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REPORT ON
INVESTIGATION AND ASSESSMENT FOR THE SITING OF A PROPOSED EFFLUENT MANAGEMENT AT LOT 166 DP 12749, No. 131 THOMPSON STREET, SCOTLAND ISLAND

PREPARED FOR: MR. E. & MRS. M. BURKE

SUBMITTED TO: NORTHERN BEACHES COUNCIL

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1. INTRODUCTION

This report outlines the results of an investigation and assessment for the siting of a proposed effluent management at Lot 166 DP 12749, No. 131 Thompson Street, Scotland Island. The investigation was performed at the request of Mr. & Mrs. Burke. The report will be submitted to Northern Beaches Council.

The unsewered property comprises a vacant parcel of land with an area of 1185m^2. Reference to the accompanying plan, Figure 1, shows that the proposed development comprises the construction of a dwelling and the siting of an associated effluent management system.

As a function of the small land area and physical characteristics of the unsewered property, in conjunction with the area taken up by the proposed dwelling and associated features, a 'best-fit' solution is applied to on-site effluent management and where possible, appropriate guidelines and standards are adhered to – i.e. 'best practicable option' from AS/NZS 1547 (2012). The best-fit solution is based on minimising water usage and effluent generation from the dwelling, providing disinfected secondary treated wastewater and applying this in an efficient manner and appropriate location over the largest possible area. Furthermore, a best practicable outcome 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 outcome and some variations to guidelines and standards to achieve a result for on-site effluent management which allows the development potential of the land to be realised.

2. PROPOSED EFFLUENT MANAGEMENT SYSTEM AND DESIGN WASTEWATER VOLUME

As confirmed with Mr. & Mrs. Burke the proposed effluent management scheme for the dwelling comprises use of an aerated wastewater treatment system **(AWTS)** with single or dual, pre-cast concrete or polyethylene processing tanks from which the disinfected secondary treated effluent will be applied to the land by subsurface dispersal.

At the point of report preparation, the particular brand and model of AWTS is not known. When the choice is made, the manufacturers specifications, NSW Health Accreditation and any other relevant details will be provided by the supplier for submission to Council in addition to this report.

The nominated location of the proposed AWTS adjacent to the southwestern corner of the dwelling as determined with Mr. Burke, pending exact final confirmation, is shown in Figure 1 – note that the area delineated is large enough to cater for a dual tank aerated system if chosen.

Pending final confirmation by the installer, it is suggested to lay the subsurface dispersal lines at a depth of 150mm in the main grass root zone – i.e. greater depth than this is not suggested and some scope for minimum depth of 100mm. This provides the maximum possible clearance from the underlying clay-based subsoil in the B horizon and enhances the benefits of evapotranspiration. Use of subsurface dispersal also best addresses adverse climatic conditions, as well as the recreational usage of the land, and provides a crude in-situ soil storage mechanism.

This report is submitted to Council as part of the approval process for the proposed dwelling and associated on-site effluent management system. Blue Mountains Geological and Environmental Services is not responsible or liable for the installation, operation, maintenance and on-going performance of both the proposed AWTS and area to be utilised for land application by subsurface dispersal. An appropriately qualified and experienced person or persons should install both the AWTS and more specialised subsurface dispersal lines in the designated area (i.e. compared with a surface irrigation arrangement).

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 implement a water usage minimisation scheme in the dwelling. 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. Consideration should therefore be given to the installation of a set of ideally five star rated water limiting devices/appliances that will be required as part of the BASIX scheme in Local Government. These include low-flow showerheads, low litreage dual flush toilets, aerator taps and what will be a water conserving front loading washing machine.

Note that the requirement for minimising water usage and effluent generation is considered to be more pronounced in offshore area such as Scotland Island due to the small size of the residential unsewered properties and setting within Pittwater.

It is suggested to utilise 'environmentally friendly' cleaning, washing and detergent products in the dwelling to reduce the levels of P, as well as sodium, discharged into the proposed AWTS and area to be utilised for land application. 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.

In addition 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.

Further to discussions with Mr. & Mrs. Burke, the following details are provided in relation to wastewater generation at the subject site:

- The proposed dwelling will be serviced with a tank water supply.
- The proposed dwelling comprises three bedrooms that will be initially occupied by the five members of the Burke family on a full-time basis.

Design effluent volume calculations are based on the maximum potential occupancy level of the dwelling, which is dependent on the number of bedrooms. Reference to Table J1 in AS/NZS 1547 (2012) shows that a three bedroom dwelling has a population equivalent of 1 - 5 persons. For this assessment, the maximum potential occupancy level of the dwelling is set at five persons. This represents an ample allowance for two persons/bedroom in two of the bedrooms and one person in the remaining bedroom.

Reference to Table H1 in AS/NZS 1547 (2012) shows that the typical domestic wastewater design flow allowance from dwellings with a tank water supply is 120 litres/person/day.

Based on the details above, the design output of effluent for the maximum of five full-time occupants in the proposed dwelling is:

* 5 persons x 120 litres/person/day = 600 litres/day.

To re-iterate, it is imperative to ensure that appropriate water-conservation practices are carried out in the dwelling so the maximum design effluent volume above is not exceeded – i.e. ideally kept as low as possible.

3. SITE DESCRIPTION

The property comprises an irregular-shaped parcel of land that has frontages onto both Thompson Street to the northeast and Hilda Avenue to the southeast. There is an approximate width of 12.2m at the upslope northeastern boundary adjacent to the alignment of Thompson Street and the land extends downslope in an overall southwesterly direction for distances ranging from 41.82m along the southeastern boundary adjacent to Hilda Avenue to 48.77m along the northwestern boundary, where the rear southwestern boundary has a length of 45.77m. The location of the proposed dwelling is shown in Figure 1.

The proposed land application area **(LAA)** for secondary treated wastewater, i.e. where the subsurface dispersal lines will be established, is situated between the dwelling and downslope southwestern boundary where there is a typical grade of about 1 in 4 - 5 in an overall westsouthwesterly to southwesterly direction. This area maintains the following set-back distances (Figure 1):

- 7.7m off the downslope southwestern side of the dwelling.
- 3m downslope of the deck off the southwestern side of the dwelling.
- 3m from the downslope southwestern boundary.
- 3m from the northwestern boundary, where the land falls in no definite way towards it.
- 3m from the southeastern boundary adjacent to Hilda Avenue, where the land also falls in no definite way towards it.

The vegetation in and adjacent to the proposed subsurface dispersal area comprises a patchy grass cover and some scattered trees. The site of the LAA on a convex sideslope is relatively well-elevated and affords some exposure to the northerly aspect and prevailing winds.

The proposed LAA is positioned at a typical elevation of about 34.5m to just under 39m and maintains a minimum set-back distance of approximately 110m from the mean high water mark at Pittwater. Note that this distance in plan view is considerably increased to about 150m when along the actual ground surface.

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

4. <u>FIELDWORK METHODS</u>

The initial phase of the fieldwork comprised a site inspection and ground survey aimed at delineating the preferred position of the LAA for secondary treated wastewater with respect to the location of the proposed dwelling and the geomorphological characteristics of the land.

Further to the ground survey, three 100mm and 150mm diameter hand-auger holes were bored to a maximum depth of 1.4m across the proposed LAA. The auger holes were used to determine the physical characteristics of the subsurface strata.

To assess soil permeability, results of the auger holes are related to the textural/structural classification in Table E1 in AS/NZS 1547 (2012) which enables determination of the soil category and corresponding indicative permeability value. An indicative permeability value can be converted to a design irrigation rate **(DIR)** from Table M1 in AS/NZS 1547 (2012).

5. GROUND SURVEY AND PHYSICAL CONSTRAINTS

The location of the proposed LAA for secondary treated wastewater has been carefully delineated on the site and in conjunction with Mr. Burke (Figure 1). Results from the ground survey indicate that the main physical constraint to on-site effluent management comprises the steep grade of the land which is typical of the terrain on Scotland Island. This constraint is exacerbated by the small area of the unsewered property and extent of the proposed dwelling, as well as the implementation of set-back distances from this and property boundaries.

In light of the constraints and considerations above, the proposed LAA is situated between the dwelling and downslope southwestern boundary. With the set-back distances shown in Figure 1 and detailed in Section 3, an area of 446m^2 has been delineated for subsurface dispersal. This is quite a large area based on experience with past sites on Scotland Island that is considered to be best suited to land application by subsurface dispersal as nominated. However, the proposal for land application does not preclude consideration to use of additional supplementary subsurface dispersal lines in landscaped areas if established.

In most instances, the proposed LAA conforms with and exceeds the recommended minimum set-back distances from the dwelling, boundaries and Pittwater in Table 5 of the guidelines n Department of Local Government et. al. (1998). The only variation to this is the 3m buffer distance from the downslope southwestern boundary, which is 3m less than that recommendation in the 1998 guidelines. This is results in the area of 446m^2 which is supported by the following:

- The use of subsurface dispersal for land application, which is a below-ground land application that considerably limits the potential for surface runoff.
- The additional area of 113m^2 it creates for subsurface dispersal compared with a 6m buffer from this boundary.

Further to the points above, liaison has been carried out with Mr. Max Payne of Council regarding the larger area of 446m^2 compared with what would be a lesser area of 333m^2 if a 6m buffer was implemented from the southwestern boundary.

The proposed LAA affords some exposure to the northerly aspect and prevailing winds, which in conjunction with the improved vegetation cover to be established and managed (see Section 7.1), will enhance the uptake by evapotranspiration and concurrently reduce the absorption loads of treated effluent on the subsurface strata.

6. SUBSURFACE PROFILE

Reference to the Sydney 1:100 000 scale Soil Landscape map indicates that the proposed LAA and property as a whole is 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). Findings from the auger holes are considered to best equate with Yellow Podzolic Soils on a sandstone bedrock.

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 profile observed in the auger holes has a 'duplex' structure, as there is a 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 moderate 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 profile observed in the auger holes across the proposed LAA is detailed below.

(i) LOAMY SAND (TOPSOIL) – A1 Horizon

- observed from the surface to an average depth of 0.2m.
- comprises dark-brown to black, fine to medium grained loamy sand with very few ironstone and weathered sandstone fragments (i.e. <2% 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) CLAYEY SAND – A2 Horizon

- observed from an average of 0.2m to a depth ranging from 0.35 - 0.4m.
- comprises grey to dark-grey, fine to medium grained clayey sand with very few ironstone and weathered sandstone fragments (i.e. <2% coarse fragments).
- whilst not included in AS/NZS 1547 (2012), considered to best equate with soil category 2 for sandy loams (see Appendix 1).

(iii) SANDY CLAY – B Horizon

- observed from 0.35 - 0.4m to a maximum depth of 1.4m.
- comprises brown to orange-brown and lesser red-brown and light-grey sandy clay with few ironstone and weathered sandstone fragments (i.e. <2% coarse fragments).
- soil category 5 for light clays.

7. DESIGN IRRIGATION RATE AND SUBSURFACE DISPERSAL AREA

As detailed in Section 5 and as part of the best-fit solution, an available area of 446m^2 has been delineated for subsurface dispersal. With the proposed subsurface dispersal lines being placed at an assumed depth ranging from 100 - 150mm, pending final confirmation by the installer, it is considered that with reference to Section 6 the A1 horizon loamy sand and A2 horizon clayey sand will collectively control the absorption and assimilation of secondary treated effluent.

Further to the details above, the DIR value for the most-limiting light clay subsoil in the B horizon will be applied to subsurface dispersal area calculations. For this soil type in category 5, reference to Table M1 in AS/NZS 1547 (2012) shows that the DIR value of is 3mm/day for subsurface dispersal (or 'drip irrigation'). Note that this DIR value is increased to 5mm/day for the overlying A1 horizon loamy sand and A2 horizon clayey sand.

The DIR value of 3mm/day for the light clay equates with a wastewater application rate of 5 litres/m^2/day. Based on this application rate, the area required for subsurface dispersal from the proposed dwelling is:

* 600L/day divided by 3L/m^2/day = 200m^2.

The equation indicates that an area of 200m^2 is required for the land application of secondary treated wastewater. However, this area will be increased to the area delineated at 446m^2. This is a 226m^2 increase, or an additional 113% beyond the area of 200m^2.

In summary,

* PROPOSED LAA FOR DWELLING = 446m^2 for the maximum design effluent volume of 600 litres/day – to be established with subsurface dispersal lines.

Based on the area above for the maximum design volume from the dwelling, this results in a minimal wastewater application rate of 1.35 litres/m^2/day (or DIR of 1.35mm/day) which is well less than that for the most limiting medium to heavy clays in soil category 6.

7.1 Preparation and Management of the Land Application Area

It is important to ensure that the subsurface dispersal system utilised effectively covers the area of 446m^2 delineated for land application so the hydraulic and nutrient loads can be adequately catered for by the soils and vegetation cover. Furthermore, there is an onus to establish what will be a consistent grass coverage across the LAA because there is a heightened requirement for the uptake of treated effluent by evapotranspiration.

Reference to Gardner et. al. (1997) indicates that loading rate should be balanced by allowable sinks. Allowable sinks for N are denitrification/volatilisation (typically 15 - 20% loss) and plant uptake, which depends on the plant yield and N concentration in the vegetation. Provided the vegetation in an irrigation area is harvested and removed on a regular basis (years for trees, months for grasses/pasture), it will provide a sustainable and recurrent sink for N.

Allowable sinks for P are plant uptake (generally 8 - 10 times less than N uptake) and the storage capacity of the soil (may account for up to 30% of the P loading). Reference to Gardner et. al., 1997) indicates that for sandy soils, the P front moves downwards at a rate of about 20 years/metre of soil depth for a P concentration of about 10mg/litre of effluent. The many adsorption sites for P in soils and aquifers suggest that adverse groundwater consequences of P leaching are likely to be the exception rather than the rule.

To raise the pH of the expected very strongly acidic soils (see Section 6) and address the potential for dispersion, as well as the sodium content in the treated effluent, it is suggested to apply agricultural lime and gypsum across the LAA and adjacent parts and lightly incorporate into the top 50 - 100mm of soil. Lime and gypsum can be applied at suggested rates of approximately 0.3 - 0.4kg/m^2 (i.e. 3 - 4kg/m^3) and 0.1 - 0.2kg/m^2 respectively (i.e. 1 - 2kg/m^3) in and adjacent to the LAA. The addition of lime and gypsum will also enhance plant growth, the uptake of nutrients and assist to maintain the soil structure in the medium to longer term periods. Liquefied versions of lime and gypsum are also available.

It is understood that lime and gypsum can be purchased from plant nurseries, landscape and rural supply stores and it is suggested to reapply the additives and carefully incorporate into the soils as required every three to five years for example. Note that it would be prudent to contact the NSW Agriculture Department to assess any advice they can provide regarding soil additives, application methods and rates.

Research by the NSW Agriculture Department shows that to help with the spreading of soil additives such as lime and gypsum across areas of pasture and increase their positive attributes, the ‘Long Worm’ (deep burrowing), ‘Turgid Worm’ (topsoil burrowing) and ‘Trap Worm’ (middle layers) should be introduced. These worms can be provided in the LAA to assist with transferring lime and gypsum to the subsoil to effectively raise soil pH and address the sodium content in the treated effluent. The addition of worms will also improve overall soil condition and drainage.

To enhance the uptake of treated effluent by evapotranspiration, it is suggested to obtain a complete and well-developed grass lawn cover with a vigorous year-round growth period in an adjacent to the LAA, particularly extending to the downslope southwestern boundary. This can be established by laying turf or intersowing with grass seed. If turf is used, the existing patchy grass should be carefully removed with nil or minimal loss of existing topsoil coverage. Up to approximately 30mm of permeable 'turf underlay' soil can also be placed on the surface once the subsurface dispersal lines are established to assist to the establishment of the grass cover.

If turf is used, which provides an immediate coverage and addresses the potential for erosion/disturbance particularly during rainfall events, consideration could be given using 'Sir Walter' or 'Matilda' buffalo which is understood to be well-suited to effluent application areas because it has high hydraulic and nutrient uptake rates and a tolerance to salt. If grass is established by seeding, consideration could be given to a blend of fescue, buffalo, paspalum, perennial rye and kentucky blue for example (or similar).

When established, the grass must be properly managed by being mown regularly in and adjacent to the LAA to promote vigorous growth with the cuttings harvested and removed to enhance the uptake of nutrients and prevent the recycling of N and P compounds back to the soil. Furthermore, grass should not be cut to a level that is too low as this may limit the depth and density of root growth.

Note that evapotranspiration, which will be enhanced at the subject site as a function of the overall temperate climate and vegetation cover to be established, will provide a concurrent reduction in the hydraulic loading rate and volumes of treated effluent permeating to the subsoil.

It is important to ensure that all upslope surface runoff is effectively diverted away from the LAA so that it has to ideally only cater for treated effluent and direct rainfall. This can be in the form of a shallow dish-drain or contour bank for example.

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.

Construction activities must not adversely impact on the area delineated for subsurface dispersal such as the compaction/stripping of topsoil, unnecessary vehicular and/or earthmoving machinery movements and the placement of soil and/or building materials for example – i.e. maintain existing depth and condition of soil coverage and suggest to partition this area prior to construction.

Stormwater provisions associated with the proposed dwelling and tank water supply must not be directed towards the proposed LAA or adversely impact upon its proper functioning. Clean watering of vegetation in and adjacent to the subsurface dispersal area must not be carried out. In addition, recreational usage should take into account the position of the LAA.

8. INSTALLATION, OPERATION AND MAINTENANCE

For the effluent management system to work well the supplier, installer, service agent, owners and residents must be committed to its management, whilst an 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 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 AWTS inspected and serviced four times per year by an approved contractor.
- have the system service include assessment of sludge and scum levels and performance of the LAA.
- have the AWTS desludged at least every three years.
- have the disinfection chamber inspected and tested quarterly to ensure correct disinfection levels.
- keep a record of pumping, inspections, and other maintenance.
- learn the location and layout of the treatment system and LAA.
- use biodegradable liquid detergents such as concentrates with low sodium and P levels (see Appendix 1).
- conserve water – deliberate attention to this issue is imperative due to the small size of the unsewered property on Scotland Island, the limited nature of the tank water supply and to also provide a way to enhance the performance/life span of the AWTS and ensure that the LAA does not become hydraulically overloaded.

DON'T

- put bleaches, disinfectants and spot removers for example in large quantities into the AWTS via the sinks or toilet.
- 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 BOD level and excess oils/fats/greases can overload or hinder the performance of any type of effluent treatment system. Use of a strainer in the kitchen sink is required and promoting the removal of excess food waste/oils from plates with paper towelling before washing would reduce the input of fats and organic material into the AWTS (paper towelling can be composted).
- switch off the power to the AWTS, even when the dwelling is unoccupied.

9. CONCLUSION

(i) An investigation and assessment has been undertaken for the siting of a proposed effluent management at Lot 166 DP 12749, No. 131 Thompson Street, Scotland Island. The unsewered property comprises a vacant parcel of land with an area of $1185m^2$.

(ii) The proposed development comprises the construction of a three bedroom dwelling and the siting of an effluent management system.

(iii) As a function of the small land area and physical characteristics of the unsewered property, in conjunction with the area taken up by the proposed dwelling and associated features, a best-fit solution has been applied to on-site effluent management and where possible, appropriate guidelines and standards are adhered to.

(iv) The proposed effluent management scheme for the dwelling comprises use of an AWTS from which the disinfected secondary treated effluent will be applied to the land by subsurface dispersal.

(v) The design output of effluent with allowance for a maximum of five full-time occupants in the dwelling and a tank water supply is 600 litres/day.

(vi) The proposed LAA for subsurface dispersal lines will be established, is situated between the dwelling and downslope southwestern boundary.

(vii) An area of $446m^2$ has been delineated for subsurface dispersal from the proposed dwelling. Guidelines in relation to the preparation and management of the AWTS and LAA should be followed.

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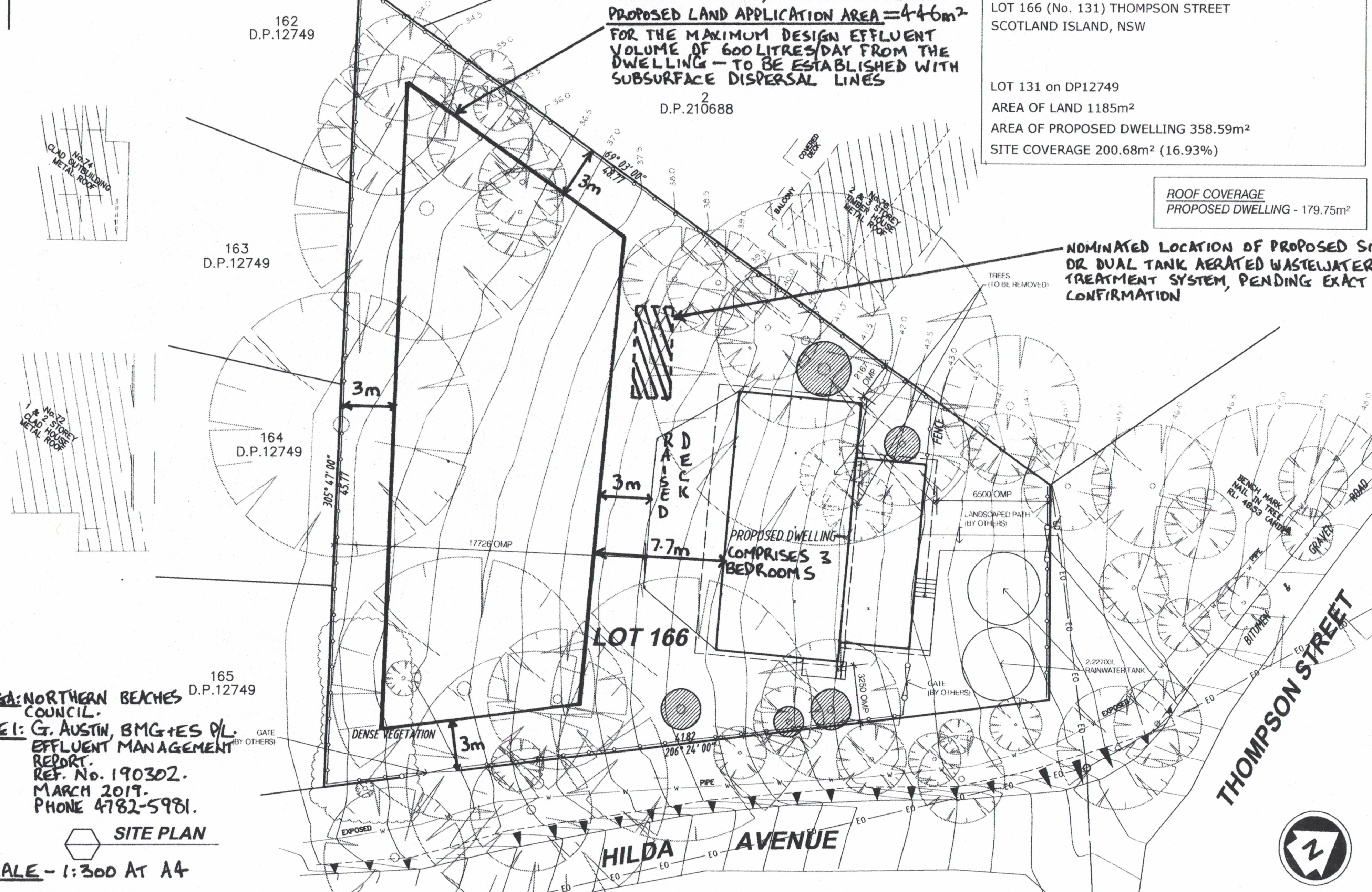
APPENDIX 1

SODIUM CONTENTS FOR A VARIETY OF LAUNDRY DETERGENTS AND SOIL CLASSIFICATIONS

FIGURE 1: PLAN SHOWING THE LOCATION OF THE PROPOSED DWELLING AND LAND APPLICATION AREA FOR SECONDARY TREATED WASTEWATER AT LOT 166 DP 12749, No. 131 THOMPSON STREET, SCOTLAND ISLAND



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