslope to the components of the land application area **(LAA)** – i.e. functions as a pump well.
- A small holding well with macerator pump (i.e. pump well) for the boat shed that is understood to transfer the limited waste generated to the septic tank.
- The LAA as a whole consists of two absorption trenches.

The proposed development comprises the renovation and extension of the dwelling. Reference to Figure 1 shows the footprint of the dwelling when renovated and extended. The works will only increase the maximum potential occupancy level of the dwelling by one person, which equates with a 25% increase beyond the current maximum. This is considered to be a positive scenario, particularly in light of the upgraded arrangement for effluent treatment and significantly improved quality of wastewater to be provided.

As a function of the small land area of the unsewered property, in conjunction with the area taken up by the existing and proposed features of development, a best-fit solution (or 'best practicable option' from AS/NZS 1547, 2012) is applied to on-site effluent management and where possible, appropriate guidelines and standards are adhered to. The best-fit solution is based on minimising water usage and effluent generation and providing a high level of wastewater treatment. This will result in beneficial effects and a much improved scenario with respect to both public health and the environment.

A best practicable option is defined in AS/NZS 1547 (2012) as being 'the option for wastewater servicing, treatment and land application that best meets public health, environmental and economic objectives'. Reliance on Council is also required to accept the best practicable option and variations to certain guidelines and standards to achieve a result for on-site effluent management and what will be the significant improvements in this regard.

2. PROPOSAL FOR EFFLUENT MANAGEMENT AND DESIGN WASTEWATER VOLUME

As determined with Mr. Wish, the proposal for effluent management from the dwelling when renovated and extended plus the boat shed comprises the following components:

- The continued use of the baffled septic tank servicing the dwelling. It is understood that this is the western tank.
- The continued use of the small pump well for the boat shed.
- The conversion of the second tank, or pump well, into an aerated wastewater treatment system **(AWTS)** – it is understood that this is the eastern one. When this is done, it will be akin to having a dual tank AWTS.
- The continued use of the existing two absorption trenches for what will be the secondary treated effluent from the AWTS. This is because it is understood that the trenches have been operating properly with the application of primary treated effluent without showing signs of failure by way of surface surcharge/waterlogging and weed plumes for example. At the time of the site investigation on 13/9/24, the areas containing the trenches also displayed no signs of failure. Furthermore, as distinct to the primary treated effluent currently being applied, the application of secondary treated wastewater will improve the condition and performance of the absorption trenches, whilst based on the approach in AS/NZS 1547 (2012), will effectively at least double their capacity.

Note that the location and dimensions of the existing two absorption trenches were indicated by the installer, Mr. P. Hebden of Pittwater Pumps and Tanks, as well as Mr. Wish. Based on this information, the position of the existing trenches are shown in Figure 1. With these operating properly without showing signs of failure based on the current two persons residing in the dwelling on a full-time basis and application of primary treated effluent, there was no obvious surface expression of them – i.e. just a feint expression. This is a positive scenario because if they were failing, then their positions would be readily observed. Mr. Hebden has also indicated that there is a twin outlet 'distribution box' associated with both absorption trenches which provide equivalent volumes of treated effluent being applied to them at any one time. At the time of the site meeting with Mr. Wish, the location of the distribution was not known or observable.

It is important to acknowledge, there is some slight approximation with the location of both trenches and their dimensions shown in Figure 1 and outlined in this report. However, based on the details provided by Mr. Hebden and observations on the property, the existing trenches to be retained for continued use have the following approximate dimensions and were installed in late 2018 or early 2019:

- Absorption trench 1 – 6.9m in length, 0.9m in width and minimum depth of 0.6m.
- Absorption trench 2 – 7.9m in length, 0.9m in width and minimum depth of 0.6m.

Further to the details above, there is also some minor approximation with the position of the two existing wastewater tanks under the deck adjacent to the southern side of the dwelling as indicated by Mr. Wish (Figure 1).

This report is submitted to Council as part of the approval process for the proposed development and arrangement for on-site effluent management. Blue Mountains Geological and Environmental Services is not responsible for the installation, operation, maintenance and on-going performance of both the existing and proposed components of the effluent management system as a whole.

The main environmental concern with the AWTS in general is considered to be the levels of nitrates, phosphates and faecal coliforms generated, particularly if prescribed treatment levels are not achieved. Reference to the Guidelines in Department of Local Government et. al. (1998) shows the expected quality of wastewater after treatment in an AWTS, which is given in Table 1. Design figures may not be indicative of long-term operational characteristics, and an AWTS must be well maintained and operated to achieve this quality on a continuous basis. Note that the aerated systems currently on the market and accredited by the NSW Health Department provide a better wastewater quality with nitrogen **(N)** and phosphorus **(P)** concentrations typically not exceeding 15 - 20mg/litre and 10 - 12mg/litre respectively.

TABLE 1: EXPECTED QUALITY OF WASTEWATER AFTER TREATMENT IN AN AERATED SYSTEM

PARAMETER	**CONCENTRATION**	**FAILURE INDICATOR**
BIOCHEMICAL OXYGEN DEMAND	<20mg/L	>50mg/L
SUSPENDED SOLIDS	<30mg/L	>50mg/L
TOTAL NITROGEN	25 - 50mg/L*	not applicable
TOTAL PHOSPHORUS	10 - 15mg/L*	not applicable
FAECAL COLIFORMS NON-DISINFECTED EFFLUENT	up to 10^4 cfu/100mL	not applicable
FAECAL COLIFORMS DISINFECTED EFFLUENT	<30cfu/100mL	>100cfu/100mL
DISSOLVED OXYGEN	>2mg/L	<2mg/L

* Improved treatment levels with currently accredited systems.

Aerated systems rely on biological activity for proper system operation. Changes to the effluent loadings, in the form of either a significant increase or decrease, may result in poor system performance. It is suggested that an AWTS must be operated continuously and the power must not be turned off, as intermittent use may require servicing of the system at each start up.

It would be prudent, as with on-site or reticulated sewer, to continue a water usage minimisation scheme in the dwelling when renovated and extended plus the boat shed. The requirement for minimising water usage and effluent generation is considered to be more pronounced on Scotland Island due to the small size of the residential unsewered properties and setting within Pittwater.

Whilst the AWTS provides for re-use of all domestic effluent by application to the land, reducing the loads to be treated and discharged will significantly decrease the potential for adverse environmental impacts. The dwelling and boat shed where applicable are understood to have a set of water-reduction fixtures and devices including low-flow showerheads, low litreage dual flush toilets, aerator taps and what is a front loading washing machine. This will reduce water usage and effluent generation at the source.

It is suggested to utilise ‘environmentally friendly’ cleaning, washing and detergent products to reduce the levels of P, as well as sodium, discharged into the proposed AWTS and existing absorption trenches. Furthermore, reducing the amounts of such products used would also be beneficial to the environment. Reference to the Figure in Appendix 1 shows the sodium contents in grams/wash for a variety of laundry detergents used in both front and top-loading washing machines (from Dr. R. Patterson, Lanfax Labs). It is recommended to utilise laundry detergents with the lowest sodium content as practical. Cross-matching low sodium products with low P ones would also be beneficial.

Further to the details above, it is important to ensure that chemical cleaning and detergent products are compatible for use with an on-site effluent treatment system. Such products can kill off bacteria in a treatment device, which results in ineffective treatment (particularly with respect to faecal coliforms). Use of harsh bleaches and disinfectants should be avoided, but only used sparingly if necessary. Alkalinity and P contents in cleaning products can also have an influence on performance and the treatment levels achieved. However, with low P products, a relatively higher alkalinity is required in order to get an appropriate level of cleaning, which can adversely impact upon a treatment system.

Based on discussions with Mr. Wish, the following details are provided in relation to wastewater generation at the subject site:

- The dwelling and boat shed is serviced with a tank water supply derived from roof runoff.
- The existing dwelling comprises two bedrooms and lacks any rooms that could be viewed by Council as a ‘potential bedroom’ such as an office of study for example.
- When renovated and extended, the dwelling will have three bedrooms and also lack a potential bedroom.

- When renovated and extended, the dwelling will continue to be occupied by only two persons on a full-time basis.
- The boat shed is fitted with a toilet and hand-basin, whilst it lacks a bedroom and is not used (or permitted by Council to be used) for overnight habitation.

For the boat shed, usage of the features of wastewater generation will be at the expense of the same not being utilised in the dwelling. Therefore, no addition will be applied to the boat shed beyond the maximum design effluent volume applied to the dwelling when renovated and extended (i.e. akin to the scenario with a rural shed for example).

The design effluent volume is dependent on the number of bedrooms. for the existing dwelling allowance is made for a maximum of four full-time occupants. Reference to Table H1 in AS/NZS 1547 (2012), the typical domestic wastewater design flow allowance for dwellings with a tank water supply is 120 litres/person/day. Based on this data, the maximum design effluent volume from the dwelling is currently 480 litres/day.

Reference to Table J1 in AS/NZS 1547 (2012) shows that a three bedroom dwelling has a population equivalent of 1 - 5 persons. With allowance for five full-time occupants in the dwelling when renovated and extended, the maximum design effluent volume will be 600 litres/day.

To re-iterate, it is important to ensure that appropriate water-conservation practices are carried out in the dwelling when renovated and extended and boat shed so the output of effluent is ideally kept as low as possible. However, for the two persons who will continue to reside in the dwelling when renovated and extended, the design output of effluent is only 240 litres/day.

3. SITE DESCRIPTION

The property comprises an elongate-shaped parcel of land that has a frontage of 10.06m onto Florence Terrace and extends downslope in a north-northeasterly direction to the mean high water mark at Pittwater for distances ranging from 58.67 - 60.655m. Reference to Figure 1 shows the footprint of the dwelling when extended off its northern side, as well as other features on the property.

The approximate location of the existing LAA as a whole comprising absorption trenches 1 and 2 is shown in Figure 1. The approximate position of the trenches with respect to each other, as well as from the existing dwelling, deck to the south and property boundaries are also shown in Figure 1. The terrain across the LAA falls in a north-northeasterly direction and in no direct way towards the adjoining properties to the east and west – i.e. dominant fall direction is towards the northern boundary and Pittwater. There is a typical grade of 3.5^0 in the area containing existing trenches 1 and 2 as measured on the site with a clinometer. The eastern parts of both trenches are crossed by a minor pathway from Florence Terrace to the dwelling.

The western part of absorption trench 1 is contained between the northern water tank and southern side of the small garden shed. There is predominantly no vegetation across this trench site and adjacent parts, but there is some grass near the eastern side of it. There is some exposure to the northerly aspect and prevailing winds at the site of trench 1, but this is partly obscured by the close proximity to mainly the garden shed and to a lesser extent the northern water tank. The vegetation at the site of absorption trench 2 comprises a complete grass cover except where it crosses the minor pathway. This area has a greater exposure to the northerly aspect and prevailing winds relative to trench 1.

The nearest ‘water feature’ in the relevant land fall direction from the northern end of absorption trench 2 is the mean high water mark at Pittwater at a minimum distance of approximately 43m in a north-northeasterly direction – note that this distance in plan view is considerably increased along the ground surface.

Climatic conditions at the site are generally temperate throughout the year. The average annual rainfall is approximately 1225mm, whilst the annual evaporation is 1790mm which exceeds rainfall in all months except May and June.

4. FIELDWORK METHODS

The initial phase of the fieldwork comprised a site inspection and ground survey aimed at delineating and assessing the general location of the absorption trenches and geomorphological characteristics of the area containing them.

Further to the ground survey, four 100mm diameter hand-auger holes were bored to maximum depths of 1.2m in the area containing the existing two absorption trenches – i.e. two holes adjacent to each trench. The auger holes were used to determine the physical characteristics of the subsurface strata and provide representative description of them.

5. GROUND SURVEY AND PHYSICAL CONSTRAINTS

The location of the components of the LAA as a whole for secondary treated wastewater have been carefully delineated on the site with Mr. Wish (Figure 1). Results from the ground survey indicate that the main physical constraints to the land application of treated effluent comprise the following:

- The waterfront locality.
- The typically steep terrain off the downslope northern side of the dwelling which is not suitable for effluent disposal. Furthermore, the proposed extension off the northern side of the dwelling extends to the foreshore building line, whereby further development and any form of effluent disposal cannot occur.

In addition to the physical constraints, the land area available for the application of treated effluent is limited by the small area of the unsewered property, extent of the existing dwelling plus other features and the proposed extension, as well as the implementation of set-back distances from these and property boundaries.

The physical constraints and associated considerations outlined above provide substantial limitations to the land available for the application of treated effluent. This has led to the best-fit solution which comprises the continued use of the existing two absorption trenches that are on the most gently sloping terrain available having what is considered to be a gentle grade and also at the furthest possible distance from Pittwater.

The components of the LAA as a whole typically afford exposure to the northerly aspect and prevailing winds, which in conjunction with the vegetation coverage to be established managed (see Section 7), will enhance the benefits of evapotranspiration and concurrently reduce the absorption loads of treated effluent on the subsurface strata.

6. SUBSURFACE PROFILES

Reference to the Sydney 1:100,000 scale Soil Landscape map indicates that the existing LAA and property as a whole are underlain by the colluvial 'Watagan' group which occurs on rolling to very steep hills on fine-grained Narrabeen Group sediments (mainly interbedded laminite and shale with quartz to lithic quartz sandstone).

The soils of the Watagan group comprise shallow to deep (30 - 200cm), Lithosols/Siliceous Sands and Yellow Podzolic Soils on sandstones; moderately deep (100 - 200cm) Brown Podzolic Soils, Red Podzolic Soils and Gleyed Podzolic Soils on shales (Chapman and Murphy, 1989).

The Watagan group is limited by mass movement hazard, steep slopes, severe soil erosion hazard, very strong acidity, low fertility, high aluminium toxicity and occasional rock outcrop (Chapman and Murphy, 1989).

The subsurface profiles observed in the auger holes have duplex structures, as there are well-defined textural and permeability contrast between the A and B soil horizons. With reference to Table E4 in AS/NZS 1547 (2012), it is considered that the A1 and A2 soil horizons have a single grained structure whilst the B horizon soil has a strong structure.

The soils are described in accordance with the classification schemes in Australian Soil and Land Survey: Field Handbook (1990) and Table E1 in AS/NZS 1547, 2012 (Appendix 1). The typical subsurface profiles observed in the auger holes across the area comprising the existing absorption trenches are basically consistent and outlined below.

Absorption Trench 1

(i) LOAMY SAND – A1 Horizon (TOPSOIL)

- observed from the surface to an average depth of 0.2m.
- comprises brown to dark-brown, fine to medium grained loamy sand with few ironstone and weathered sandstone fragments (i.e. 2 - 10% coarse fragments from Table E2 in AS/NZS 1547, 2012).
- soil category 2 for sandy loams from Table E1 in AS/NZS 1547 (2012).

(ii) SANDY LOAM – A2 Horizon

- observed from an average depth of 0.2 - 0.4m.
- comprises dark-brown, fine to medium grained sandy loam with few ironstone and weathered sandstone fragments (i.e. 2 - 10% coarse fragments).
- soil category 2 for sandy loams.

(iii) LIGHT CLAY - B Horizon

- observed from an average of 0.4m to a maximum depth of 1.2m.
- comprises stiff to very stiff, brown to orange-brown light clay with few ironstone and weathered sandstone fragments (i.e. 2 - 10% coarse fragments).
- soil category 5 for light clays.

Absorption Trench 2

(i) LOAMY SAND – A1 Horizon (TOPSOIL)

- observed from the surface to an average depth of 0.25m.
- comprises brown to dark-brown, fine to medium grained loamy sand with few ironstone and weathered sandstone fragments (i.e. 2 - 10% coarse fragments).
- soil category 2 for sandy loams.

(ii) SANDY LOAM – A2 Horizon

- observed from an average depth of 0.25 - 0.6m.
- comprises dark-brown, fine to medium grained sandy loam with few ironstone and weathered sandstone fragments (i.e. 2 - 10% coarse fragments).
- soil category 2 for sandy loams.

(iii) LIGHT CLAY - B Horizon

- observed from an average of 0.6m to a maximum depth of 1.2m.
- comprises stiff to very stiff, brown to orange-brown light clay with few ironstone and weathered sandstone fragments (i.e. 2 - 10% coarse fragments).
- soil category 5 for light clays.

7. ASSESSMENT OF THE EXISTING ABSORPTION TRENCHES AND SUGGESTED MANAGEMENT MEASURES

As detailed in Section 2, the provision of an AWTS will result in a substantial improvement in effluent quality from primary to secondary. This has associated benefits in that the application of disinfected secondary treated wastewater will improve the condition, longevity and performance of the absorption trenches and effectively at least double their capacity.

The at least approximate doubling or more of the trench capacities is based on the differences in the design loading rate **(DLR)** values listed in Table L1 of AS/NZS 1547 (2012) for both primary and secondary treated wastewater. For the A1/A2 and B horizon soils in the existing LAA as a whole outlined in Section 6, the conservative DLR values for primary treated effluent are 3.3 and 2.4 times that respectively for secondary treated effluent. It is the increase in DLR for the application of secondary treated effluent that proportionally increases the capacity of the absorption trenches by 2.4 - 3.3 times.

When the dwelling is renovated and extended and with allowance for the boat shed, there will be no increase in the maximum design effluent volume currently generated. With the approximate more than doubling and tripling of the design capacity of the trenches with provision of an AWTS, this indicates that they will continue to function properly into the future based on their current performance when accepting primary treated effluent.

In light of the increase in design capacity and proper function of the two existing absorption trenches without showing signs of failure based on the application of primary treated effluent, it is therefore proposed to continue their use for the much higher quality secondary treated wastewater from an aerated system when the dwelling is renovated and extended.

With regards to the area comprising the existing absorption trenches, the following measures are suggested to enhance the performance and operation:

- Grass should be managed by being mown regularly in and adjacent to the LAA to promote vigorous growth, and cuttings harvested and removed in order to enhance the uptake of nutrients and prevent the recycling of N and P compounds back to the soil.

Furthermore, ensure that grass is not cut to a level that is too low as this may limit root growth.

- For trench 1 and the adjacent parts (particularly downslope side to the north), a complete grass cover must be provided preferably by laying turf, or if not, by intersowing seed with a blend such as fescue, buffalo, kikuyu and paspalum for example, but other blends would also be suitable. Note that the existing grass cover at and adjacent to the site of trench 2 is considered to be appropriate in its current form. However, this does not preclude the option of seeding.
- In the event of weed proliferation due to the discharge of treated effluent, it is suggested that adequate eradication measures are implemented to prevent their possible spread beyond the margins of the LAA as a whole.
- Any upslope runoff should also be diverted away from the components of the LAA so they ideally have to cater for only treated effluent and direct rainfall. This can be achieved with use of a shallow dish drain or contour bank for example above a LAA.
- It is imperative to ensure that renovation and extension works on the dwelling do not adversely impact on the components of the LAA such as topsoil compaction, the stripping of topsoil, vehicular/earthmoving movements (if relevant) and the placement of building materials for example – i.e. maintain existing soil depth and condition and suggest to partition the trench areas from the works. Note that single vehicular or earthmoving movement over an absorption trench will significantly damage it, probably make it inoperable and lead to it needing to be re-constructed or replaced at a new location.
- Clean watering of grass and other vegetation in and adjacent to absorption trenches 1 and 2 must not be carried out unless totally necessary, for example when it is establishing in and adjacent to trench 1 and/or during periods of nil or low rainfall if the grass is dying off.

Whilst it is proposed to continue use of the absorption trenches when the AWTS is installed, a concerted regime will also be put in place to continue to reduce water usage/effluent generation and monitor the on-going performance of the system. This will provide a safe-guard measure and further enhance the operation and performance of the effluent management system as a whole, whilst providing a way to ascertain if there are ever any signs of less than optimum performance or failure.

8. INSTALLATION, OPERATION AND MAINTENANCE

For the effluent management system to work well, the supplier, installer, service agent and owners/residents must be committed to its management, whilst the AWTS must be serviced on a quarterly basis. Quarterly services as part of maintenance agreements normally involve inspection of the mechanical, electrical and functioning parts of the system to ensure they are operating properly, replacement of chlorine tablets for disinfection and a check of the components of the LAA. A properly operated and maintained system should meet the expected parameters for wastewater quality (see Table 1, Section 2).

Newly installed systems often require a lead-in time before satisfactory performance is achieved. This time can often be reduced by promoting establishment of the bacteria in the treatment system. The effectiveness of the system will, in part, depend on how it is used and maintained. A guide to good maintenance procedures, from Department of Local Government (1998), is listed below:

DO

- have the system inspected and serviced four times per year by an approved contractor.
- have the system service include assessment of sludge and scum levels and the performance of absorption trenches 1 and 2.
- have the AWTS desludged at least every three years.
- have the disinfection chamber inspected and tested quarterly to ensure correct disinfection levels.
- have the grease trap (if installed) cleaned out at least as required on a regular basis.
- keep a record of pumping, inspections, and other maintenance.
- learn the location and layout of the treatment system and absorption trenches.
- use biodegradable liquid detergents such as concentrates with low sodium and P levels (see Appendix 1).
- conserve water – deliberate attention to water conservation is considered to be important to not only reduce the usage of clean water from the limited tank supply, but to also enhance the performance of the AWTS and absorption trenches by reducing the hydraulic loadings and allowing treated wastewater to be properly accepted in the medium to long-term periods.

As previously detailed, this has a heightened requirement on the subject site at Scotland Island.

DON'T

- put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into the AWTS via sinks, toilets or washing machines.
- allow any foreign material such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- use more than the recommended amounts of detergents.
- put fats and oils down the drain and keep food waste out of the system – this is considered to be particularly important because food scraps can result in a higher than acceptable biochemical oxygen demand level and excess oils/fats can overload or hinder the performance of any type of effluent treatment system. Use of a sink strainer in the kitchen is required, al0ng with removing excess food waste/oils from plates with paper towelling before washing would reduce the input of fats and organic material into the AWTS (used paper towels can be composted).
- switch off the power to the system, even when the dwelling is unoccupied.

9. CONCLUSION

(i) An investigation and assessment has been undertaken for on-site effluent management at Lot 108 DP 12749, No. 11 Florence Terrace, Scotland Island. The unsewered property has an area of 734m^2 that comprises an existing two bedroom dwelling, boat shed with toilet and hand-basin, small garden shed and associated features.

(ii) There is a system for on-site effluent management which comprises:

- 2 x 3000 litre polyethylene tanks for the dwelling. The first tank functions as a septic tank. The second tank accepts the primary treated liquid effluent and has a pump to transfer the material upslope to the components of the LAA.
- A small holding well with macerator pump (i.e. pump well) for the boat shed that is understood to transfer the limited waste generated to the septic tank.
- The LAA as a whole consists of two absorption trenches.

(iii) The proposed development comprises the renovation and extension of the dwelling that will result in an additional bedroom.

(iv) The proposal for effluent management from the dwelling when renovated and extended plus the boat shed comprises:

- The continued use of the baffled septic tank servicing the dwelling.
- The continued use of the small pump well for the boat shed.
- The conversion of the second tank, or pump well, into an AWTS.
- The continued use of the existing two absorption trenches with dimensions outlined for what will be the secondary treated effluent from the AWTS.

(v) The effective more than doubling and tripling of the design capacity when an AWTS is installed based on the soil types encountered and proper functioning of the two existing absorption trenches without showing signs of failure based on the application primary treated effluent is a positive scenario. Management measures in relation to the proposed AWTS and existing absorption trenches should also be followed.

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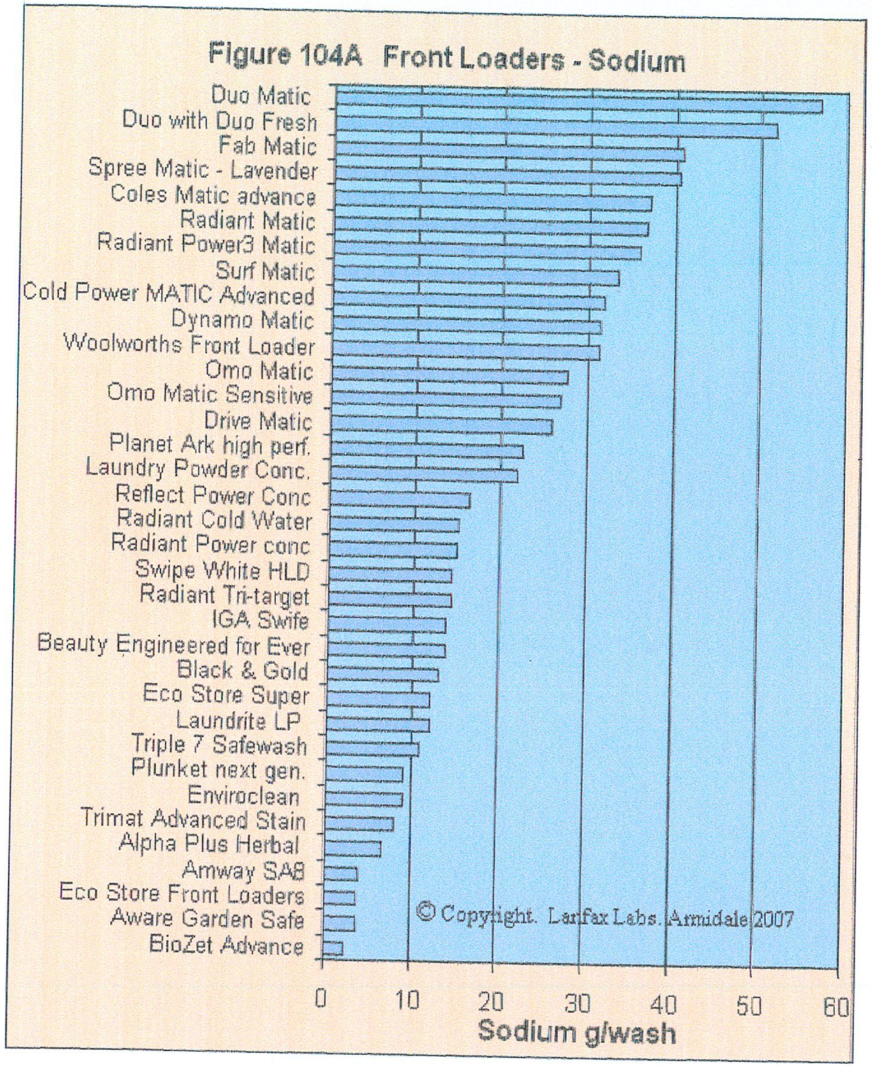
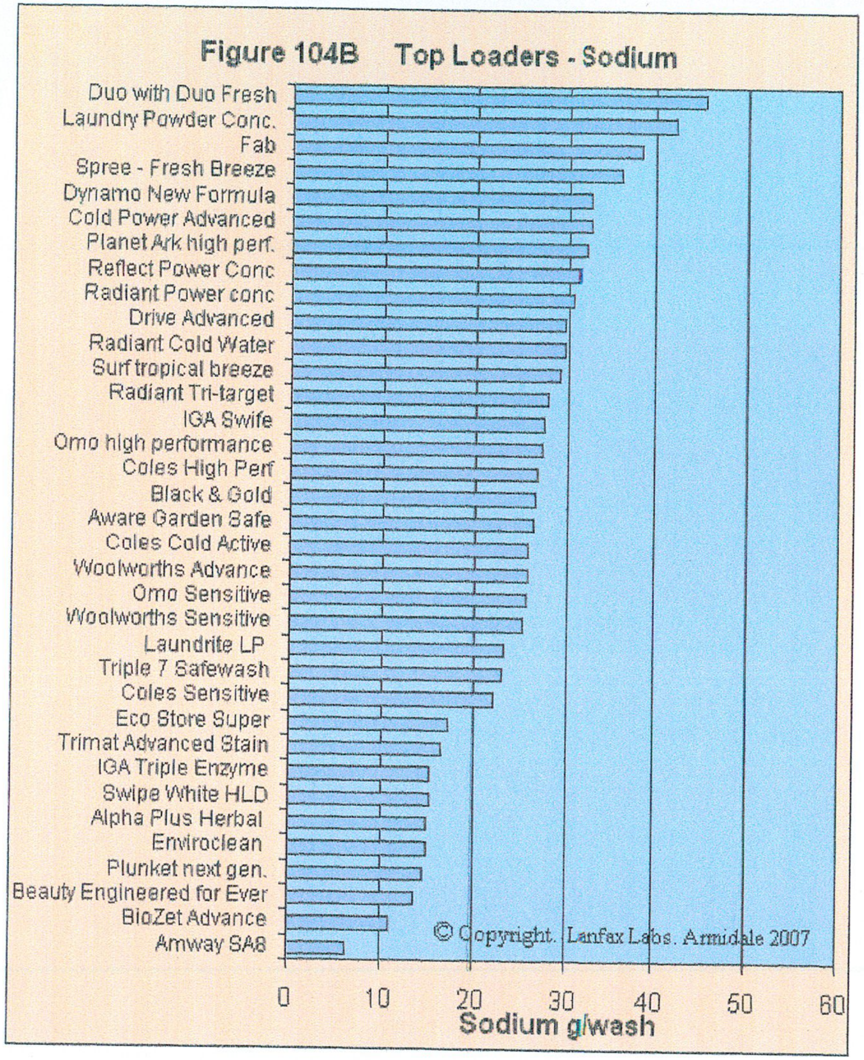
APPENDIX 1

SODIUM CONTENTS FOR A VARIETY OF LAUNDRY DETERGENTS AND SOIL CLASSIFICATIONS





Dr Robert Patterson, Lanfax Labs, Armidale NSW. Laundry Products Research **49 Laundry Detergents Powders (updated 24th November 2007) www. lanfaxlabs.com.au Accessed 9/5/08.**

TABLE E1
ASSESSMENT OF SOIL TEXTURES

Soil category	Classification	Properties	Typical clay content% (see Note)
1	Sand	Very little to no coherence; cannot be moulded; single grains stick to fingers	Less than 5
2	Loamy sand	Slight coherence; forms a fragile cast that just bears handling; gives a very short (5 mm) ribbon that breaks easily: discolours the fingers	5 – 10
	Sandy loam	Forms a cast but will not roll into a coherent ball; individual sand grains can be seen and felt; gives a ribbon 15 – 25 mm long	10 – 20
3	Fine sandy loam	As for sandy loams, except that individual sand grains are not visible, although they can be heard and felt; gives a ribbon 15 – 25 mm long	10 – 20
	Loam	As for sandy loams but cast feels spongy, with no obvious sandiness or silkiness; may feel greasy if much organic matter is present; forms a thick ribbon about 25 mm long	10 – 25
	Silty loam	As for loams but not spongy; very smooth and silky; will form a very thin ribbon 25 mm long and dries out rapidly	10 – 25
4	Sandy clay loam	Can be rolled into a ball in which sand grains can be felt; forms a ribbon 25 – 40 mm long	20 – 30
	Fine sandy clay	As for sandy clay loam, except that individual sand grains loam are not visible although they can be heard and felt; forms a ribbon 40 – 50 mm long	20 – 30
	Clay loam	Can be rolled into a ball with a rather spongy feel; slightly plastic; smooth to manipulate; will form a ribbon 40 – 50 mm long	25 – 35
	Silty clay loam	As for clay loams but not spongy; very smooth and silky; will form a ribbon about 40 – 50 mm long; dries out rapidly	25 – 35
5	Sandy clay	Forms a plastic ball in which sand grains can be seen, felt or heard; forms a ribbon 50 – 75 mm long	35 – 45
	Light clay	Smooth plastic ball that can be rolled into a rod; slight resistance to shearing between thumb and forefinger; forms a ribbon 50 – 75 mm long	35 – 40
	Silty clay	As for light clay but very smooth and silky; will form a ribbon about 50 – 75 mm long but very fragmentary; dries out rapidly	40 – 50
6	Medium clay	Smooth plastic ball, handles like plasticine and can be moulded into rods without fracture; some resistance to ribboning, forms a ribbon 75 mm or more long	40 – 55
	Heavy clay	Smooth plastic ball that handles like stiff plasticine; can be moulded into rods without fracture; firm resistance to ribboning; forms a ribbon 75 mm or more in length	50 or more

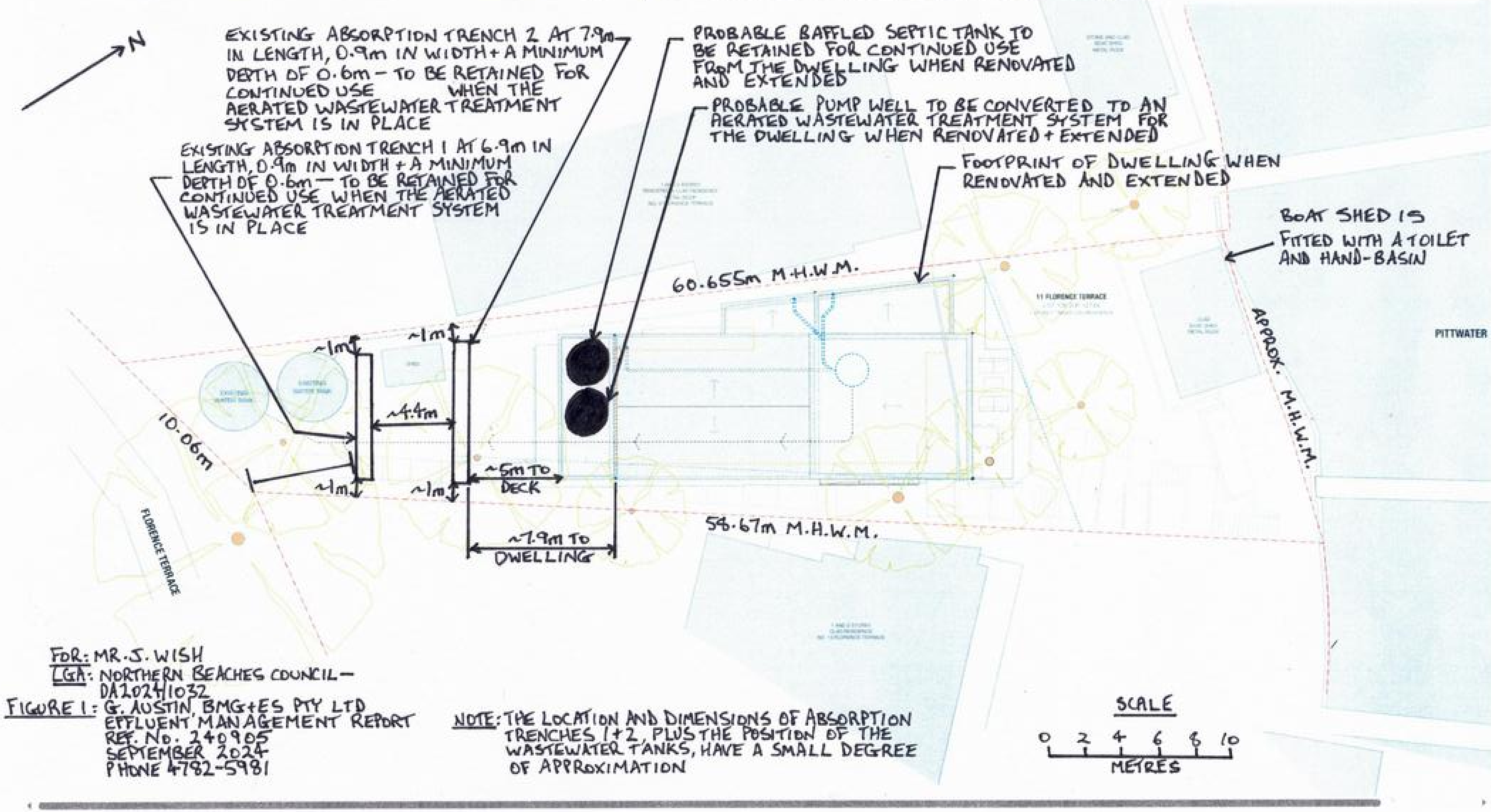
NOTE: The typical clay content figures are included for information only.

SOIL CLASSIFICATION

Field Texture Grade		*Behaviour of moist bolus*	*Approximate clay content (%)*
S	*Sand*	coherence nil to very slight; cannot be moulded; sand grains of medium size; single sand grains adhere to fingers.	commonly less than 5%
LS	*Loamy sand*	slight coherence; sand grains of medium size; can be sheared between thumbs and forefinger to give minimal ribbon of about 5mm.	about 5%
CS	*Clayey sand*	slight coherence; sand grains of medium size; sticky when wet; many sand grains stick to fingers; will form minimal ribbon of 5-15mm; discolours fingers with clay stain.	5%-10%
SL	*Sandy loam*	bolus coherent but very sandy to touch; will form ribbon of 15-25mm; dominant sand grains are of medium size and are readily visible.	10%-20%
L	*Loam*	bolus coherent and rather spongy; smooth feel when manipulated but with no obvious sandiness or 'silkiness'; may be somewhat greasy to the touch if much organic matter is present; will form ribbon of about 25mm.	about 25%
ZL	*Silty Loam*	coherent bolus; very smooth to often silky when manipulated; will form ribbon of about 25mm.	about 25% and with silt 25% or more
SCL	*Sandy clay loam*	strongly coherent bolus; sandy to touch; medium size sand grains visible in finer matrix; will form ribbon of 25-40mm.	20%-30%
CL	*Clay loam*	coherent plastic bolus; smooth to manipulate; will form ribbon of 40-50mm.	30%-35%
CLS	*Clay loam, sandy*	coherent plastic bolus; medium size sand grains visible in finer matrix; will form ribbon of 40-50mm.	30%-35%
ZCL	*Silty clay loam*	coherent plastic bolus; plastic and often silky to the touch; will form ribbon of 40-50mm.	30%-35% and with silt 25% or more
LC	*Light clay*	plastic bolus; smooth to touch; slight resistance to shearing between thumb and forefinger; will form ribbon of 50-75mm.	35-40%
LMC	*Light medium clay*	plastic bolus; smooth to touch; slight to moderate resistance to ribboning shear; will form ribbon of about 75mm.	40%-45%
MC	*Medium clay*	smooth plastic bolus; handles like plasticine and can be modelled into rods without fracture; has moderate resistance to ribboning shear; will form ribbon of 75mm or more.	45%-55%
MHC	*Medium heavy clay*	smooth plastic bolus; handles like plasticine; can be modelled into rods without fracture; has moderate to firm resistance to ribboning shear; will form ribbon of 75mm or more.	50% or more
HC	*Heavy clay*	smooth plastic bolus; handles like stiff plasticine; can be modelled into rods without fracture; has firm resistance to ribboning shear; will form ribbon of 75mm or more.	50% or more

From: Australian Soil and Land Survey: Field Handbook 1990

FIGURE 1: PLAN SHOWING THE EXISTING AND PROPOSED FEATURES, AS WELL AS THE COMPONENTS OF THE EFFLUENT MANAGEMENT SYSTEM AT LOT 108 DP 12749, No.11 FLORENCE TERRACE, SCOTLAND ISLAND



FOR: MR. J. WISH
LGA: NORTHERN BEACHES COUNCIL – DA2024/1032
FIGURE 1: G. AUSTIN, BMG+ES PTY LTD
EFFLUENT MANAGEMENT REPORT
REF. No. 240905
SEPTEMBER 2024
PHONE 4782-5981

NOTE: THE LOCATION AND DIMENSIONS OF ABSORPTION TRENCHES 1+2, PLUS THE POSITION OF THE WASTEWATER TANKS, HAVE A SMALL DEGREE OF APPROXIMATION