Revised Wastewater Management Report

Proposed Assistance Dogs Kennels

Location:
8 Austin Place
Lot 23 DP 239091
ORCHARD HILLS NSW 2748

Penrith City Council Reference: DA 17/0763

Prepared for:

Therian Pty Ltd

Report No:

HMC 2015.149

July 2017

As Revised September 2018

HMC environmental consulting pty ltd

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RE: Proposed Assistance Dogs Training Facility - 8 Austin Place, Orchard Hills NSW 2748

HMC Environmental Consulting Pty Ltd is pleased to present our revised management proposal for sewage & wastewater generated by the abovementioned development.

This revised report incorporates the revised design of the proposed effluent treatment and disposal methods and corresponding changes to the development. The revision address the concerns raised by Penrith City Council with Planit Consulting (P. Anzellotti, emails dated 5/4/2018 and 24/8/2018).

We trust this report meets with your requirements. If you require further information please contact HMC Environmental Consulting directly on the numbers provided.

Yours sincerely

Helen Tunks
(B.App.Sc.Env.Hlth)

Document Control Summary	
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Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time, natural processes and the activities of man. Changes to the subsurface, site or adjacent site conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

The findings of this report are based on the objectives and scope of work outlined within. HMC performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environment assessment profession. No warranties or guarantees, expressed or implied, are made. Subject to the scope of work, HMC's assessment is limited strictly to identifying typical environmental conditions associated with the subject property, and does not include evaluation of any other issues. This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of the work stated, and does not relate to any other works undertaken for the Client. All conclusions regarding the property area are the professional opinions of the HMC personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made by HMC, HMC assume no responsibility or liability for errors in any data obtained from regulatory agencies, or information from sources outside HMC's control, or developments resulting from situations outside the scope of this project.

1 EXECUTIVE SUMMARY

Proposed Development	Proposed Assistance Dogs Australia (ADA) Training Facility. The applicant proposes to construct a facility for education and training of people living with a range of disabilities and their service dogs including community service buildings.			
Key Contacts	Therian Pty Ltd	Design Manager	Bryan King	07 56 576 709
	Assistance Dogs Australia	Chief Executive Officer	Richard Lord	
	HMC Environmental Consulting	Waste Management Sewage Management	Helen Tunks	07 55 368 863
	Planit Consulting	Town Planner	L. Blandford	02 66 745 001
Site Address	8 Austin Place, Orchard Hills NSW 2748			
Property Description	Lot 23 DP 239091			
Site Constraints & Limitations	Gently sloping site with moderate rainfall, with higher rainfalls recorded in the summer months. Very poorly drained, compacted clay soils. Limited available area. Existing infrastructure. Protected vegetation			
Revised OSSM Design	The revised on-site sewage management proposal comprises a commercial sewage treatment plant (STP) and effluent disposal via pressure dosed sand mounds. The sand mound system provides an aggregated effluent disposal bed constructed within sand fill above the soil surface. Secondary treated effluent is distributed in even and timed doses into the mounds via a pumpwell within the STP. A level area is best for building sand mound systems and the site presents a gentle slope that will be cut and levelled for the mound construction. The sand mounds provide additional effluent treatment as it moves through the sand mound, and reduces the retained rainfall. The fenced assistance dogs training areas are not required for effluent disposal and 100% reserve land application area is provided.			
Penrith City Council Request for Further Information (April 2018; August 2018)	The revised development and OSSM system incorporates design changes. This revised report presents key information addressing Council's concerns • Hydraulic Loading • Treatment Tanks • Sizing of EDAs • Location of EDAs • Size of Development			

<table>
<tr><td rowspan="9">Wastewater Flow Design Allowances</td><td>A. Administration</td><td>20 x staff</td><td>40L/p/day</td><td>800L/day</td></tr>
<tr><td>B. Reception Building</td><td>12 x visitors (60/week)</td><td>35L/p/day</td><td>420L/day</td></tr>
<tr><td>C. Training Building</td><td>No Amenities</td><td>-</td><td>-</td></tr>
<tr><td>D. Accommodation</td><td>5 x guests + 5 x carers</td><td>150L/p/day</td><td>1500L/day</td></tr>
<tr><td>E1. Training/Kennels</td><td>5 x staff
40 x dogs
8 x Laundry loads</td><td>40L/p/day
40L/dog/day
50L/load/day</td><td>2200L/day</td></tr>
<tr><td>E2. Training/Kennels</td><td>2 x staff
20 x dogs</td><td>40L/p/day
40L/dog/day</td><td>1080L/day</td></tr>
<tr><td>F. Caretakers (3 br)</td><td>4 x persons</td><td>150L/p/day</td><td>600L/day</td></tr>
<tr><td colspan="3">TOTAL PEAK HYDRAULIC LOADING</td><td>6600L/day</td></tr>
<tr><td colspan="3">TOTAL OFF PEAK/WEEKENDS HYDRAULIC LOADING (E1, E2, F)</td><td>3880/day</td></tr>
<tr><td>Effluent Treatment</td><td colspan="4">Secondary treatment with Nutrient Reduction
• Install a Taylex CABS system 10KL/day comprising 3 x underground concrete tanks (see Appendix 9), or equivalent STP as approved by PCC. Existing Aerated Wastewater Treatment Systems to be decommissioned.
• Discharge generated by incident rainfall on outdoor grassed kennel runs to be screened for gross pollutants and discharged directly to stormwater management system.
• Additional treatment is provided in the sand mounds as effluent moves through the sand.
• Reserve effluent disposal area 100%.</td></tr>
<tr><td>Faecal Matter Management On-site composting</td><td colspan="4">Faecal matter collected in kennels as solid waste and composted on site in OSCA (see Appendix 5 for specifications).
Screening to be provided to all exterior washdown drains, internal floor wastes and in-sink wastes. Not to be discharged to the Sewage Treatment Plant.</td></tr>
</table>

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2 INTRODUCTION

HMC Environmental Consulting Pty Ltd (HMC) has been commissioned by Therian Pty Ltd (the client) to provide a revised Wastewater Assessment Report for the proposed Assistance Dogs training facility at Lot 23 DP 239091, No. 8 Austin Place, Orchard Hills, NSW 2748. The site is serviced by reticulated town water. Reticulated sewerage is not available.

An original Wastewater Assessment Report was prepared by HMC (Report No. HMC2015.149, July 2017) and revised report prepared in July 2018. This revised report incorporates a change of design for the proposed effluent treatment and disposal, and changes to the development layout. The revision addresses the concerns raised by Penrith City Council with Planit Consulting (P. Anzellotti, emails dated 5/4/2018 and 24/8/2018.

2.1 Council's Concerns

Hydraulic Loading Estimation:

- Dog numbers decrease from 68 to 60, assuming 100% occupancy of 2 dogs per each kennel with a total of 30 kennels proposed in Buildings E1 and E2.
- Hydraulic loading within this revised report is calculated using Penrith City Council's On-Site Sewage Management and Greywater Reuse (OSMGR) Policy 2014, including staff numbers based on desk spaces, and amenities detailed on plans. Reference is made to Sydney Water's recommendations for daily water usage per property development and an estimation of visitors based on floor plan for conference rooms and café facilities and PCC's OSMGR Policy 2014.
- Overnight guests increased from 8-10 persons to include private carers.
- It is noted that Kennel Buildings E1 and E2 provide amenities reasonable for staff to provide dog welfare only. No staff accommodation facilities are proposed in the Kennel Buildings. Using Table B1 of PCC's OSMGR Policy, it is determined that kennel staff hydraulic loading should remain at @40L/p/day design wastewater flow allowance.

Sewage Treatment:

- The original proposed configuration of 4 x Aerated Wastewater Treatment Systems (AWTS) across the site is replaced with a single commercial Sewage Treatment Plant comprising underground tanks. The site presents suitable fall to enable the installation of gravity sewer pipes to the STP.
- The STP provides surge flow balance tanks and electronic controls to suit the influent load changes.
- An example of a commercially available STP is included to demonstrate project feasibility.

Sizing of EDAs:

- Effluent disposal areas (EDAs) in this revised report are designed as sand mounds located on the ameliorated ground surface: 2 x Sand Mounds: each 8m x 51m x 0.9m high. The secondary treated effluent from the STP is treated further as it moves through the sand mound, and is then further treated and disposed of in the ameliorated soil underneath the mound.
- The size of the sand mounds is based on Converse and Tyler, 2000 and the design loading rates in Table N1 of AS/NZS1547: 2012. Effluent disposal area (EDA) designed as sand mounds of using a SLR of 40mm/day and DLR of 8mm/day.
- Small scale plans show dimensions of the proposed mounds and STP. Detailed design including hydraulic component type specification would be provided at construction approval stage.

Location of EDAs:

- Geotechnical investigation within the proposed sand mound locations has been carried out by via additional testpits.
- Soil amelioration for the base native soil is specified.
- The report references the PCCs On-site Wastewater and Greywater Reuse Policy 2014 and AS/NZS1547:2012.
- Blacktown soil landscape is referenced as the expected soil landscape, as mapped by the Soil Conservation Service (Bannerman & Hazelton, 1990).
- A buffer of 12 m between the proposed sand mounds and the downslope stormwater detention basin is determined as meeting the objectives to minimise risk to the environment. The setback is grassed with <10% slope. The revised development includes engineered intercept bunds upslope of the sand mounds to intercept stormwater run-on, and downslope bunds to intercept and divert mound run-off to the protected tree area.
- The stormwater detention basin is the engineered stormwater treatment accepting overland flows from the site, including run-off from the open kennel runs. The detention basin provides infiltration and filtration of stormwater prior to off-site discharge to a stormwater drain abutting the M4 Motorway embankment. The formed drain continues west approximately 120m, heads north under the M4 and discharges to Claremont Creek approximately 80m downstream. Claremont Creek drains north-east through rural residential and urban areas, forming the stormwater/flood mitigation channel through Claremont Meadows residential estate. The receiving waters are therefore not considered high in resource value.

Size of Development:

- The proposed kennel building E2 has been reduced in size by 50% and a reconfiguration of the site layout has enabled a revised effluent disposal method and centralised effluent treatment within a single Sewage Treatment Plant.
- Effluent disposal via sand mound requires a smaller footprint, does not retain rainfall and provides additional effluent treatment prior to disposal to the soil. Wet weather storage is not required.
- A reserve effluent disposal area has been nominated in size and configuration suitable for two future sand mounds . The reserve EDA is sized as 100% of the design area, in compliance with Council policy. The reserve EDA does not incorporate any training areas. The reserve effluent disposal area is to be levelled for the construction of future sand mounds.

3 PROJECT DESCRIPTION

Proposed Development	Proposed Assistance Dogs Training Facility
Site Address	8 Austin Place, Orchard Hills
Property Description	Lot 23 DP 239091
Property Land Area	2.192 ha
Client	Assistance Dogs Australia
Local Government Authority	Penrith City Council
Planning Approval	Development Application for a Material Change of Use subject to impact assessment
Local Authority Waste Collection Service	Penrith City Council - Visy (Recycled Waste), Sita (General Waste)
Environment Protection Authority	As the proposed development generates effluent volumes of less than 750kL/day, it is not a Scheduled Activity under the Protection of Environment Operations Act 1997. An Environmental Protection Licence from NSW EPA is not required.

4 PROPERTY DESCRIPTION

The property presents gently sloping land draining predominantly towards the northern boundary forming the frontage to the M4 Western Motorway.

The site currently supports existing accommodation structures and ancillary buildings on the more elevated land in the south, with vacant predominantly cleared grassed land with a stand of trees approximately 50m deep along the northern boundary.

There are no watercourses or groundwater wells or bores on the site. The property is continuing to be used for residential caretaking purposes with low volumes of wastewater being generated of less than 500L/day. The wastewater is currently treated in one of 3 existing and ageing Biocycle Aerated Wastewater Treatment Systems located on the site. Treated wastewater is currently being applied to the land via surface spray irrigation that is partly damaged resulting in unsatisfactory coverage.

The location of the site, its topographic features and relationship with adjoining development is shown on the aerial photographs in Figures 1 and 2.

5 SITE LOCATION

The figures below provide a location and boundaries of the subject site located within the locality of Orchard Hills, a predominantly rural residential suburb, west of Sydney. The area marked by the arrow in Figure 1a identifies the site location west of Sydney.

Figure 1 Site boundaries (NSW LPI) .

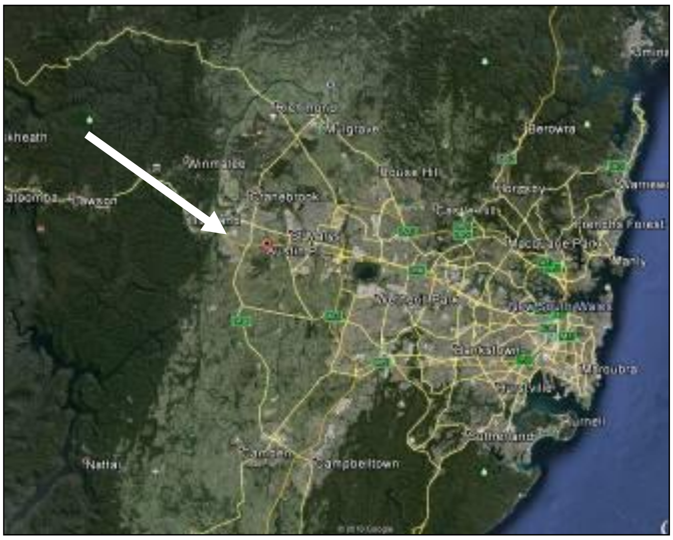


Figure 2 Site Location (Google Earth)

Figure 3 Site location (NSW LPI)

6 SITE AND SOIL ASSESSMENT

6.1 Site Information

Should conditions vary from those described during any stage of installation HMC is to be notified to ensure the recommendations of this report remain valid or alternative recommendations be made.

The following information relates to the general site but more specifically to proposed effluent disposal areas (EDAs) as nominated on the Site Plan in Appendix 1.

Inspected by	Helen Tunks, HMC Environmental Consulting
Date & Time of Inspection	17 November 2015 20 January 2016. 19 July 2018 See Appendix 9 for site photos.
Site Conditions	**17/11/2015**: Weather – hot and dry during inspection. 0mm received previous 24 hours. ~50mm received previous 7 days ~140mm total received previous 14days. **20/1/2016**: Weather – hot and dry during inspection 0mm received previous 48 hours.~40m received previous 7 days~186mm total received previous 14 days. **19/6/2018**: Weather – cold, intermittent rain during inspection, 2.6mm, <1mm < 20mm total for previous 3weeks and <3mm rain for the previous month. 210mm received to date in previous 6 months with a single highest daily rainfall event of 50mm. Rainfall data 2015-2016 sourced from BOM Station 67084 Orchard Hills Treatment Works and 2018 sourced from Penrith Lakes AWS BOM Station 67113.
Soil Type AS/NZS1547:2012 Table 5.1	**Soil Category 6.** See Soil Profile information in Appendix 2 Additional geotechnical investigation carried out on 19 June 2018 – 6 x Test Pits to 1m+ depth. Clay Loam overlying hard setting Light -Medium Clays with high silt/sand content. Heavy Clays at depths>900mm pH ranges from 6-10. Compaction/weak structure. Soils to be considered as Soil Category 6. Expected >2m to groundwater table Indicative permeability K_{sat} <0.6m/day Soil amelioration recommended in the form of deep tilling to incorporation of gypsum (1kg/m2) and imported sand/gravel below EDA to a depth of 500mm.
Size of property	~2.2Ha
Slope of EDA	Approximately 5-15% gentle slopes.
Exposure & Aspect of EDA	Predominantly north, some shading expected from adjacent structures.

Boulders /Rock Outcrops	Nil recorded within 1m below surface during geotechnical investigation.
Run-on/Seepage	Roof catchment overflow and stormwater from upslope neighbouring farm to east to be diverted away from EDAs.
Run-off	Minimal expected due site stormwater retention/controls
Flooding Potential	Nil
Indicative Site Drainage	Poorly drained sub-soil due to compaction
Surface Condition	Currently sparsely grassed
Erosion/mass movement	None observed in vicinity
Depth to Water Table Depth to artificial horizon	Soil profile minimum depth 1.5m to weathered shale in proposed EDA. No groundwater intercepted.
Buffer Distances from Absorption OSSM System (Table 3 PCC OSMGR Policy 2014)	**Complying:** >100m to permanent watercourse >12m to downslope property boundary >250m to nearest groundwater bore/well >1m from drip line of trees 3m across slope to driveway **Non-complying:** EDA 12m to stormwater bioretention basin. Mitigation provided by highly treated effluent and upslope and downslope intercept bunds to effectively isolate EDA runoff from the stormwater treatment basin. Refer to commentary note C5.5.3 of AS/NZS for setback distance variation. See Section 6.3 of report for buffer distance risk assessment.
Local Elevation	~ 50-64m AHD
Landscape element	Gentle slopes of broad ridge/ plateau
Vegetation	Exotic pasture grasses and scattered trees
Estimated Phosphorus sorption	8000kg P sorption/ha/m depth (Based on soil texture and assessment)
Climate	Warm-Temperate and moderately-high volume, seasonal winter rainfall typical of region. BOM Station 67084 Orchard Hills Treatment Works 95th percentile rainfall Oct 1970 to March 2018= 1044mm per annum.
Indicative Permeability	Not field tested. Indicative <0.06 mm/day Ksat from texture/structure analysis in accordance with Table 5.1 AS/NZS1547:2012. Soil amelioration recommended in the form of deep tilling to incorporation of gypsum (1kg/m2) and imported sand/gravel below EDA to a depth of 500mm.
Wet Weather Storage	Nil required
Reserve Effluent Disposal Area	816m2, being 100% of the design EDA

6.2 Soil Assessment

The soil profile assessment was carried out on the site during the site inspections in December 2015 and January 2016, and more recently in June 2018. Hand auger excavations and mechanical test pits were carried out in multiple locations across the site to a depth of 700mm – 1000mm. The soil profile was generally consistent across the site, with hard-setting clay loam/light clay topsoils overlying light to heavy clays subsoils.

The geotechnical investigation by mechanical excavation occurred after an extended dry period with 210mm rainfall recorded in the last six months to 19 June 2018. The mechanical excavations in the proposed new EDA locations revealed a soil profile typical of high silt/sand soils, presenting hard-setting soils weak structure and compaction, and medium - heavy clay at depths below 900mm.

Appendix 2 presents the soil profiles recorded in the boreholes and test pits that demonstrate the consistency of soil profiles encountered throughout the site, and the compaction presented at depth. Locations of the boreholes and testpits are provided in the Site Plan in Appendix 1.

6.3 Setback Distance Assessment

The setbacks proposed for the installation of the on-site sewage management system for this commercial development were designed using Table 3 of Council's OSMGR Policy 2014 as a guide. In addition, AS/NZS 1547:2012 and the Environmental & Health Protection Guidelines (NSW Depth of Local Government, 1998), were used as a guide, as recommended in Section 2.1.1 of Council's Policy.

Table 1 below presents the setback distance compliance assessment for the on-site sewage management system (OSSM) including sewage treatment plant (STP) tanks and effluent disposal areas (EDAs) to the relevant site features.

Table 1 Setback Distance Compliance Assessment

Site Feature	Horizontal Setback Distance from OSSM	Complying?
Property Boundary Dwellings	12 m downslope 6m upslope	Yes
Driveways and Buildings	6m upslope	Yes
Groundwater Well	>250m downslope	Yes
Permanent Surface Waters	>100m downslope	Yes
Drainage areas and overland flow paths: Stormwater detention basin & overflow weir –	STP tanks 15m; downslope EDA 12m upslope - Upslope intercept and downslope detention bunds provide barrier to overland flow path	No 40m recommended
Rainwater tanks	To be installed above ground	Yes
Drip line of native trees and shrubs	>1m upslope	Yes

*See Table 2 for risk assessment

A setback distance assessment was carried out for the non-complying setback distance to the stormwater detention basin, using Table R2 of AS/NZS 1547:2012, as recommended by Council's Policy.
The setback of 12m is vegetated with <5% slope. The detention basin and weir is part of the engineered stormwater treatment accepting overland flows from the site, including run-off from the open kennel runs. The basin provides infiltration and filtration prior to off-site discharge.

The stormwater engineering design includes upslope intercept bunds and downslope retention bunds for the effluent disposal sand mounds. The stormwater design essentially provides a separation between stormwater overland flow and effluent disposal area run-off, mitigating the setback distance. The proposed secondary effluent quality with additional treatment provided within the above ground sand mound further mitigates the site constraint.

The receiving water offsite for the stormwater discharge is a stormwater drain abutting the M4 Motorway embankment. The formed drain continues west approximately 120m, heads north under the M4 and discharges to Claremont Creek approximately 80m downstream. Claremont Creek drains north-east through rural residential and urban areas, forming the formed stormwater/flood mitigation channel through Claremont Meadows residential estate. The receiving waters are not considered sensitive or of high resource value.

The risk assessment process demonstrated a low potential risk to public and environmental health from the proposed location of the nominated sand mounds 12m upslope of the nearest point of the stormwater retention basin.

The setback of 12 m was therefore determined as meeting the objectives to minimise risk to the environment. The risk assessment process is summarised in Table 2 below.

Table 2 Site Constraints Risk Assessment Summary

Item	**Site/system feature**	**Constraint Scale Factors**		**Constraint**	**Risk Rating**
		Lower ⟷	**Higher**		
A	Microbial quality	Secondary treatment	Primary treatment	Secondary, nutrient reduction, disinfection	Low
B	Surface water	Category 1-3 soil >40m to surface water Low rainfall s	Category 4-6 soils <40m to surface water High rainfall High resource value	Category 5-6 12m setback mitigated by surface water controls. Moderate rainfall Low resource value	Medium
C	Groundwater	Category 5 & 6 soils, low resource value	Category 1 & 2 soils, high resource value	Low resource value - GW bore >250m	Low
D	Slope	<10% Subsurface application	>30% subsurface application	<10%	Low
E	Position of land application area	Downgradient of feature	Upgradient of feature	Upslope, mitigated by Surfacewater controls-	Low

F	Drainage	Category 1 and 2 soils, gently sloping	Category 6 soils, seepage, low lying area	Category 5-6 Mitigated by sand mound construction	Low
G	Flood potential	> 1 in 20 year contour	<1 in 20 year flood contour	>1 in 20 year	Low
H	Geology and Soils	Category 3 and 4 soils	Category 1 and 6 soils	Category 5-6 Mitigated by sand mound construction	Low
I	Landform	Hills crests, convex slopes & plains	Drainage plains and channels	Lower slopes/plains	Low
J	Application method	Drip irrigation or subsurface application	Surface/above ground application	Sand mounds - Low	Low
	RESULTS	**90% Low 10% Medium**			

7 MANAGEMENT – SOLID WASTE

For the purposes of characterising the wastewater stream and solid waste volumes, this Wastewater Assessment provides an estimate of the likely volume of solid dog faecal matter waste expected to be generated by the kennel operations, and the methods of collection, storage and disposal.

No faecal matter collected as solid waste is proposed to be discharged to the on-site sewage management system. All dog and human food waste is also to be collected and composted on-site.

Table 3 Management of Kennel Solid Waste – Dog Manure, Food Waste, Bedding

WASTE MATERIAL	MANAGEMENT METHODS	ON-SITE COMPOSTING
Dog faeces	Dog manure to be collected twice daily via dry method from kennels and training yards and potty areas. Storage within containers/drums within tight fitting lids. Approximately 26kg/day manure generated at 100% kennel occupancy	Compostable waste material is to be transported to the On-site Composting Apparatus (OSCA). Any remainder to be bagged and disposed off-site as general waste. OSCA technical specification is provided in Appendix 8. The end product is to be used as compost material for onsite landscaping , and is not to be taken off site.
Food Waste	Dog food and other food waste to be separated from general waste. Food waste to be stored with containers/drum with tight fitting lids.	
Dog bedding	Soiled bedding of compostable material is to be separated from general waste and stored in containers/drums with tight fitting lids.	
Cardboard, paper hand towels, compostable plates, cups, cutlery	These products to be separated at source within the buildings, and stored in containers/drums with tight fitting lids.	

8 LIQUID WASTE MANAGEMENT – ON-SITE SEWAGE & WASHDOWN WATER

8.1 Existing On-site Sewage Facility

As the existing on-site sewage management systems are aged and malfunctioning, it is recommended the tanks and associated irrigation areas are decommissioned. Approval under Section 68 Local Government Act is required from Council to install and operate the proposed new on-site sewage management facility.

8.2 Proposed Commercial Sewage Treatment Plant

It is proposed to install a commercial Sewage Treatment Plant to treat the on-site sewage and interior washdown water all buildings.

The proposed STP is capable of each up to 10,000L/day of the expected low-strength effluent generated from the development. The recommended make and model is the Taylex CABS, and this will be subject to contractual agreement to be decided at time of installation approval. Detail of a suitable commercial STP is provided in Appendix 8. The location of the STP on the site in provided in the Site Plan Appendix 1.

Figure 4 Example of an installed 10kL/day STP (Courtesy of Taylex)

8.3 Pre-treatment - Building Design Requirements

- Shallow under cover surface drains within interior floor of kennels to receive washdown water
- Screened sumps/shallow drains constructed at end of exterior runs to receive clean run-off from exterior runs during rainfall events, and discharge to underground piped stormwater reticulation system.
- Basket trap within all floor wastes and sink wastes to provide removal of grit, hair and particulates prior to discharge to the sewage treatment plant for treatment.

8.4 *Effluent Disposal Method – Sand Mounds*

This revised report proposes the use of sand mounds, not ETA beds, and therefore eliminates the need for for wet weather storage and management.

Sand mounds are raised, pressure-dosed bottomless sand filters that provide a treatment and land application function all in one. The sand mound itself is made of layered sand fill containing a raised distribution bed of coarse aggregate constructed near the top of the mound. The mound is constructed on top of the existing, pre-prepared ground surface (Bishop et al, 2007).

Pre-treated effluent is pressure dosed via a manifold in the aggregate distribution bed. The effluent then permeates through the mound of sand where it undergoes treatment before it enters the underlying soil. Mounds offer the smallest footprint combination of secondary on-site treatment and land application, and depending up design, can significantly reduce BOD5 and Total Suspended Solids. (Whitehead & Geary, 2009).

8.4.1 *Design References*

The sizing criteria and design specifications are based on the following guiding references:

- AS1547:2012 Appendix N
- Designing and Installing On-site Wastewater Systems – A Sydney Catchment Authority Recommended Practice (SCA, 2012)
- Optimising Mound Designs – Incorporating Best Practice and Innovation (Bishop & Whitehead, 2007)
- Port Stephens Council Standard Designs for On-site Wastewater Management Systems in Tilligerry Creek (Whitehead & Associates, 2005)
- Sand Mounds for Effective Domestic Effluent Management (Whitehead & Geary, 2009).
- Table 13-10 Infiltration rates for determining base area of mound - sand 50mm/day (Crites & Tchobanoglous,1998)
- Table 13-11 Mound fill material and infiltration rates – sand 50mm/day (Crites & Tchobanoglous,1998)
- Wisconsin Mound Soil Absorption System: Siting, Design and Construction Manual (Converse & Tyler, 2000. http://www.soils.wisc.edu/sswmp/sswmp_catalogue.htm#15
- http://www.soils.wisc.edu/sswmp/pubs/15.24.pdf
- Wisconsin Mound Soil Absorption System. Siting, Design and Construction Manual (Converse & Tyler, 1990)
- Pressure Distribution Network Design (Converse, 1990). http://www.soils.wisc.edu/sswmp/pubs/9.14.pdf

8.4.2 Preliminary Sand Mound Sizing – Site Feasibility Only

Table 4 Hydraulic Loading -Mound Design Inputs

Design Effluent Load	7kL/day - rounded up from peak daily design flow of 6600L/day for conservative design (see Section 9 for hydraulic loading calculations)
STP Discharge Effluent Quality	Secondary with nutrient reduction and disinfection
Slope over basal area	Level filled land,
Soil Type & Amelioration	Imported gravel to a depth of 500mm below sand mounds . Native underlying soil is compacted medium clay. (Soil Category 6, Table 5.1 AS1547:2012). Deep tilling/ploughing of native soil beneath imported gravel. Incorporation of gypsum (1kg/m2 guide only) into native soil beneath imported gravel.
Drainage	Primarily horizontal movement of effluent in the soil beneath the toe of the mound.
Sand Loading Rate (SLR)	40 mm/day (secondary) used to size the aggregate distribution bed. (complies Section N2.1 AS1547:2012) Less than 50mm/day for secondary effluent (Bishop et al, 2007); Crites &Tchobanoglous, 1998)
Mound Design Loading Rate (MDLR) or Basal Loading Rate (BLR)	8mm/day (Light Clay) Complies with Table N1 AS1547:2012
Linear Loading Rate (LLR)	31L/m/day. Complies with 50L/m/day in Section N2.2 AS1547:2012). High quality effluent , and delivery is to be time-dosed under pressure. Pressurised distribution within aggregate beds to be divided into 2 zones per mound.
Batter or Mound Face Slope	3 (horizontal): 1 (vertical) to maximise shedding of incident rainfall. Finished surface is to be turfed, and mound is to be capable of being mown to enable regular harvesting and removal of grass.
Filter Sand	The basal layer of the mound is to be specially selected filter sand. Sand must be medium grain size in the range 0.25 – 1.0mm with a uniformity coefficient less than 4 and less than 3% of fines passing a 0.074mm sieve, and be free of clay, limestone, and organic matter - (from AS1547:2012 Clause N3.3.2)
Basal Fill Depth	The native soil within the LAA at the levelled base of mound is to be prepared via scarification and amelioration through lime, gypsum and importation of sand/gravel to a depth of 500mm to bed the mound. Vertical separation distance to groundwater is not a limiting factor.
Aggregate Distribution Bed	33m x 2.5m per mound (x 2) Total Bed area = 165m2, levelled, comprising a minimum 150mm depth of 20-60mm river run aggregate (non-crushed, rounded). Bed contains distribution network on the aggregate. Laterals are to be laid level. Laterals to be capable of being flushed periodically between timed doses to remove any sediment and prevent slime growth. The bed surface and distribution network is overlain by filter cloth and formed in the top of the sand fill media, a minimum of 300mm below surface cap of mound.

	A 150mm layer of good quality clay loam – light clay topsoil is placed over mound surface. The mound surface is finished by laying established turf, to produce a finished mound capable of being mown. and maximum rainfall shedding capability.
Effluent Distribution Network	Distribution will be time dosed through an indexing valve Distribution laterals will be 25mm PE pipe within 100mm DWV, 3.5mm holes at 1m spacing. Pump will be time-dosed and sized & chosen accordingly based on minimum operation pressure & pump performance. Detailed hydraulic design to be provided at installation approval.
Wet Weather Storage Within Sand Mound	Mound Volume = Mound Cross Sectional Area x Length 6.5m2 x 51m = 331m3 per mound Porosity of Sand = Assume 30% Effluent Storage Volume/Mound = 30% x 331m3 x 2 mounds.= 198m3 or 198kL 198kL/6.52kL/day = 30 Days of Wet Weather Storage prior to mound saturation.

A site layout of the sand mound system is provided in Appendix 1. Detailed sand mound design with hydraulic specifications would be provided at installation approval stage. Figure 2 below provides a typical cross section of a sand mound showing distribution aggregate bed and side slopes.

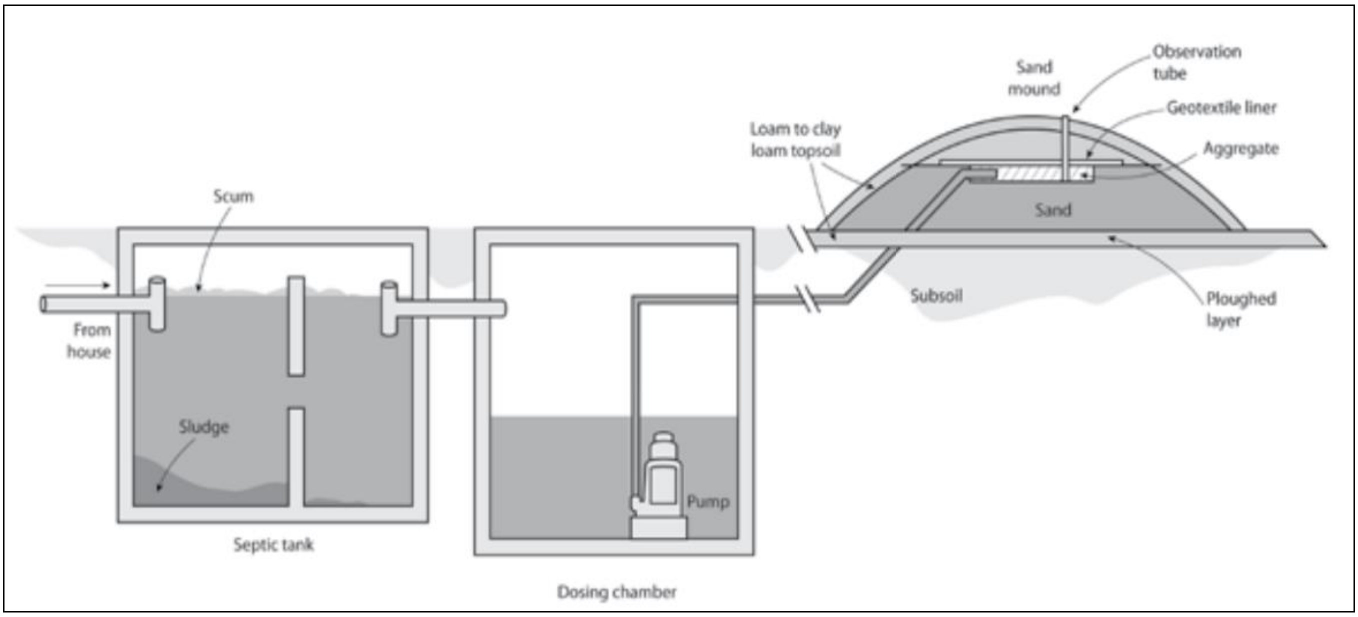


Figure 2 Cross section of a sand mound (Source: Sydney Catchment Authority, 2012)

9 HYDRAULIC LOADING

9.1 Design Flow Calculation

The water supply to the training facility is from a reticulated water supply. The design wastewater flow allowances used to calculate the estimated hydraulic loading are sourced from:

- Table B1 of Penrith City Council's On-site Sewage Management and Greywater Reuse (OSMGR) Policy, April 2014,
- Industrial 9.5kg washer product specification (see Appendix 6)
- High pressure, low volume washdown hose specification (see Appendix 7)

This revised report recommends that all buildings will discharge to a common Sewage Treatment Plant (STP) via gravity sewer drainage pipe network in compliance with the Plumbing Code of Australia.

In consideration of Council's comments dated April 2018 and August 2018, Table 4 below is based on conservative design using maximum capacities as limited by the floor plans, as recommended by Council.

Table 5 Design Daily Hydraulic Load Breakdown – All Buildings Wash Down Water + Amenities

Wastewater Flow Design Allowances	E. Administration	20 x staff*	40L/p/day	800L/day
	F. Reception Building	12 x visitors (60/week)**	35L/p/day	420L/day
	G. Training Building	No Amenities	-	-
	H. Accommodation	5 x guests + 5 x carers***	150L/p/day	1500L/day
	E1. Training/Kennels	5 x staff* 40 x dogs* 8 x Laundry loads	40L/p/day 40L/dog/day 50L/load/day	2200L/day
	E2. Training/Kennels	2 x staff* 20 x dogs*	40L/p/day 40L/dog/day	1080L/day
	G. Caretakers (3 br)	4 x persons	150L/p/day	600L/day
	PEAK DAILY HYDRAULIC LOADING – Monday to Friday			6600L/day
	OFF PEAK HYDRAULIC LOADING (E1, E2, F) – Saturday & Sunday			3880/day

**Staff: Number based on desk spaces and Table B1 Council's OSMGR Policy 2014. No facilities are provided for overnight accommodation in Kennel Buildings E1 and E2.*

***Visitors: 3 conference rooms @ 4 visitors/room; average 12 visitors/week, 60 visitors per week*

**** Assumes each guest person has a private carer staying overnight who is not a staff person.*

*****Source: Therian Pty Ltd - expected water usage data using high pressure, low volume equipment.*

9.2 Operational Assumptions

The following assumptions were used to determine hydraulic load and design of OSSM systems, based on the Operational Plan provided by Assistance Dogs Australia.

- 60 visitors per week expected in Conference Building, based on ADA estimations using the current training facility.
  An average of 12 persons/week day @ 35L/p/day in accordance with "Community Hall – banqueting" in Council's Table B1 of the OSMGR Policy.
  and a café of 37m2 in area including kitchenette. Using the Sydney Water Guideline, " Average daily water use by property development type", a "Club" has an average water use demand of 3.77L/m2 and a "Café" 2.48L/m2.
  2 conference rooms of 34m2 each in area,
- Dog welfare and instructors shared between both Kennel buildings E1 and E2
- No overnight accommodation in Kennel buildings E1 and E2
- Laundry in E1
- Caretakers use amenities in Building "F".
- No amenities in Building "C"
- 100% pen occupancy by 2 dogs/pen
- Daily dry collection of manure as solid waste and spot cleaning prior to hosing.

- Washing of 60 towels/day or equivalent in on-site industrial washer and dryer, assumed 10kg capacity (see Appendix 6).
- Daily washing of dog pens for 3 minutes each via high pressure, low volume hose expected to generate 40L wastewater/dog/day. Assume flow of 12L per minute, high pressure, 15m hose (see Appendix 7)

10 NUTRIENT LOADING

To establish the limiting factor in sizing of the effluent disposal area (EDA), the expected nutrient loading within the wastewater was calculated using production figures per person, depending on expected fixture use, and per dog, as per Section 10. The commercial sewage treatment plant (STP proposed for the effluent treatment are design to achieve system nutrient reduction, as described in Section 8.2 and further additional nitrogen reduction is expected within the sand mound/soil interface.

The total nutrient load expected to be generated from the expected occupancy of dogs, staff, visitors and guests within the proposed development is:

- 123.85kg Total Nitrogen/year
- 12.85kg Total Phosphorous/year

The expected nutrient loading to the EDA is calculated as detailed in the Tables in Appendix 4. The total nutrient loading was used in the nutrient balance modelling in Appendix 4 for sizing of the EDA.

10.1 Kennel Wastewater

The expected loading generated from the dog faecal matter was investigated to ensure the nutrient loading including the kennel washwater.

According to the "Kennel Waste Management Guidelines" (Water and Rivers Commission, Government of Western Australia, 1999), an average sized dog is expected to produce approximately 2g nitrogen/day. The guidelines also state that removal of manure can reduce the nitrogen loading by more than 50%.

An alternative reference, Hall & Schulte (1999) cited in Khwanboonbumpen, S. (2006) reported a nitrogen production of 4.6g dog/day and phosphorous production of 0.15g/dog/day. The latter reference was used within this report for loading calculations of nitrogen and phosphorous to remain conservative.

Based on Khwanboonbumpen, 2006, and assuming 50% reduction due to solid faeces collection, it is calculated that a design peak occupancy of 60 dogs would be expected to produce:

- TN: 60 dogs @ 2.3gTN/dog= 138.0 g TN/day and 55.37 kg TN/year.
- TP: 60 dogs @ 0.075gTP/dog = 4.5 g TP/day and 1.64 kg TP/year

Assuming an average 50% kennel occupancy over the year for the purposes of nutrient loading only, this equates to:

- TN: 27.7 kg TN per year.
- TP: 0.82 kg TP/year.

The TN and TP loadings summarised, and the effluent disposal area modelled in Appendix 4.

Table 6 Design Model Inputs

Design Factor	Loading Factors	
Design References:	• AS/NZS 1547:2012 – monthly water balance • Council's On-site Sewage and Greywater Reuse Strategy 2014 • Boughton Daily Water Balance Model + Nutrient Mass Balance– Northern Rivers Councils 1999	
Climate Data	Orchard Hills Treatment Works (1970-2018) BOM Station 067084. Mean monthly rainfall 832.7mm	
Design Wastewater Loading	6600L/day PEAK DAILY 7000L/day used in sand mound sizing for the purposes of conservative design	
Nitrogen (TN)	123.05 kg TN kg/year (see Section 10 and Appendix 4 for calculations)	
(TN) System Nutrient Reduction	Secondary Treatment + Sand Mound	70% TN reduction
	Above outputs are considered conservative with additional denitrification taking place in disposal field.	
Vegetation Removal (TN)	Kikuyu up to 300kg/ha/year (NSW Agriculture 1997 as cited in LCC, 2007). Conservative rate for local species of (300 kg/ha/year)	
Phosphorus (TP)	12.83 kgTP/year (see Section 10 and Appendix 4 for calculations)	
Vegetation Removal (TP)	30 kg/ha/year (Myers et al 1994, cited in LCC 2007)	
Phosphorus Adsorption	~8 000 kg/ha/ based on field texture and soil profile analysis	
Design Loading Rate	8 mm/day	

Table 7 Sizing Table for Sand Mounds Per Each

Design Load (L/day)	Aggregate Distribution Bed Dimensions (m)			Overall Mound Dimensions (m)				Hydraulics	
	Length	Width	Thickness	Length	Width	Height	Area (m2)	Flow Rate (L/min)	Residual Head (m)
6600	33	2.5	0.2	50	8	0.9	400	180	5

Table 8 Summary of EDA Sizing

Factor	Design Load	Minimum Planted Effluent Disposal Area (m2)
Hydraulic Load	6600L/day (PEAK DAILY)	816
Nitrogen (TN)*	123.05 kg/year	984*
Phosphorus (TP)	12.83 kg/year	854*

* See Appendix 4 The nutrient management zone incorporates the vegetated natural soil in the 2m spacing between each constructed sand mound. This area is demonstrated by the Site Plan in Appendix 1 to be adequately provided on the site.

11 DISCUSSION

The proponent is committed to achieving high standard of environmental and human health protection, over and above the minimum expected for site suitability. As expected of developments with Penrith City Council, this proposal provides a system that far exceeds primary treatment based systems that rely on soil absorption only and are prone to failure in the local soils.

The on -site sewage management techniques presented in this revised report significantly improve upon even typical secondary sewage treatment and land application techniques. High level treatment provided in the robust sewage treatment plant (STP) is enhanced by further treatment in an engineered sand mound. The natural biological processes within the sand mound are well documented as providing additional nutrient reduction and biological disinfection, lifting the bar above STP discharges. Pressurised distribution via a controlled network further improves the efficiencies of the operation and minimises the risk of nuisance. All levels of the system can be controlled from the quality and quantity of the influent, right through to the time-dosed distribution of effluent through the sand mound.

The revised development has been reduced in footprint and the adopted 100% occupancy rates for hydraulic loading calculations provide a conservative system design. A reserve effluent disposal area of 100% of peak daily design load is provided to further minimise the risk of the development impacting negatively on human or environmental health. Conflicts between land uses within the site have been addressed with separation of the effluent disposal from the pedestrian accessible areas of the walkways, dog training yards and protected trees of the site.

Stormwater engineering within the revised development has provided water controls to effectively isolate the effluent sand mounds from the stormwater detention basin, thereby mitigating the proximity of effluent disposal mounds.

The dry composting of the dog faecal material minimises contamination of the wastewater stream, and produces a natural product that can be used as a soil conditioner on site. The outstanding compost product resulting from the waste management process will provide for improved community amenity and awareness of the potential for reusing such a waste.

The revised on-site sewage management has adequately addressed the limitations of the site with a system design that provides flexibility and security for long term operational performance.

In conclusion, it is considered that the proposed on-site sewage management (OSSM) system exceeds the requirements for development proposals as listed in Section 13.3B of Penrith City Council's Development Control Plan 2014:

a) Sustainable management of sewage is achieved through the utilisation of a biological sewage treatment plant and sand media for final effluent polishing and disposal, minimising the use of chemicals and pumps.
b) The OSSM system is designed to achieve the minimum land application area required for long term hydraulic loading and provides for well in excess of 50 years of nutrient loading. The wetting and drying cycles achieved by the time-dosing achieves prime conditions for de-nitrification to occur within the mound.

c) The proposed STP will be equipped with a flow meter and sampling point to enable valuable data to be recorded and monitored in terms of wastewater generation.
d) The effluent is treated to secondary quality, with disinfection and disposed of below ground, therefore provide multiple barriers to human exposure and minimisation of risk of harm. A reserve effluent disposal area is provided as part of the risk management process to be available for future expansion or resting, or duplication or replacement of the system due to future site circumstances.
e) The high quality of effluent and low effluent loading rates to the basal area within the mound, and overland setback distances provide protection of the land and vegetation of the site.
f) Engineer designed surface water controls has resulted in separation of the “clean” surface water run on and potential run-off downslope of the EDA, thereby protecting surface water quality.
g) Conservation of resources is achieved by providing biological effluent treatment processes within an on-site solution for effluent disposal, rather than relying on off-site pump-out disposal.
h) To protect community amenity there are controls on the OSSM system operation to prevent nuisance and provide high levels of amenity. Monitoring of flow volumes will enable ongoing efficiency of system operations.

12 RECOMMENDATIONS AND CONCLUSION

Based on the information in this report, it is considered that the recommended wastewater management methods listed below, and detailed in this report, are sufficient to minimise the risk to public health and achieve an acceptable level of environmental impact from the proposed development.

1. Prior Council approval to install and operate a waste treatment device is required under Section 68 of the Local Government Act 1993 prior to installation of the on-site sewage management facility. A detailed design of the on-site sewage management facility, including hydraulic analysis and component detail of the sand mound effluent distribution network, and an Operation and Maintenance Manual, is to be provided with this application following development approval.

   A performance based review of the on-site sewage management system, including representative effluent quality and flow monitoring, is to be completed after 12 months of operations and prior to Stage 2 construction proceeding. This will enable design, Council approval and implementation of any necessary system augmentation to service the proposed Stage 2 Kennel building operations.,

2. Installation of a commercial Sewage Treatment Plant with engineering design capable of treating 10kL/day. The STP is to incorporate timer pumps to enable the capping of the discharge volume to the sand mounds over each 24 hour period. The STP is to be installed below ground in the general location indicated on the Site Plan in Appendix 1.

3. The layout and configuration of the mounds is to be generally in accordance with the Site Plan in Appendix 1, and remains subject to plumbing/drainage connections and final detailed hydraulic design. Detailed specification and hydraulic analysis of the mound distribution network is to be submitted for Council approval at installation approval stage.

4. Pre-treatment of all waste water within the kennels buildings is to be provided in the form of basket traps in floor wastes, sinks and the outdoor pen drainage. Detailed design is to be provided at construction stage approval.

5. A "squirt" test is to be carried out on the punched poly lines within the distribution beds prior to installing within the slotted wall PVC pipes. This is to ensure sufficient pressure is attained to ensure uniform effluent distribution and wetting pattern throughout each bed.

6. Full water saving devices are to be fitted within the Assistance Dogs Training Facility including the combined use of low volume dual flush water closets, shower-flow restrictors and shower timers, timed or spring return aerator faucets and water conserving appliances.

7. Dog Manure is to be collected twice daily as solid waste from kennels, training yards and potty areas. Dog manure is to be stored in bags in containers/drums within tight fitting lids prior to emptying into the mobile garbage bins, and transferred to the OSCA for on-site composting. Any excess manure is to be bagged and transferred to collection point for disposal off-site as solid waste.
8. Shallow under cover surface drains within interior floor of kennels to receive washdown water.

9. Screened sumps/shallow drains are to be constructed at end of exterior runs to receive clean run-off from exterior runs during rainfall events, and discharge to underground piped stormwater reticulation system.
10. Basket traps are to be provided within all floor wastes and sink wastes to provide removal of grit, hair and particulates prior to discharge to STP for treatment.

11. A flow meter is to be installed on the pump out line. Monitoring is to be recorded as necessary to determine the representative daily load and corresponding dog, visitor, guest and staff numbers. The reporting of results and any corrective actions are to be submitted to Council should effluent flow consistently exceed the system daily design discharge flows of 7kL/day to the sand mounds:

12. Effluent quality monitoring is to be carried out quarterly for a 12-month period following commencement of operations. Review of the information is to be carried out and a report prepared with recommended corrective actions as necessary.

    The reporting of results and any corrective actions are to be submitted to Council should effluent flow consistently exceed the individual system design discharge flows and/or the effluent quality does not achieve secondary quality criteria with nutrient reduction as summarised below:
    - BOD <20 mg/L
    - SS <30 mg/ L
    - *coli* <30 cfu/100 mL
    - TN <30mg/L
    - TP <5mgL

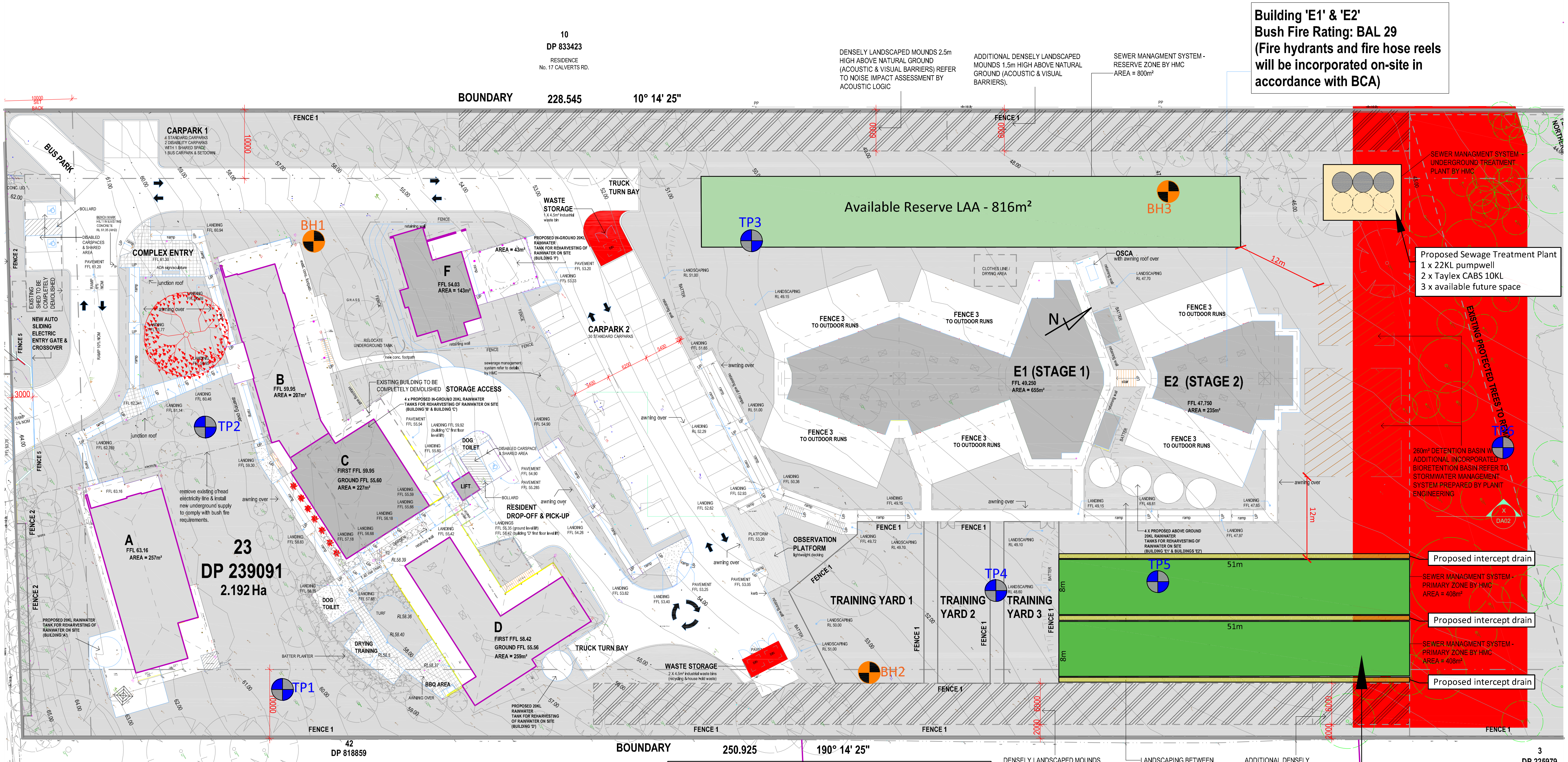
13 REFERENCES

- Alderson, G. & Associates Pty Ltd "Draft Richmond Tweed On-site Regional Wastewater and Sewage Management Strategy", 1999.
- AS/NZS 1547: 2012 On-site Domestic Wastewater Management
- Ballina Shire Council, "On-site Sewage Management Strategy", 2017.
- Ballina Shire Council, "On-site Sewage Management Guidelines", 2017.
- Bannerman, S.M.& Hazelton, P.A., "Soil landscapes of the Penrith 1:100,000 Sheet", Soil Conservation Service, Sydney, 1990.
- Bishop, A. & Whitehead, J.H., Asquith, B. *Optimising Mound Designs – Incorporating Best Practice and Innovation*. In Patterson, R.A. Jones, M.J. (Eds.) Proceedings of On-site '07: Innovation and Technology for On-site Systems. Lanfax Laboratories, Armidale, 2007
- Converse, J. C. and Tyler, E. J. Wisconsin Mound Soil Absorption System: Siting, Design and Construction Manual. Small Scale Waste Management Project, University of Wisconsin-Madison, 2000. http://www.soils.wisc.edu/sswmp/pubs/15.24.pdf
- Research Report, NSW Department of Local Government, 112 pp. accessible at http://www.dlg.nsw.gov.au/Files/Information/R14-Lismore%20City%20Council.pdf
- Department of Local Government, EPA (NSW), NSW Health, Land and Water Conservation and Department of Urban Affairs and Planning, "*Environment & Health Protection Guidelines – On-site Sewage Management for Single Households*", February 1998.
- Geary, P. and Gardner, E, "On-site Disposal of Effluent" in *Innovative Approaches to On-site Management of Waste and Water: A One Day Conference*, 1996, SCU Lismore, 1996
- Hazelton, P. and Murphy, B. "Interpreting Soil Test Results – What Do All The Numbers Mean?", NSW Dept. of Natural Resources, Collingwood 2007 (CSIRO Publishing)
- Khwanboonbumpen, S. (2006). Sources of Nitrogen and Phosphorus in Stormwater Drainage from Established Residential Areas and Options for Improved Management. Retrieved from http://ro.ecu.edu.au/theses/75
- Lismore City Council, "Revised On-site Sewage and Wastewater Management Strategy," 2007
- Morand, D.T., Soil Landscapes of the Tweed Heads - Murwillumbah 1:100 000 Sheet, 1996.
- Munsell Soil Color Charts, GretagMacbeth, New Windsor, NY, USA, 2000.
- National Water Quality Management Strategy - Australian Guidelines for Water Recycling (Environment Protection and Heritage Council, Natural Resource Management Ministerial Council, Australian Health Minsters' Conference, 2006),
- NSW Dept. Of Water & Energy (DWE), "*Liquid Trade Waste Regulation Guidelines*", April 2009.
- NSW Soil Conservation Service, "Soil landscapes of the Penrith 1:100,000 Sheet"
- Ongerth, H.J., Ongerth, J.E. "*Health consequences of wastewater reuse*". Annual Review of Public Health*1982; 3(4): 9-44. 1982*
- Penrith City Council, "On-Site Sewage Management and Greywater Reuse Policy" 14 April 2014
- Petterson SR, Ashbolt NJ. "Viral risks associated with wastewater reuse: modeling virus persistence on wastewater irrigated salad crops". Water Sci Technol 2001; 43(12):23-6.
- Sydney Catchment Authority, "Designing and Installing On-site Wastewater Systems. A Sydney Catchment Authority Current Recommended Practice", SCA, May 2012
- Whelan, B.R. And Titammis, Z.V., 1982. "Daily chemical variability of domestic eptic tank effluent". *Water, Air and Soil Pollution* ***17***, 131-139
- Whitehead & Associates, Standard Designs for On-site Wastewater Management Systems in Tilligerry Creek (Port Stephens Council, October, 2005)
- Whitehead, J., Geary, P. *Sand mounds for effective domestic effluent management*. *Water* Vol. 36, Issue 1, p. 80-80; Australian Water Association 2009.

14 APPENDICES

14.1 Appendix 1 Site Plan

SEE NEXT PAGE



Note: Setbacks for proposed EDA's

- >100m to watercourse
- >12m to downslope property boundary
- >12m to bio-retention basins
- 3m to across slope driveways and buildings
- 2m to walkways
- 2m to training yards
- 2m to landscaped acoustic mounds
- >250m to nearest groundwater bore/well
- 1.5m tank setback to buildings
- Rainwater harvest tanks to be above ground

Scale Printed @ A3

0 5 10 30m

TP1-6 HMC Soil Investigation (19.6.2018)

BH 1-3 HMC Soil Investigation (20.1.2016)

ONSITE SEWAGE MANAGEMENT DESIGN - EFFLUENT DISPOSAL AREAS (EDA)

8 Austin Place
Orchard Hills

Base Drawing Source: ADA_Site Plan (DA02) 18-9-18 HMC Ref: HMCDWG2015.149.11.Wisconsin Mounds

HMC Environmental Consulting Pty Ltd
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Job No: 2015.149
Date: September 2018
Revision Date:

14.2 Appendix 2 Soil Profile Descriptions

Table 9 HMC Soil Investigation - 19 June 2016

Soil Profile – HMC TP1 via mechanical excavation						
Depth mm	Field Texture/ Soil Category*	Structure	Colour (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test**
0-300	Sandy Clay Loam Soil Category 4	Weak Hard-setting	Dry Dark Yellowish Brown (10YR2/4)	6	Few fine gravels	Class 7/8 Slaking No limitation
300-700	Light Silty Clay Soil Category 5	Weak Compacted	Dry Brown (10YR4/3)	6	Few fine gravels	Class 7/8 Slaking No limitation
700-800	Medium Silty Clay Soil Category 6	Weak Compacted	Olive Brown 2.5Y4/4	8.5	Few fine gravels/grit visible	Class 2 Slight dispersion
Soil Profile – HMC TP2 via mechanical excavation						
Depth	Field Texture Determination	Structure	Colour (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test
0-200	Sandy Clay Loam Soil Category 4	Weak Hard-setting	Dry Dark Yellowish Brown (10YR2/4)	6	Few fine gravels	Class 7/8 Slaking No limitation
200-500	Light Clay Soil Category 5	Weak Compacted	Dry Brown (10YR4/3)	6	Few fine gravels	Class 7/8 Slaking No limitation
500-800	Medium Silty Clay Soil Category 6	Weak Compacted	Olive Brown 2.5Y4/4	8.5	Few fine gravels/grit visible	Class 2 Slight dispersion
800-900	Heavy Silty Clay	Weak Compacted	Olive Brown 2.5Y4/4	9	Few fine gravels/grit visible	Class 2 Slight dispersion
Soil Profile – HMC TP3 via mechanical excavation						
Depth mm	Field Texture Determination	Structure	Colour Moist (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test
0-200	Light Clay	Weak Hard-setting	Dark Yellowish Brown 10YR3/4	7.5	Nil/	Class 7 Slaking
200-400	Medium Silty Clay	Weak compacted	Dark Brown 10YR3/3	8	Nil	Class 2 Slight dispersion
400-800	Medium Silty Clay	Weak compacted	Dark Yellowish Brown 10YR3/4	8.5	Nil	Class 2 Slight dispersion
800-900	Light Silty Clay	Weak compacted	Strong Brown 7.5YR5/6		NIl	Class 2 Slight dispersion

Soil Profile – HMC TP4 via mechanical excavation						
Depth mm	Field Texture Determination	Structure	Colour Moist (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test
0-250	Light Clay	Weak Hard-setting	Dark Yellowish Brown 10YR3/4	7.5	Nil/	Class 7 Slaking
450-400	Medium Silty Clay	Weak compacted	Dark Brown 10YR3/3	8	Nil	Class 2 Slight dispersion
400-900	Medium Silty Clay	Weak compacted	Dark Yellowish Brown 10YR3/4	8.5	Nil	Class 2 Slight dispersion
900-1000	Light Silty Clay	Weak compacted	Strong Brown 7.5YR5/6 Mottling		NIl	Class 2 Slight dispersion

Soil Profile – HMC TP5 via mechanical excavation						
Depth mm	Field Texture Determination	Structure	Colour Moist (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test
0-300	Clay Loam Silty	Weak Hard-setting	Dark Yellowish Brown 10YR3/4	7.5	Few fine gravels	Class 8 Slaking
300-900	Medium Silty Clay	Weak compacted	Yellowish Red 5YR4/6 Mottling	8	Nil	Class 7 Slaking
900-1000	Heavy Silty Clay	Weak compacted	Yellowish Brown 10YR5/4. Mottling	8.5	Nil	Class 2 Slight dispersion

Soil Profile – HMC TP6 via mechanical excavation						
Depth mm	Field Texture Determination	Structure	Colour Moist (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test
0-300	Clay Loam Silty	Weak Hard-setting	Dark Yellowish Brown 10YR3/4	7.5	Few fine gravels	Class 8 Slaking
300-900	Medium Silty Clay	Weak compacted	Yellowish Red 5YR4/6 Mottling	8	Nil	Class 7 Slaking
900-1000	Heavy Silty Clay	Weak compacted	Yellowish Brown 10YR5/4 Mottling	8.5	Nil	Class 2 Slight dispersion

Table 10 HMC Soil Investigation- 20 January 2016

Soil Profile – HMC BH1 via hand auger						
Depth mm	Field Texture/ Soil Category*	Structure	Colour (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test**
0-250	Fine Sandy Clay Loam Soil Category 4	Moderate	MoistVery Dark Brown (7.5YR2.5/3)	6	Nil	Class 3/6 Slake 2 No limitation
250-700	Light Clay Soil Category 5	Strong	Moist Dark Brown (7.5YR3/3)	6	Nil	Class 3/6 Slake 3 No limitation
Soil Profile – HMC BH2 via mechanical excavation						
Depth	Field Texture Determination	Structure	Colour (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test
0-100	Fine Sandy Clay Loam Soil Category 4	Moderate	Moist Very Dark Brown (7.5YR2.5/3)	6	Nil	Class 3/6 Slake 2 No limitation
100-700	Light Clay Soil Category 5	Strong	Moist Dark Brown (7.5YR3/3)	6	Nil	Class 3/6 Slake 3 No limitation
Soil Profile – HMC BH3 via hand auger						
Depth mm	Field Texture Determination	Structure	Colour Moist (MUNSELL CHART)	pH	Coarse Fragments	Modified Emerson Aggregate Test
0-150	Fine Sandy Clay Loam Soil Category 4	Moderate	MoistVery Dark Brown (10YR2/2)	6	Nil	Class 3/6 Slake 2 No limitation
150-700	Medium Clay Soil Category 6	Strong	Moist Dark Brown(7.5YR3/2)	6	Nil	Class 3/6 Slake 2 No limitation

* Refers to Soil Category as described in Table 5.1 AS/NZS1547:2012

**As described by Robert Patterson Lanfax Labs Technical Note T14-1 (November 2014)

14.3 Appendix 3 Guidelines for Setback Distances – Risk Assessment

14.3.1 Penrith City Council OSSMGR Policy (2014):

Table 3 Buffer Distances for OSSM Systems

System	Buffer Distances
All OSSM systems (including tank)	• 250 metres to domestic groundwater well • 100 metres to permanent surface waters (e.g. rivers, creeks, streams, lakes etc) • 40 metres to other waters (e.g. dams, stormwater easements, overland flow paths, intermittent waterways and drainage areas etc) • 15 metres from an in-ground water tank • 1 metre from the drip line of native trees and shrubs • For tank – minimum 1.5 metres from dwelling
Surface spray irrigation	• 15 metres to dwellings • 6 metres if area up-slope and 3 metres if area down-slope of buildings, driveways and property boundaries • 3 metres to paths and walkways • 6 metres to swimming pools and recreational areas
Surface drip and trickle irrigation	• 6 metres if area up-slope and 3 metres if area down-slope of dwellings, swimming pools, property boundaries, driveways and buildings
Subsurface irrigation	• 6 metres if area up-slope and 3 metres if area down-slope of dwellings, swimming pools, property boundaries, driveways and buildings
Absorption system	• 12 metres if area up-slope and 6 metres if area down-slope of property boundaries and dwellings • 6 metres if area up-slope and 3 metres if area down-slope of swimming pools, driveways and buildings

***Notes**: (1) Additional buffer distances may be required as identified during Council's assessment of the development proposal.*

14.3.2 AS/NZS 1547:2012

Table R1 -Guidelines for Horizontal and Vertical Setback Distances (to be used in conjunction with Table R2)

Site Feature	Setback Distance range (m)[1]	Site constraint items of specific concern (from table R2)[1]
	Horizontal Setback Distance (m)	
Property Boundary	1.5-50[2]	A, D, J
Buildings/houses	2.0->6[3]	A, D, J
Surface Water[4]	15-100	A, B, D, E, F, G, J
Bore, Well[5]	15-50	A, C, H, J
Recreational areas (Children's play areas, swimming pools and so on)[7]	3-15[8,9]	A, E, J
In-Ground water tank	4-15[10]	A, E, J
Retaining wall and Embankments, escarpments, cuttings[11]	3.0m or 45° angle from toe of wall (whichever is greatest)	D, G, H
	Vertical Setback Distance (m)	
Groundwater [5,6,12]	0.6->1.5	A, C, F, H, I, J
Hardpan or bedrock	0.5->1.5	A, C, J

Table R2
Site Constraint Scale for Development of Setback Distances
(used as a guide in determining appropriate setback distances from ranges given in Table R1)

Item	**Site/system feature**	**Constraint Scale** [1] **Lower** ⟷ **Examples of constraint factors**[2]	**Higher**	**Sensitive features**
A	Microbial quality of effluent [3]	Effluent quality consistently producing ≤10^6 cfu/100mL *E.coli* (for example, primary treated effluent)	Effluent quality consistently producing ≥10^6 cfu/100mL *E.coli* (for example, primary treated effluent)	Groundwater and surface pollution hazard, public health hazard
B	Surface water [4]	Category 1 to 3 soils [5] no surface water down gradient within > 100m, low rainfall area	Category 4 to 6 soils, permanent surface water <50m down gradient, high rainfall area, high resource/environmental value[6]	Surface water pollution hazard for low permeable soils, low lying or poorly draining areas
C	Groundwater	Category 5 & 6 soils, low resource/environmental value	Category 1 and 2 soils, gravel aquifers, high resource/environmental value	Groundwater pollution hazard
D	Slope	0-6% (surface effluent application)	>10% (surface effluent application), >30% subsurface effluent application	Off-site export of effluent erosion
E	Position of land application area in landscape [6]	Downgradient of surface water, property boundary, recreational area	Upgradient of surface water, property boundary, recreational area	Surface water pollution hazard, off-site export of effluent
F	Drainage	Category 1 and 2 soils, gently sloping area	Category 6 soils, sites with visible seepage, moisture tolerant vegetation, low lying area	Groundwater pollution hazard
G	Flood potential	Above 1 in 20 year flood contour	Below 1 in 20 year flood contour	Off-site export of effluent, system failure, mechanical faults
H	Geology and Soils	Category 3 and 4 soils, low porous regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, high porous regolith	Groundwater pollution hazard for porous regolith and permeable soils
I	Landform	Hill crests, convex side slopes and plains	Drainage plains and incise channels	Groundwater pollution hazard, resurfacing hazard
J	Application method	Drip irrigation or subsurface application of effluent	Surface/above ground application of effluent	Off-site export of effluent, surface water pollution

14.4 Appendix 4 Nutrient Loading Calculations & EDA Size Modelling

Table A Nitrogen Load Calculations – Kennel Wash Down Water – Solid Faeces Collected

No. of Dogs	Estimated Nitrogen Produced	Reductions – Management and Operations	Mass Load of Nitrogen (kg/year)
60 dogs (peak)	4.6gN/dog/day*	50% via faeces removal = 2.3gTN/dog/day 50% av. occupancy p.a. = 1.15 g TN/dog/day	1.15gTN/dog/day x 60 dogs x 365 days = TOTAL 27.7kgTN/year

*Hall & Schulte (1999) cited Khwanboonbumpen, S. 2006 – assumes average 20 kg dog

Table B Phosphorous Load – Kennel Wash Down Water – Solid Faeces Collected

No. of Dogs	Estimated Phosphorous Produced	Reductions – Management and Operations	Mass Load of Phosphorous Kg/year
60 dogs (maximum)	0.15gP/dog/day*	50% via faeces removal = 0.075 gTP/dog/day 50% av. occupancy p.a. = 0.04 g TP/dog/day	0.04gTP/dog/day x 60 dogs x 365 days = TOTAL 0.82kg TP/year

* Hall & Schulte (1999) cited in Khwanboonbumpen, S. 2006 - assumes average 20kg dog.

Table C Nutrient Load Breakdown Per Fixture

Production Figures for N in kg/person/year

Parameter	Toilet	Kitchen	Dishwasher	Laundry	Bath	Total
Total N	2.6	0.26	0.30	0.45	0.19	3.8*
	68%	7%	8%	12%	5%	100%

Production Figures for P in kg/person/year

Parameter	Toilet	Kitchen	Dishwasher	Laundry	Bath	Total
Total N	0.2	0.05	0.15	0.1	0.1	0.6

Source: Whelan & Titammis,1982 cited in LCC, 2007

Table D Nitrogen Load to EDA – Human Sewage + Kennel Wastewater (NO MANURE)

Source – Refer to Operational Management Plan (SEE)	Reductions – Fixture and Operations	TN Load per Person (kg/P/Year)	Total TN Load (kg TN/year)
4 x overnight caretakers	Nil reduction	3.8	4 x 3.8 = 15.2
10 x guests/carers	No laundry	3.35	10 x 3.35 = 30.35
20 admin staff 7 kennel staff	No laundry 2 meals/day 5 days /week	3.35 3.35 x 66%=2.2 2.2 x 71% = 1.6	27 x 1.6 = 43.2
60 x visitors/week Average 9/day	No laundry 1 meal/day	3.35 3.35 x 66%=2.2 2.2 x 33% = 0.73	9 x 0.73 = 6.6
SUB TOTAL Human sewage	95.35 kg TN/year		
SUB TOTAL Kennel Wastewater	27.7 kg TN/year (from Table A above)		
TOTAL	123.05 kg TN/year (untreated)		

Table E Phosphorous Load to EDA – Treated Sewage & Kennel Wastewater (NO MANURE)

Source – Refer to Operational Management Plan (SEE)	Reductions – Fixture and Operations	TP Load per Person (kg/P/Year)	Total TP Load (kg TP/year)
4 x overnight caretakers	Nil reduction	0.6	4 x 0.6 = 2.4
10 x guests/carers	No laundry 2 meals/day,	0.5 0.5 x 66%=0.33	10 x 0.33 = 3.3
20 admin staff 7 kennel staff	No laundry 2 meals/day 5 days /week	0.5 0.5 x 66%=0.33 0.33 x 71% = 0.23	27 x 0.23 = 6.21
60 x visitors/week Average 9/day	No laundry 1 meal/day	0.5 0.5 x 66%=0.33 0.33 x 33% = 0.11	9 x 0.11 = 0.1
SUB TOTAL Human sewage	12.01 kg TP/year		
SUB TOTAL Kennel Wastewater	0.82 kg TP/year (from Table B above)		
TOTAL	12.83 kg TP/year (untreated)		

Table F Nitrogen Balance

NITROGEN BALANCE

1 - Determine the daily N load	from Table D Appendix 4
mg/day	123050000
2 - Determine the annual N load	
No of Days	365
N mg/year	123050000.0000
3 - Allow 20% loss through denitrification processes	0.8
Annual N load x 0.8 mg/year	98440000
Convert to kg/year (divide by 1,000,000)	98.44
Allow TN reduction via treatment system	29.53
4 - Allow for an uptake by plants (application rate)	

Nitrogen Reduction (assumed)	
Sand Mound	70%
Septic Tank	20%
AWTS	50%

Rate of Nitrogen Uptake (source Gardner, 1995 & Myers et al,

Species in Disposal Area	Nitrogen Uptake Rate (Kg/ha/year)	Nitrogen Uptake Rate ($mg/m^2/day$)
Eucalypts	50 (long term)	14
Eucalypts	120 - 150 (<4 years)	33-41
Grasses (Typha, Phragmities, fresh pasture)	300	82
Phragmities, Typha	5656	1550
Turf	200	55

5 - Divide the annual N load by the application rate	0.09844	
convert from hectares to m^2 (x 10,0	984	m^2

Table G Phosphorus Balance

PHOSPHORUS BALANCE

1 - Determine the daily P load	SEE Table E

2 - Determine the annual P load	
No. of days	365
P mg/year - From Table E Appendix 4	12830000
Convert to kg/year (divide by 1,000,000)	12.83
System Reduction 80%	2.566
3 - Allow for an uptake by plants (application rate) kg/P/ha/yr	30

4 - Allow for an uptake by soils (application rate)	8000
Phosphorus Uptake by Soils	
Soils in Disposal Area	**Average Phosphorus Uptake Rate (kg/ha/yr) 15mg/L Effluent Concentration**
Alluvial	10,000
Dark Basaltic Soils (Chocolate Soils)	12,000
Krasnozems (Red Basaltic)	10,000
Sandy Duplex Soils (Sandy Podzolic)	8,000
Clayey Duplex Soils	8,000
Humic Gley Soils	NA to be tested
Podzols Sandy Soils	1,000

5 - Multipy average uptake by actual adsorption rate in field	
0.25-0.5 actual adsoprtion rate in field	0.625
5 - Determine P sorption each year for 50 years	
application rate * 0.625/50 (kg/ha/yr)	0.03
6 - Determine total annual application rate	
Plant uptake + P sorption	30.032075
7 - Divide the annual P load by the application rate x 10,000 to convert back m^2	854

Source: BALLINA SHIRE COUNCIL OSSM STRATEGY 2017

Phosphorus Sorption Uptake Values

Soil Category	Texture	Structure	Typical P_{sorp}* (mg/kg)
1	Gravels and sands	Structureless	75
2a	Sandy loams	Weak	75
2b	Sandy loams	Massive	75
3a	Loams	High / moderate	150
3b	Loams	Weak / massive	150
4a	Clay loams	High / moderate	300
4b	Clay loams	Weak	300
4c	Clay loams	Massive	300
5a	Light clays	Strong	500
5b	Light clays	Moderate	500
5c	Light clays	Weak / massive	500
6a	Med-heavy clays	Strong	500
6b	Med-heavy clays	Moderate	500
6c	Med-heavy clays	Weak / massive	500

* If soil parent material is basalt then increase Psorp by 100 mg/kg

Nutrient Uptake Rates

Vegetation Type	Total Nitrogen (kg/ha/year)	Total Phosphorus (kg/ha/year)
Good quality woodland	90	25
Poor quality woodland	65	20
Lawn – fully managed (clippings removed)	240	30
Lawn – unmanaged	120	12
Improved pasture	280	24
Perennial pasture	99	11
Shrubs and some trees – fully managed	150	16
Shrubs and some trees – unmanaged	75	8

For **bulk density (g/cm^3)**, apply the following values:

Sandy soil – 1.8 g/cm^3
Intermediate – 1.5 g/cm^3
Clayey soil – 1.3 g/cm^3

TABLE H - HYDRAULIC LOADING

Wastewater flow	Q	6600	L/day
Daily Loading Rate	DLR	8	mm/day
Crop factor	C	0.75	unit less
Retained rainfall coefficient	RRc	0.2	unit less
Media void space ratio	V	0.3	unit less
Rainfall data	Penrith Treatment Works - 1970-2018		
Evaporation data	Sydney Av. Pan Evap. 1975 - 2005		

(L) Nominated land application area	**750**	m2

Recommended coefficients in Water Balance:
Pan Evap/Crop: = 0.75 (eg grass)
Retained Rainfall Fraction:
Mound 1:3 slope 0 - 0.2

Media void space ratio - 0.3 for gravel bed beneath base of mound

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	
Rainfall	R		mm/month	103.7	109.5	91.6	65.5	56.4	57.3	35	41	35.3	53.9	77.1	72.7	799
Evaporation	E	E	mm/month	175	150	125	105	50	60	60	100	70	150	150	200	1395
Crop factor	C	Crop Factor		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
Outputs																
Evapotranspiration	ET	ExC	mm/month	131	113	94	79	38	45	45	75	53	113	113	150	1046
Percolation	B	DLRxD	mm/month	248	224	248	240	248	240	248	248	240	248	240	248	2920
Outputs		ET+B	mm/month	379	337	342	319	286	285	293	323	293	361	353	398	3966
Inputs																
Retained rainfall	RR	RxRRc	mm/month	21	22	18	13	11	11	7	8	7	11	15	15	160
Effluent irrigation	W	(QxD)/L	mm/month	273	246	273	264	273	264	273	273	264	273	264	273	3212
Inputs		RR+W	mm/month	294	268	291	277	284	275	280	281	271	284	279	287	3372
Storage Calculation																
Storage remaining			mm/month	0	0	0	0	0	0	0	0	0	0	0	0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-86	-68	-51	-42	-1	-10	-13	-42	-21	-77	-73	-111	-594
Cumulative storage	M		mm	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Maximum effluent	N	mm	**0**													
Storage	V	NxL (litres)	**N/A**													
Water balance-to achieve maximum 200mm storage for worst month		**750**	m^2													

14.5 Appendix 5 On-site Composting Apparatus (OSCA)

SEE NEXT PAGE

OSCA Bite-Size Composting Technologies

AUSTRALIAN MADE AND OWNED

specification

OSCA Bite-Size 200

Organic Waste Handling Ability

- kitchen waste including plate scrapes and paper napkins
- spoiled or unusable food
- kitchen preparation waste
- pre-harvest loss
- processing remains
- compostable food packaging, utensils and bags
- animal manures and bedding
- grass clippings
- mulched green waste

Waste Processing Capacity

As a rough guide OSCA Bite-size 200 can process 200ltrs per day or 1400ltrs per week mixed waste (balanced carbon: nitrogen)

Site Requirements

Hard standing flat surface

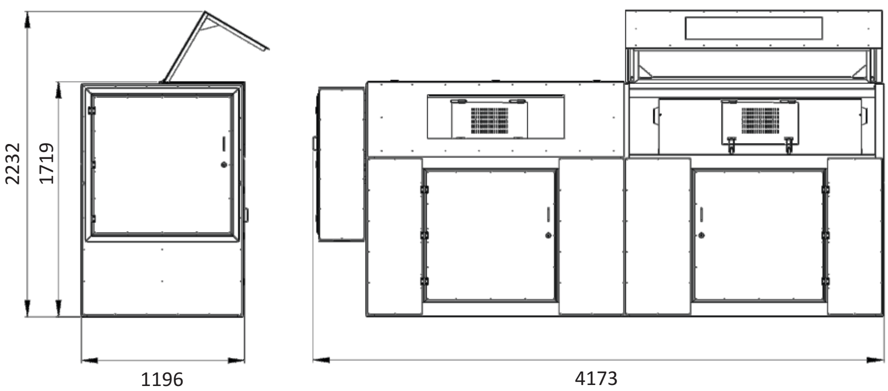
Operation

Simple to operate by alternating between two barrels which can be loaded over a period of time.

Why OSCA?

- Reduction in waste disposal costs & waste to landfill
- Generates quality compost for on-site landscaping in 2 weeks
- Short investment return and low operating costs
- Full Solar option available
- No odours and quiet operation
- Built to last - Heavy-duty construction
- No water/additives required
- Safety features included

OSCA Bite-size 200 Specification		
Length	m	4.2
Width	m	1.2
Height	m	1.7
Electricity (single phase)	volts	240
Power Consumption (per day)	kWh	2
Processing Capacity (per day mixed waste)	ltrs	200



For Further Information

www.onsitecomposting.com.au

OSCA@wormsdownunder.com.au

Contact phone +61 (0)7 5445 9704

Worms Downunder

Patent Protected

14.6 Appendix 6 Industrial Washer Information

SEE NEXT PAGES

Commercial front load washer for on-premises laundry applications

CW10

Dependable & efficient

- Freestanding: can be installed on any floor and any level
- Stainless steel outer and inner drum
- Door opens 180° for easy loading and unloading
- Standard drain pump
- Redesigned soap box with 4 compartments
- 440 G-force extraction
  - removes more moisture
  - minimizes drying times and utility costs
- 5 wash programs including possibility of programming cycle modifier options
  - added prewash
  - extra wash time
  - extra rinse

Control

- Micro-Display control (MDC)
  - Digital display shows vend price
  - Five cycle options
  - Cycle time countdown
  - LED progress indicators
  - Cycle time: long/short cycle

Product may vary from image shown.

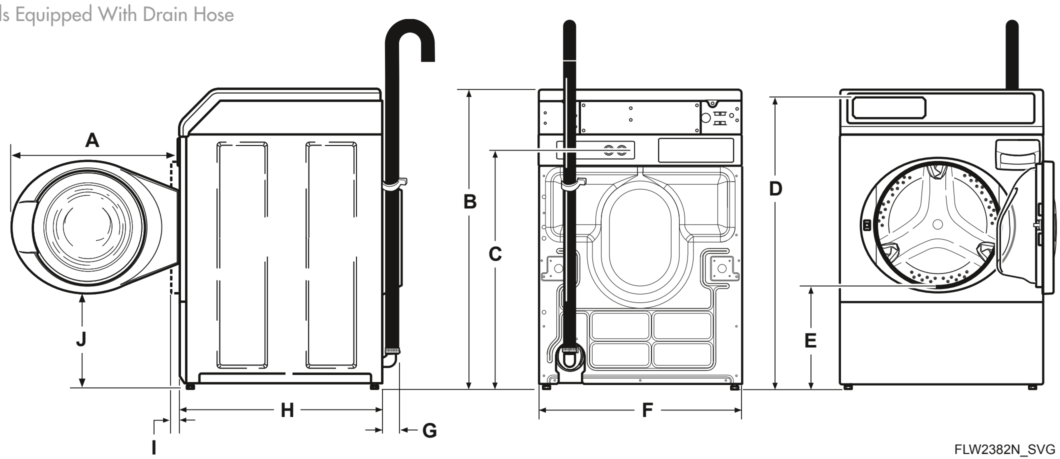
CW10

	CW10
Model	BFNBLBSP303AW01
Drum	
Capacity	9,5 kg
Cylinder volume	96,8 l
Drum speed	
Spin speed	440 G
Spin speed	1200 RPM
Motor	
Motor size	0,67 kW
Cabinet	
Cylinder finish	SS
Colours	White
Door type (solid/window)	N/A
Heating	
Heat sources	N/A
Heating element	N/A
Connection	
Gas inlet connection	N/A
Gas consumption	N/A
Operation	
Water temperatures	3
Cycles	5
Water consumption per cycle	44,3 l
Water pressure	1.4 - 8.3 bar
Cycle indicator lights	Y
Power	
Electrical requirements (Voltage/Hz/Phases)	10AMP/240/50/1
Weight	
Net weight	113 kg
Shipping weight	122 kg
Dimensions	
Unit dimensions	
Height	1027 mm
Width	683 mm
Depth	704 mm
Packing dimensions	
Height	1156 mm
Width	737 mm
Depth	832 mm

*Heights may vary slightly depending on levelling adjustments.

	A	B	C	D	E	F	G	H	I	J	K	L
CW10 Drain Hose	611	1027	813	1006	371	683	52	704	40	333		

Models Equipped With Drain Hose



14.7 Appendix 7 Water Usage Information – Wash down equipment

SEE NEXT PAGE

SPITWATER®
INDUSTRIAL CLEANING & HEATING EQUIPMENT

Interpump

soga®

PROUDLY AUSTRALIAN MADE

SPITWATER®
INDUSTRIAL CLEANING & HEATING EQUIPMENT

Illustration Only

HP110 - WALL MOUNTED COLD WATER CLEANER

SPECIFICATIONS

1650 P.S.I. (110 Bar) Pump Pressure
2400 P.S.I. Turbo Pressure (Optional)
12 Litres per minute Pump Volume
15Amp Plug 3 H.P. Electric Motor
1450 RPM Industrial Machine
Bypass Timer Fitted

STANDARD EQUIPMENT

10 Metres High Pressure Hose
Insulated On/Off Pistol Assembly
Single Lance Assembly
Galvanised Chassis & Stainless Steel Cover
on a Skid Base
Galvanised Wall Mounting Brackets
High & Low Pressure Mode
Operators and Parts Manuals

FEATURES		BENEFITS
Interpump with Ceramic Pistons and Brass Head, 1450RPM Low Speed	➔ ➔	Longer pump life, non corrosive pump head Reduced maintenance costs
Water By-Pass Cooling Tank	➔	Reduces potential damage to the pump in bypass
Inlet Water Filter	➔	Stops debris from scoring pistons and seals
Pressure Gauge	➔	Easily monitor pump performance
Galvanised Chassis	➔	Resistant to corrosion

14.8 Appendix 8 Commercial STP – Taylex CABS 10kL

SEE NEXT PAGE

About the CABS (Commercial Advanced Blower System)

The Taylex CABS System is a purpose built 'off the shelf' Commercial Sewage Teatment Plant. It is not a series of Domestic Treatment Plants to make up a commercial system. It is essentially a 5,000 litre per day off-the-shelf modular system that can be used to treat commercial sewage from 5,000, 10,000, 15,000 or 20,000 litres per day. Larger systems such as 50,000 or 60,000 litres per day can also be created.

To our knowledge the 5,000 litres per day "CABS" tank is the only off-the-shelf module aerobic commercial treatment system in Australia. There are tremendous benefits with the CABS design which we will cover later in this brochure.

The system Taylex has created, is called a CABS (Commercial Advanced Blower System)

How did we do it?

Taylex is the largest producer of Domestic Treatment Systems in Australia. We sell over 2,000 systems a year and we have been in the business of sewage treatment for over 40 years. In fact, we now have our 3rd generation of family working in our business. It took us nearly 3 years from design implementation to a completed CABS on the ground.

We have built a dedicated Commercial Tank that rectifies many of these problems that all commercial systems face.

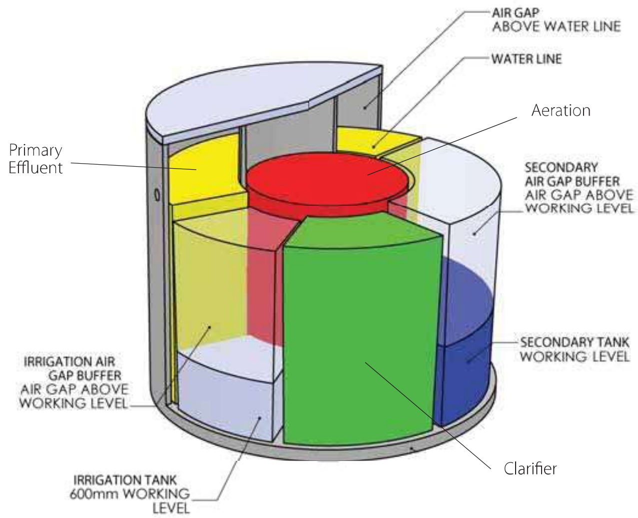
The Taylex Difference

We build our range of commercial systems to last the test of time. They are easy to maintain and operate and they are very price competitive.

Commercial treatment systems are expensive to buy, so don't just pick one on price alone. The system you are about to buy has to last many years and work constantly, 24 hours a day 7 days a week, year in year out. One of the common reasons for future problems is that the system has not been designed correctly.

A Taylex system is scalable to your future effluent processing needs!
- Because, you can add to it at a later date

How Does a 5000 Litres Per Day CABS (Commercial Advanced Blower System) Work?



The CABS is a specifically designed, monolithic, 5 chamber tank that can treat 5,000 litres of effluent per day. The influent is treated over a full 24 hour period using a timed buffering system.

The secret to treating commercial effluent correctly is to treat it slowly.

The CABS system allows us to hold the effluent in the secondary/buffer chamber so that it can be treated over an extended 24 hour period. Every hour we pump a controlled flow through the system. The CABS will treat 208 litres every hour. That's 5,000 litres over a 24 hour period!

Buffer Zones

Another great feature of the CABS System is the extremely large buffer zones.

The Buffer Volumes are as follows:

Primary = 1604 litres
Secondary = 1020 litres
Aeration = 1153 litres
Clarifier = 633 litres
Irrigation = 392 litres

Total buffer in case of emergencies (excluding the pump station) is 4802 litres. Or nearly one day's buffer. So, if something goes wrong, we have a day before it becomes a problem.

Proven Track Record:

The CABS System is a giant version of our domestic treatment plant which we designed in the early 1990's. We have a proven track record with literally 10's of thousands of these systems being installed all over Australia.

Irrigation Areas:

Each CABS will come with its own irrigation pump so we can irrigate to different irrigation areas if required.

Flow Meters:

All CABS tanks are fitted with a flow meter in the irrigation chamber that records the hydraulic volume used by each system. This meter over time, gives us accurate records of the volume of effluent that your CABS system produces both in quiet and busy periods.

Description of a CABS Process Train

The 5,000 litre per day CABS system is a 5 chambered monolithic tank that uses an extended aeration process that can be turned on and off to adjust nitrogen levels.

The effluent enters the primary chamber and then flows into the secondary/buffer chamber which then pumps the desired amount of conditioned effluent to the aeration chamber via the CABS controller unit.

This effluent is pumped from the secondary buffer tank to the aeration chamber once per hour and the amount of effluent pumped across can be varied depending on the amount of effluent that enters the system on a daily basis i.e 100 litres per hour 150, 208 litres per hour.

The aerated (aerobic) chamber has large areas of submerged fixed film growth media to promote stable biomass which acts as a biological filter through which all effluent passes many times before entering the clarifier.

From this the aeration chamber effluent flows into a coned clarifier where any solid particles remaining sink to the bottom of this cone and are pumped via a Davey D25 Vortex pump that operates 4 times a day for 10 seconds to the primary chamber.

The remaining liquid then gravity feeds through 2 Taylex TFG filters which are located in the clarifier to stop any solid particles from flowing to the irrigation chamber.

From this clarification chamber the treated, cleaned effluent is then gravity fed into the irrigation disinfection chamber, the disinfected, cleaned effluent is then pumped to the irrigation management area.

Increasing the System's Capacity at a Later Stage

The CABS system was designed so that at a later stage, you can cost effectively add another CABS System as your needs grow.

In most cases to add one CABS tank is a one day job.

Steps to putting an extra CABS tank in:

1) Dig the new CABS tank into the ground.
2) Run power to the new CABS.
3) Run a line to the irrigation field.
4) Run an extra 32mm line from the pump station to the new CABS tank.

It's that easy!

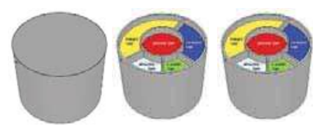
We can make a CABS Bigger

This is a simple process.

PUMP STATIONS

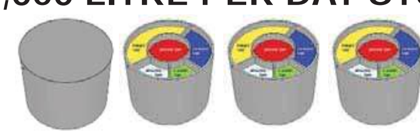
- One pump station can supply to 2 to 4 CABS Tanks.

10,000 LITRE PER DAY SYSTEM



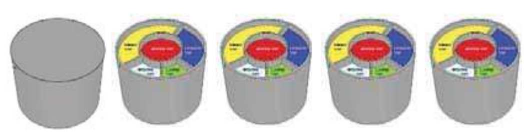
2 x CABS plus 1 x 10,000Lt Up-Front Pump Station

15,000 LITRE PER DAY SYSTEM



3 x CABS plus 1 x 10,000Lt Up-Front Pump Station

20,000 LITRE PER DAY SYSTEM



4 x CABS plus 1 x 22,000Lt Up-Front Pump Station

Design Parameters of the CABS Tank

Water Volume

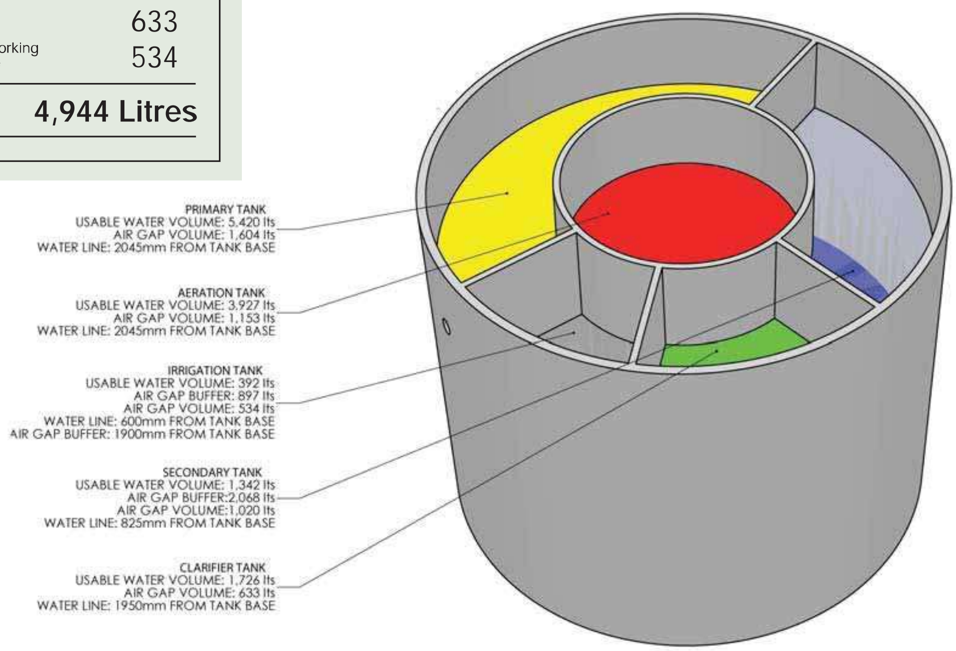
Primary	5,420
Secondary	1,342
Secondary Air Gap Buffer	2,068
Aeration	3,927
Clarifier	1,726
Total Working Capacity	**14,483 Litres**
Plus Irrigation	392
Plus Irrigation Air Gap Buffer	897
Total Working Capacity	**1,289**

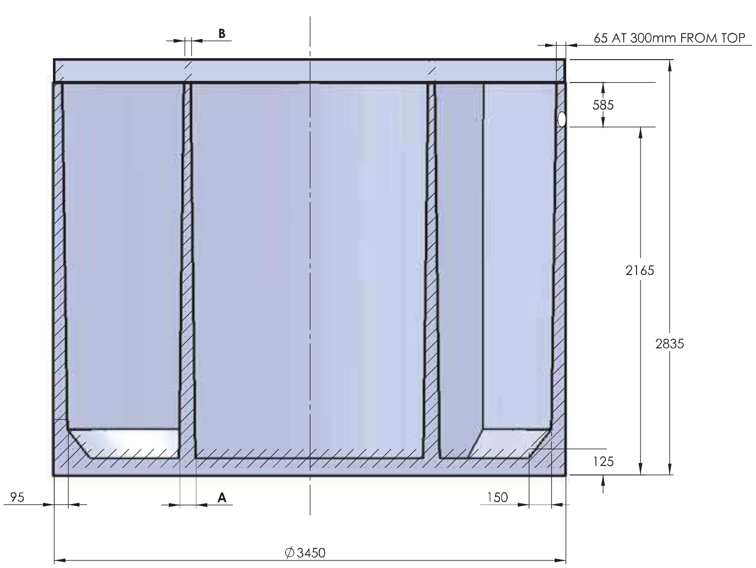
Air Volume

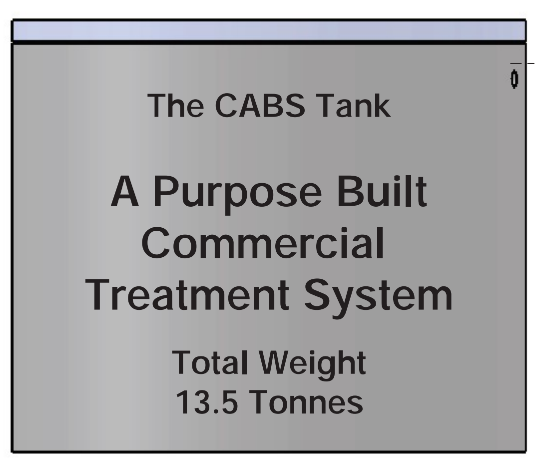
Primary		1,604
Secondary Air Gap	from Working Volume	1,020
Aeration		1,153
Clarifier		633
Irrigation Air Gap	from Working Volume	534
Total Air Volume		**4,944 Litres**

Tank Construction – All Concrete

Height	2835mm
Inlet Invert (from Base)	2165mm
Tank Diameter	3450mm
Tank Dry Weight	11.5 tonnes
Lid Dry Weight	2 tonnes
Total Tank Weight	13.5 tonnes
Maximum Hydraulic Loading	5,000 Litres/day
Operating Capacity	14,483 Litres
Total Tank Capacity	20,716 Litres







Features	Benefits
A Purpose Built Commercial System	Not a Converted Domestic Treatment System
Large Purpose Built Tank	Designed to handle Commercial Effluent
Walls that go all the way to the roof	Minimising Cross Contamination Issues
Tank & Chambers poured all at the same time	No Leaking Internal Walls - Extremely Strong Tank
Purpose Built Simple Diagnostic Controller.	The System tells you exactly what's wrong with it. Simple to read and understand.
Timed Dose Pump in Secondary Chamber	The Effluent is treated evenly over a full 24 hour period
Every electrical item is fitted with its own Earth Leakage Safety Switch	If there is a fault with any electrical component the system will shut off that electrical component and not the entire treatment plant. The alarm will then sound so the fault can be fixed.
Timed Controlled Aeration	The Aeration motor can be turned off and on to suit the system's needs where possible, saving power.
Systems can be added to at a later stage	A very cost effective way to add to the systems as your needs grow
All eletrical components are 3 pin, plug-in, plug-out	No electrician required to change components

Taylex Manufacture The Most Reliable Vessel for a Commercial Sewage Treatment Plant in Australia

Design Parameters for Effluent

The Taylex CABS Commercial System will acheive the below effluent discharge provided the incoming influent is not greater than the table below, and/or the system is not overloaded by adverse chemicals.

Parameter	Unit	Influent (In)	Effluent (Out)
Biological Oxygen Demand (BOD_5)	mg/L	400	<10
Total Suspended Solids (TSS)	mg/L	350	<10
Oil & Grease	mg/L	75	<5
pH		6.5 - 8.2	
Faecal Coliforms, FC	cfu/100mL		<10/100

Phosphorus Removal:
Sometime in 2013, most of the major manufacturers of detergents in Australia will cease using phosphates in their manufacturing processes as they did in America some years ago. This being the case, phosphate should not be an issue in treatment plants but if for some reason you have a treatment plant that needs phosphate reduction, Taylex has a phosphorus reduction system that can be fitted.

Nitrogen Reduction:
This is a very complex issue in treatment plants and there is no easy fix to nitrogen reduction. There are many ways to reduce nitrogen in treatment systems and we have found that each site is unique and comes with its own set of challenges depending on the grade of influent that each commercial site produces. Nitrogen reduction has to be treated on a site by site basis and we will not know the actual levels that can be acheived until the treatment plant is fully functional.

14.9 Appendix 9 Site Photos

Photo 1 View W over existing Biocycle aerated wastewater treatment system (AWTS) tank located between Building B and proposed Building F. All existing Biocycles are to be decommissioned (HMC, 2016).

Photo 2 View S and upslope along eastern boundary adjacent to Building D (HMC,2016).

Photo 3 View W along rear of Building D (HMC 2016).

Photo 4 View north and downslope of existing Biocycle on eastern boundary (HMC 2016).

Photo 5 View E and across slope below Buildings B and C (HMC 2016).

Photo 6 View N and downslope over the proposed Reserve Effluent Disposal Area, along western boundary towards M4 frontage (HMC 2016) .

Photo 7 View N and downslope over the proposed Primary Effluent Disposal Area showing gentle slope to NW (HMC 2016).

Photo 8 View E through existing stand of trees at northern end of property (HMC 2016).

Photo 9 View west from TP1 and soil exposed by mechanical excavation.

Photo 10 Cracks in hard-setting surface soils were observed across the site in sparsely grassed locations (HMC 2018).

Photo 11 View west across site from TP 5 within proposed primary EDA showing gentle ground slope (HMC, 2018).

Photo 12 View north along centre of site towards protected trees in north of site showing gentle slopes to the NW..

Photo 13 Soil profile exposed by hand auger in 2016 (BH2)

Photo 14 Soil profile exposed by hand auger at (BH 4) .

Photo 15 Soil profile exposed by mechanical excavation at TP1 (HMC 2018).

Photo 16 Soil profile exposed by mechanical excavation at TP1 (HMC 2018)

Photo 17 Soil profile exposed by mechanical

Photo 18 Soil profile exposed by mechanical

excavation at TP2 (HMC 2018) **excavation at TP2 (HMC 2018)**

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Photo 19 Soil profile exposed by mechanical excavation at TP4 (HMC 2018)

Photo 20 Soil profile exposed by mechanical excavation at TP5 (HMC 2018)