



Land Capability Services

Site & Soil Assessment
for
On-site Effluent Disposal

Proposed Subdivision
Lot 1
in Lot 4 DP1086437 & Lot 130 DP754908
613 Tallagandra Lane
Sutton NSW 2620

May 2026

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INTRODUCTION

Scope This report provides site and soil assessment for on-site effluent disposal at the applicant's proposed new subdivision. The report focuses on the land in proximity to the proposed building envelope. Other areas within the proposed subdivision may also be suitable for on-site effluent disposal pending further investigation at building DA stage. A four-bedroom dwelling is assumed. An Aerated Wastewater Treatment System (AWTS) is proposed.

An AWTS coupled with surface or subsurface irrigation provides a suitable form of effluent treatment for the site and soil characteristics of the land in question.

The management prescriptions include the size and location of the proposed irrigation area.



References

AS/NZS 1547:2012 *On-site domestic wastewater management*

Onsite Wastewater Management Guidelines (NSW OLG, 2025)

Jenkins, B.R. *Soil Landscapes of the Canberra 1:100 000 Sheet*

SITE CHARACTERISTICS

The terrain of the site comprises a gently inclined lower slope of 2 degrees overlying sedimentary geology of the Canberra Formation. The slope across the proposed irrigation area has a slightly linear divergent configuration ensuring that runoff does not concentrate within the site. The soil at the site is an imperfectly drained Chromosol within the Williamsdale soil landscape. It comprises silty loam then clay loam topsoil horizons to 10cm and 30cm respectively, overlying medium clay then light clay subsoil horizons to 60cm and 100cm+ respectively.



SITE EVALUATOR

Company Land Capability Services
Name Richard Miller
ph: 0417 694 638
email: rgmiller@me.com
Date of assessment May 14, 2026

Signature of evaluator



SITE INFORMATION

Address Lot 1 in Lot 4 DP1086437 & Lot 130 DP75490
613 Tallagandra Lane, Sutton NSW 2620
Council area Yass Valley
Owner Cappello
Area: 22.3 ha
Site plan attached Yes
Photograph attached Yes
Intended water supply Rainwater
Expected wastewater quantity (litres/day) 720
(Assumed 4 bedroom dwelling, potentially housing 6 occupants generating design flows of 120L/person/day = 720 litres/day)
Local experience Aerated wastewater treatment systems provide adequate treatment of effluent on appropriate soils.



SITE ASSESSMENT

Climate Warm to hot summers with a high evaporative deficit. Cool to cold winters with a small evaporative deficit

Where appropriate:

Rainfall water balance calculated	Yes
Land application area calculated	Yes
Wet weather storage area calculation attached	NA

Flood potential:

Land application area above 1 in 20 year flood level	Yes
Land application area above 1 in 100 year flood level	Yes
Electrical components above 1 in 100 year flood level	Yes

Exposure	Well exposed with no shade
Slope	Linear divergent
Landform	Lower slope
Run-on	None
Seepage	None
Erosion Potential	Slight with adequate vegetation
Site Drainage	Imperfectly drained
Fill	None in application area

Groundwater:

Horizontal distance to groundwater well	>250m
Groundwater vulnerability map referred to	Yass LEP 2013 Sheet CL2_005
Vulnerability rating	Within vulnerability area
Bores in the area and their purpose	Stock & domestic

Buffer distance from wastewater management system to:

Spring Flat Creek	>100m
Dams	>40m
Drainage lines	>40m
Boundary of property	>6m
Driveway	>6m
Swimming pools	>6m
Dwelling	>15m

Is there sufficient land area for:

Application system (including buffer distances)	Yes
Reserve application system (including buffer distances)	Yes
Surface rocks	None

SOIL ASSESSMENT

Depth to bedrock or hardpan	>100cm
Depth to soil water table	>100cm
Hydraulic loading rate	
Soil structure	Weakly structured topsoil Strong to moderately structured subsoil
Soil texture	Silty loam to clay loam topsoil Medium clay to light clay subsoil
Permeability category	(3) 0.5-1.5m/day in topsoil (6) <0.06m /day in subsoil
Hydraulic loading recommended for irrigation system	1.6mm/day irrigation
Coarse Fragments	10% to 10mm in A ₂ topsoil 5% to 20mm in B ₃ subsoil
Bulk Density	Estimate 1.5 in topsoil Estimate 1.3 in subsoil
Ph (1:5 Water)	Topsoil 4.7 Subsoil 5.7
Electrical conductivity (dS/m)	Topsoil .13 Subsoil .13
Geology & soil landscape survey	
Presence of discontinuities	None
Presence of fractured rock	None
Soil landscape reference	Williamsdale
Dispersiveness	None in topsoil EAT 5(2) None in subsoil EAT 5(3)

SYSTEM SELECTION

Consideration of connection to a centralised sewerage system

Nearest feasible connection point >5km

Potential for future connection to centralised sewerage None

Potential for future connection to reticulated water None

Type of land application system best suited to site:

Surface or subsurface irrigation

Reason

Suited to site and soil characteristics. Medium clay subsoil at 30cm depth precludes subsoil dispersal of effluent.

Type of treatment system best suited to site and application system:

Aerated wastewater treatment system

Reason

Superior standard of treatment for site and soil conditions.

GENERAL COMMENTS

Are there any specific environmental constraints?

Strongly acid topsoils are recommended to be ameliorated with lime as per management prescriptions prior to establishment of improved pasture species over the effluent application area.

Withing groundwater vulnerability area although low risk with surface applied secondary treated irrigation maximising evapotranspiration and deep clay subsoils maximising separation distance between effluent dispersal and underlying geology.

Are there any specific health constraints?

None

MANAGEMENT PRESCRIPTIONS

Aerated wastewater treatment systems treat effluent to an improved, or secondary standard, reducing any impact on groundwater and making available water for landscaping and other purposes. The following prescriptions are site specific and must be strictly adhered to, in order to maximise water and nutrient uptake, and thus minimise runoff and seepage.

The AWTS must be accredited by NSW Health.

An irrigation area of 450 m² should be allocated and sown to improved pasture species, within the area shown as suitable in Figure 1.

The treated effluent may be applied by surface irrigation. Surface sprays must be of the large droplet type that do not produce aerosols and are to be regularly rotated throughout the effluent application area to evenly spread hydraulic and nutrient loads.

The treated effluent may also be applied by sub-surface irrigation. Flush return lines to the AWTS to be installed to ensure flocculants in the lines are recycled back to the tank. Pressure compensating dripper heads to be used. Vacuum breakers or air release valves to be installed at highest point in irrigation field, to prevent migration of soil into irrigation lines. Irrigation laterals to be installed on the contour at 100mm depth and at nominal 1000mm spacing. A disc filter of 150mm x 400mm utilising the red coloured filter disks is to be installed upstream of irrigation system. Filters to be cleaned at minimum quarterly service intervals.

Lime to be spread over the irrigation area at the rate of 2000kg/ha or approximately 90kg over the 450m² area, and thereafter every 3 years.

House area and rainwater tank runoff to be directed clear of the effluent application area.

The irrigation area must not be disturbed by any building activity such as stockpiles of excavated material or vehicle traffic. Livestock to be excluded from the site.

Detergents should be selected for low levels of phosphorus and sodium.
(See appendix 3)

Fig 1. Area suitable for effluent application



Photo point 

Slope direction 

Drainage line 

WATER BALANCE

A water balance model is helpful in assessing the sensitivity of the design to various input and output characteristics.

Irrigation area sizing using Nominated Area Water Balance for Zero Storage																	
Site Address:			Lot 1 in 613 Tallagandra Lane, Sutton														
Date:						Assessor:											
INPUT DATA																	
Design Wastewater Flow		Q	720	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013)												
Design Irrigation Rate		DIR	2.0	mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013)												
Nominated Land Application Area		L	450	m ²													
Crop Factor		C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type ²												
Rainfall Runoff Factor		RF	1.0	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff												
Mean Monthly Rainfall Data		Canberra Airport (070014)			BoM Station and number												
Mean Monthly Pan Evaporation Data		Canberra Airport (070014)			BoM Station and number												
Parameter		Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month		D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall		R		mm/month	58.5	56.4	50.7	46	44.4	40.4	41.4	46.2	52	62.4	64.4	53.8	616.6
Evaporation		E		mm/month	260.4	207.2	176.7	111	68.2	48	52.7	80.6	114	161.2	198	248	1726
Crop Factor		C		unitless	0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	
OUTPUTS																	
Evapotranspiration		ET		mm/month	208	166	124	78	41	29	32	48	80	129	158	198	1290.73
Percolation		B	ExC	mm/month	62.0	56	62.0	60.0	62.0	60.0	62.0	62.0	60.0	62.0	60.0	62.0	730.0
Outputs			ET+B	mm/month	270.3	221.76	185.7	137.7	102.9	88.8	93.6	110.4	139.8	191.0	218.4	260.4	2020.7
INPUTS																	
Retained Rainfall		RR	RxCF	mm/month	58.5	56.4	50.7	46	44.4	40.4	41.4	46.2	52	62.4	64.4	53.8	616.6
Applied Effluent		W	(QxD)/L	mm/month	49.6	44.8	49.6	48.0	49.6	48.0	49.6	49.6	48.0	49.6	48.0	49.6	584.0
Inputs			RR+W	mm/month	108.1	101.2	100.3	94.0	94.0	88.4	91.0	95.8	100.0	112.0	112.4	103.4	1200.6
STORAGE CALCULATION																	
Storage remaining from previous month				mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month		S	(RR+W)-(ET+B)	mm/month	-162.2	-120.6	-85.4	-43.7	-8.9	-0.4	-2.6	-14.6	-39.8	-79.0	-106.0	-157.0	
Cumulative Storage		M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area		N		mm	0.00												
		V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE				m ²	105	122	165	236	381	446	427	348	246	174	140	108	
MINIMUM AREA REQUIRED FOR ZERO STORAGE:					447.0			m ²									

Based on a potential quantity of 720 litres/day of wastewater, spread across 450 m² of irrigation area, the effluent application rate of 1.6mm/day results in a moisture deficit in all months of the year. Importantly, the deficit is theoretical and it should be noted that saturation is possible at any time following periods of extended wet weather.

The application rate of 1.6mm/day is comparatively conservative, against the rate of 2mm/day for a medium clay determined from table M1 from AS1547:2012.

NUTRIENT BALANCE

The nutrient balance examines the discharge of nitrogen and phosphorus against the capacity of plants and soil to assimilate those nutrients. Excess nutrients may eventually impact upon watercourses via surface run-off or groundwater.

Nitrogen Balance									
Site Address:		Lot 1 in 613 Tallagandra Lane, Sutton							
SUMMARY - LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE								350	m ²
INPUT DATA¹									
Wastewater Loading					Nutrient Crop Uptake				
Hydraulic Load	720	L/day	Crop N Uptake	180	kg/ha/yr	which equals	49.32	mg/m ² /day	
Effluent N Concentration	30	mg/L							
% N Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal							
Total N Loss to Soil	4320	mg/day							
Remaining N Load after soil loss	17280	mg/day							
NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES									
Minimum Area required with zero buffer			Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)						
Nitrogen	350	m ²	Nominated LAA Size	450	m ²				
			Predicted N Export from LAA	-1.79	kg/year				
			Minimum Buffer Required for excess nutrient	0	m ²				

720 litres/day wastewater quantity at 30mg/l total N concentration
 = 7.9 kg Nitrogen discharged per year, applied over an irrigation area of
 450 m² = 176 kg/ha/yr.

The establishment of improved grasses should provide a rate of nitrogen uptake of around 180kg/ha/yr.

Total nitrogen loss to soil processes should account for 35kg/ha/yr.

Therefore the discharge of nitrogen should be balanced by plant uptake and soil processes.

Phosphorus Loading

720 litres/day wastewater quantity at 10 mg/l of P
 = 2.6 kg P discharged per year, applied over an irrigation area of 450m²
 = 58kg/ha/yr.

Native & improved grasses should provide a rate of P uptake of around 20kg/ha/yr.

Balance of 38kg/ha/yr. applied to P sorption capacity of soil;

P sorption capacity of in-situ soil 5690 kg/ha. ¹

Lifetime of irrigation area 150 years in terms of P sorption capacity.

¹ SCA "Design and Installation of On-site Wastewater Systems", P. Sorption Uptake Values (Typical)

Soil Survey Sheet

Date: 14.5.26

Site Address: Lot 1 in 592 Tauranunga Lane, Sutton

Client: Capello

Land Capability Services

ICS

	Depth	Boundary	Texture	Structure	Colour	Mottles	Coarse Frag	Consistence	Plasticity
A ₁	0-100		Silty loam	weak	Moderate yellowish brown	-	-	dry weak	Slight
A ₂	100-300	Clayey	Clay loam	Weak	Moderate yellowish brown	-	light brown	dry firm	Moderate
B ₂	300-600	Sandy	Medium clay	Strong	Moderate reddish brown	-	-	dry strong	Very
B ₃	600-1000+	Clayey	Very clayey	Moderate	Dark brown yellow	-	5g to 22m	dry firm	Very

APPENDIX 1: SOIL SURVEY SHEET

APPENDIX 2: NSW HEALTH ACCREDITED AWTS

AWTS Model	Company/Agent	Contact
Ultra Clear ST8, ST10	Highland Tanks	1800 049 911
ECO PRO	Eco-septic	1800 808 135
TAYLEX – various models	Taylex	1300 660 225
Fuji Clean ACE 1200,	Fuji Clean Australia	1300 733 619
BioSeptic Performa, S-Ten	Bioseptic	1300 658 111
BioCycle Pro	Eco-septic	1800 808 135
Aqua Advanced	Everhard Industries	131 926
Garden Master Elite Advanced	Garden Master	02 4932 1011
Ozzi Kleen RP10	Suncoast Waste Water	1800 450 767
Envirocycle Oxyfix	Envirocycle	1800 688 588
Super-Treat SE 10, SB 10	Super-Treat Systems	02 4422 3861
Turbojet Single Advanced	Icon-Septech	1300 557 143
Alpha Treat DP10	Alpha Treat	07 3205 3666
Earthsafe SS10	Earthsafe Australia Pty Ltd	1800 043 635
UBI Aqua	Global Tanks	07 4697 7099
Kingspan BioFicient	Kingspan Water & Energy	1300 736 562
Rivatec RWT10	Rivatec Environmental	1300 327 847

Appendix 3: Important Reading

Phone Office/Lab (02) 6775 1157
Fax (02) 6775 1043
ABN: 72 212 385 096
email: rob@lanfaxlabs.com.au
Website: <http://www.lanfaxlabs.com.au>
493 Old Inverell Road
(P.O. Box W90) Armidale NSW 2350
Director: Dr Robert Patterson FIEAust, CPSS, CPAg
Soil Scientists and Environmental Engineers

Lanfax Laboratories

Performance certified by Aust. Soil & Plant Analysis Council

LAUNDRY PRODUCTS RESEARCH

Laundry products were purchased by *Lanfax Labs* from supermarkets in Armidale, NSW and a number of boutique products were provided by manufacturers. A total of 41 liquids and 54 powders were tested by mixing each product at the manufacturer's recommended dose for either front loading or top loading automatic washing machines. The dose was calculated at the full cycle load, that is 75 L for front loaders and 150 L for top loaders. The full cycle accounts for the water used in the wash, spin, rinse, deep rinse and spin rinse cycle. The quantities of 75 L for front loaders and 150 L for top loaders were taken from averaged rates for those machines (Patterson, 2004).

Each sample was mixed with cold (20°C) deionised water (to replicate good quality rainwater). Where town water supplies are used, the values reported for sodium concentrations may increase because of sodium in the reticulated water – that will vary from location to location, usually higher in inland than coastal towns. Each sample was shaken for 30 minutes to replicate the washing action.

The concentrations of sodium and phosphorus (and other elements) were measured on the samples using Inductively Coupled Plasma (ICP) technology in accordance with current Good Laboratory Practices at *Lanfax Labs*.

Only sodium (g/wash) and phosphorus (mg/L) are reported in the graphs presented here.

Additional information on this unique research may be obtained at: www.lanfaxlabs.com.au/laundry.htm

Other papers on laundry detergents can be found at: www.lanfaxlabs.com.au/publications.html

HOW TO READ THE GRAPHS

Each product is represented by two bars: the top bar (if present) shows the phosphorus concentration (mg/L); while the lower bar shows the sodium load (g/wash). The graph is arranged in ranked order of sodium load. Figure F1 is for 54 detergents at the front loader rate, Figure T1 is for 89 detergents at the top loader rate.

Sodium Load

For all on-site systems that apply the effluent by surface or subsurface application, the levels of sodium in the discharge are critical to long term absorption. Choose the product with the lowest sodium load (g/wash). Levels above 20 g/wash are likely to be detrimental to plants and the soil although plant tolerance and soil types will vary. The shorter the bar, the lower the load. When in doubt, choose the lower sodium load.

The detergents with long sodium bars (greater than 20 g/wash) should not be thrown onto your favourite garden as the sodium may be detrimental to the plants. High pH (see the website for pH data) is also detrimental to plants and soil. The pH of liquids (average pH 8) is generally lower than pH of powder detergents (average pH 10.5).

Phosphorus Concentration

The choice of a suitable level of phosphorus in the greywater (laundry water discharge) will depend upon the soil type and the use of the effluent. In some soils, phosphorus is not a real concern because of the natural ability of the soil to immobilize the phosphorus and limit its leaching from the disposal site. In other soils, phosphorus is likely to build up to high levels and leach from the soil. It is preferable to choose the lower phosphorus values as well as the low sodium values. The load of phosphorus for each product is available in the website data.

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This material may only be reproduced in full (three pages) for educational purposes. None of the graphs should be construed as an endorsement of one product over another, or that one product is superior or inferior to another. The data are presented as measurements of fact, ranked in order of sodium.

This research was funded by Lanfax Labs and was independent of any manufacturer or other organisation.

Caution: Formulations may have changes since these products were purchased in 2005.

Soil survey and analytical assessments, landscape analysis and plant nutrient relationships
Independent research and commercial analytical laboratories. Environmental management consultants

Figure F1 - FRONT LOADING MACHINE CYCLE

Full wash cycle: Front loader = 75 L

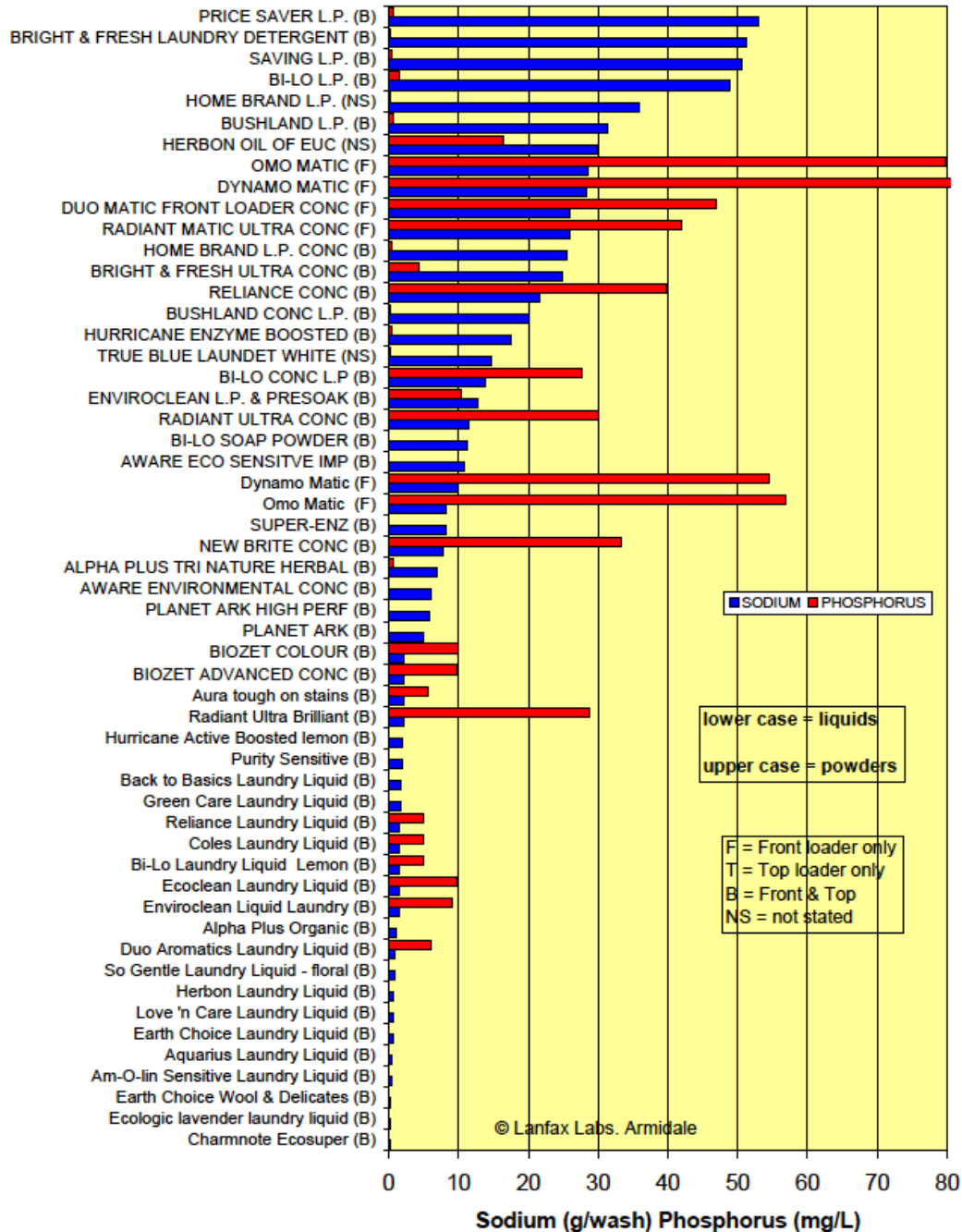
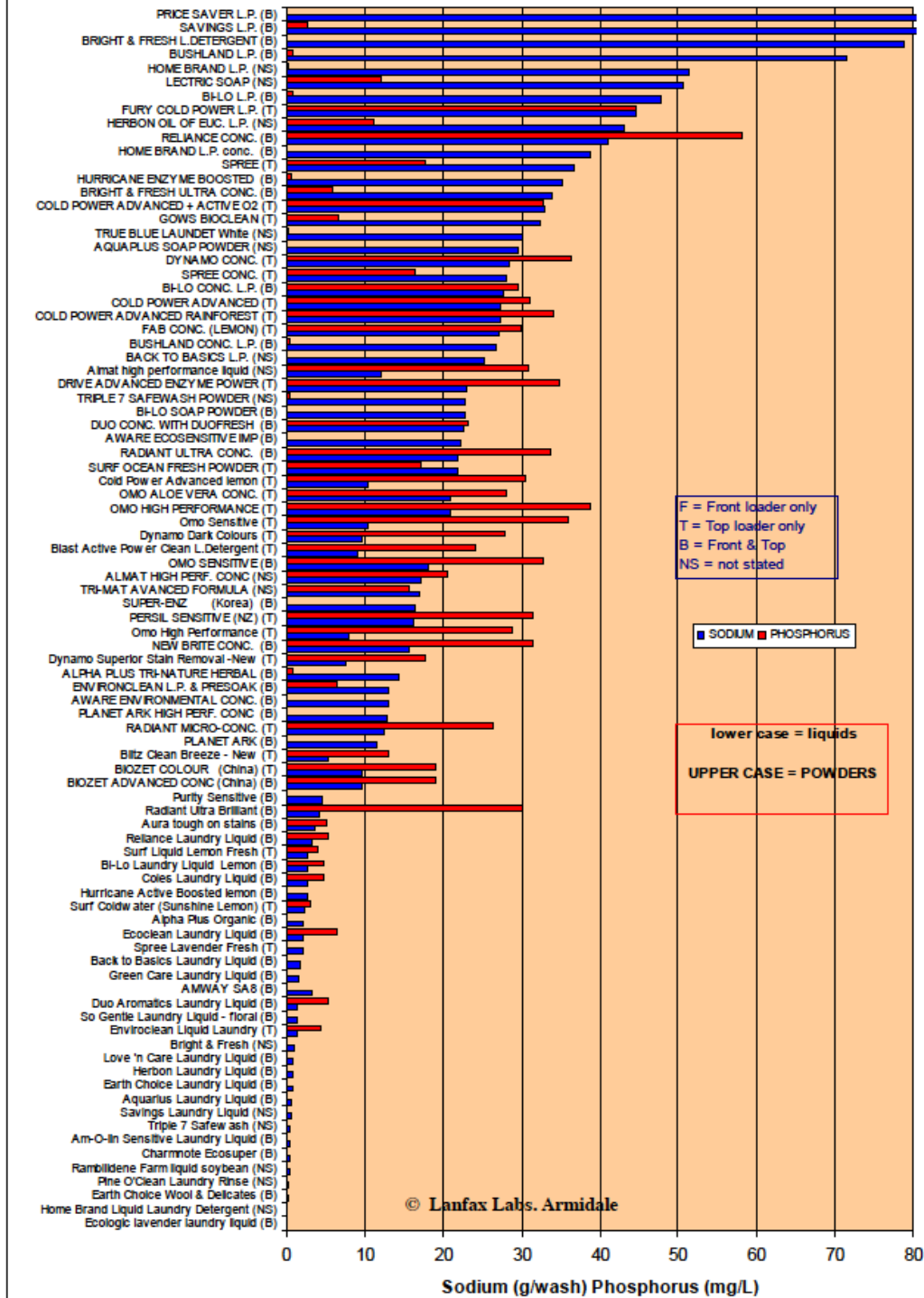


Figure T1 - TOP LOADING MACHINE CYCLE

Full wash cycle: Top loader = 150 L



NOTES



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INTRODUCTION

Scope This report provides site and soil assessment for on-site effluent disposal at the applicant's proposed new subdivision. The report focuses on the land in proximity to the proposed building envelope. Other areas within the proposed subdivision may also be suitable for on-site effluent disposal pending further investigation at building DA stage. A four-bedroom dwelling is assumed. An Aerated Wastewater Treatment System (AWTS) is proposed.

An AWTS coupled with surface or subsurface irrigation provides a suitable form of effluent treatment for the site and soil characteristics of the land in question.

The management prescriptions include the size and location of the proposed irrigation area.



References

AS/NZS 1547:2012 *On-site domestic wastewater management*

Onsite Wastewater Management Guidelines (NSW OLG, 2025)

Jenkins, B.R. *Soil Landscapes of the Canberra 1:100 000 Sheet*

SITE CHARACTERISTICS

The terrain of the site comprises a gently inclined mid slope of 4-5 degrees overlying sedimentary geology of the Canberra Formation. The slope across the proposed irrigation area has a linear divergent configuration ensuring that runoff does not concentrate within the site. The soil at the site is an imperfectly drained Chromosol within the Williamsdale soil landscape. It comprises fine sandy clay loam topsoil horizons to 40cm, overlying a heavy clay subsoil horizon to 100cm+.



SITE EVALUATOR

Company Land Capability Services
Name Richard Miller
ph: 0417 694 638
email: rgmiller@me.com
Date of assessment May 14, 2026

Signature of evaluator



SITE INFORMATION

Address Lot 3 in Lot 4 DP1086437 & Lot 130 DP75490
613 Tallagandra Lane, Sutton NSW 2620
Council area Yass Valley
Owner Cappello
Area: 40 ha
Site plan attached Yes
Photograph attached Yes
Intended water supply Rainwater
Expected wastewater quantity (litres/day) 720
(Assumed 4 bedroom dwelling, potentially housing 6 occupants generating design flows of 120L/person/day = 720 litres/day)
Local experience Aerated wastewater treatment systems provide adequate treatment of effluent on appropriate soils.



SITE ASSESSMENT

Climate	Warm to hot summers with a high evaporative deficit. Cool to cold winters with a small evaporative deficit	
Where appropriate:		
Rainfall water balance calculated		Yes
Land application area calculated		Yes
Wet weather storage area calculation attached		NA
Flood potential:		
Land application area above 1 in 20 year flood level		Yes
Land application area above 1 in 100 year flood level		Yes
Electrical components above 1 in 100 year flood level		Yes
Exposure	Well exposed with minimal shade	
Slope	Linear divergent	
Landform	Mid slope	
Run-on	None	
Seepage	None	
Erosion Potential	Slight with adequate vegetation	
Site Drainage	Imperfectly drained	
Fill	None in application area	
Groundwater:		
Horizontal distance to groundwater well		>250m
Groundwater vulnerability map referred to		Yass LEP 2013 Sheet CL2_005
Vulnerability rating		Within vulnerability area
Bores in the area and their purpose		Stock & domestic
Buffer distance from wastewater management system to:		
Perennial Watercourses		NA
Dams		>40m
Drainage lines		>40m
Boundary of property		>6m
Driveway		>6m
Swimming pools		>6m
Dwelling		>15m
Is there sufficient land area for:		
Application system (including buffer distances)		Yes
Reserve application system (including buffer distances)		Yes
Surface rocks		None

SOIL ASSESSMENT

Depth to bedrock or hardpan	>100cm
Depth to soil water table	>100cm
Hydraulic loading rate	
Soil structure	Weakly structured topsoil Moderately structured subsoil
Soil texture	Fine sandy clay loam topsoil Heavy clay subsoil
Permeability category	(4) 0.12-0.5m/day in topsoil (6) <0.06m /day in subsoil
Hydraulic loading recommended for irrigation system	1.6mm/day irrigation
Coarse Fragments	20% to 50mm in A ₂ topsoil None in subsoil
Bulk Density	Estimate 1.5 in topsoil Estimate 1.3 in subsoil
Ph (1:5 Water)	Topsoil 5.7 Subsoil 5.8
Electrical conductivity (dS/m)	Topsoil .04 Subsoil .02
Geology & soil landscape survey	
Presence of discontinuities	None
Presence of fractured rock	None
Soil landscape reference	Williamsdale
Dispersiveness	None in topsoil EAT 5(2) None in subsoil EAT 5(3)

SYSTEM SELECTION

Consideration of connection to a centralised sewerage system

Nearest feasible connection point >5km

Potential for future connection to centralised sewerage None

Potential for future connection to reticulated water None

Type of land application system best suited to site:

Surface or subsurface irrigation

Reason

Suited to site and soil characteristics. Heavy clay subsoil at 40cm depth precludes subsoil dispersal of effluent.

Type of treatment system best suited to site and application system:

Aerated wastewater treatment system

Reason

Superior standard of treatment for site and soil conditions.

GENERAL COMMENTS

Are there any specific environmental constraints?

Withing groundwater vulnerability area although low risk with surface applied secondary treated irrigation maximising evapotranspiration and deep clay subsoils maximising separation distance between effluent dispersal and underlying geology.

Are there any specific health constraints?

None

MANAGEMENT PRESCRIPTIONS

Aerated wastewater treatment systems treat effluent to an improved, or secondary standard, reducing any impact on groundwater and making available water for landscaping and other purposes. The following prescriptions are site specific and must be strictly adhered to, in order to maximise water and nutrient uptake, and thus minimise runoff and seepage.

The AWTS must be accredited by NSW Health.

An irrigation area of 450 m² should be allocated and sown to improved pasture species, within the area shown as suitable in Figure 1.

The treated effluent may be applied by surface irrigation. Surface sprays must be of the large droplet type that do not produce aerosols and are to be regularly rotated throughout the effluent application area to evenly spread hydraulic and nutrient loads.

The treated effluent may also be applied by sub-surface irrigation. Flush return lines to the AWTS to be installed to ensure flocculants in the lines are recycled back to the tank. Pressure compensating dripper heads to be used. Vacuum breakers or air release valves to be installed at highest point in irrigation field, to prevent migration of soil into irrigation lines. Irrigation laterals to be installed on the contour at 100mm depth and at nominal 1000mm spacing. A disc filter of 150mm x 400mm utilising the red coloured filter disks is to be installed upstream of irrigation system. Filters to be cleaned at minimum quarterly service intervals.

House area and rainwater tank runoff to be directed clear of the effluent application area.

The irrigation area must not be disturbed by any building activity such as stockpiles of excavated material or vehicle traffic. Livestock to be excluded from the site.

Detergents should be selected for low levels of phosphorus and sodium.
(See appendix 3)

Fig 1. Area suitable for effluent application

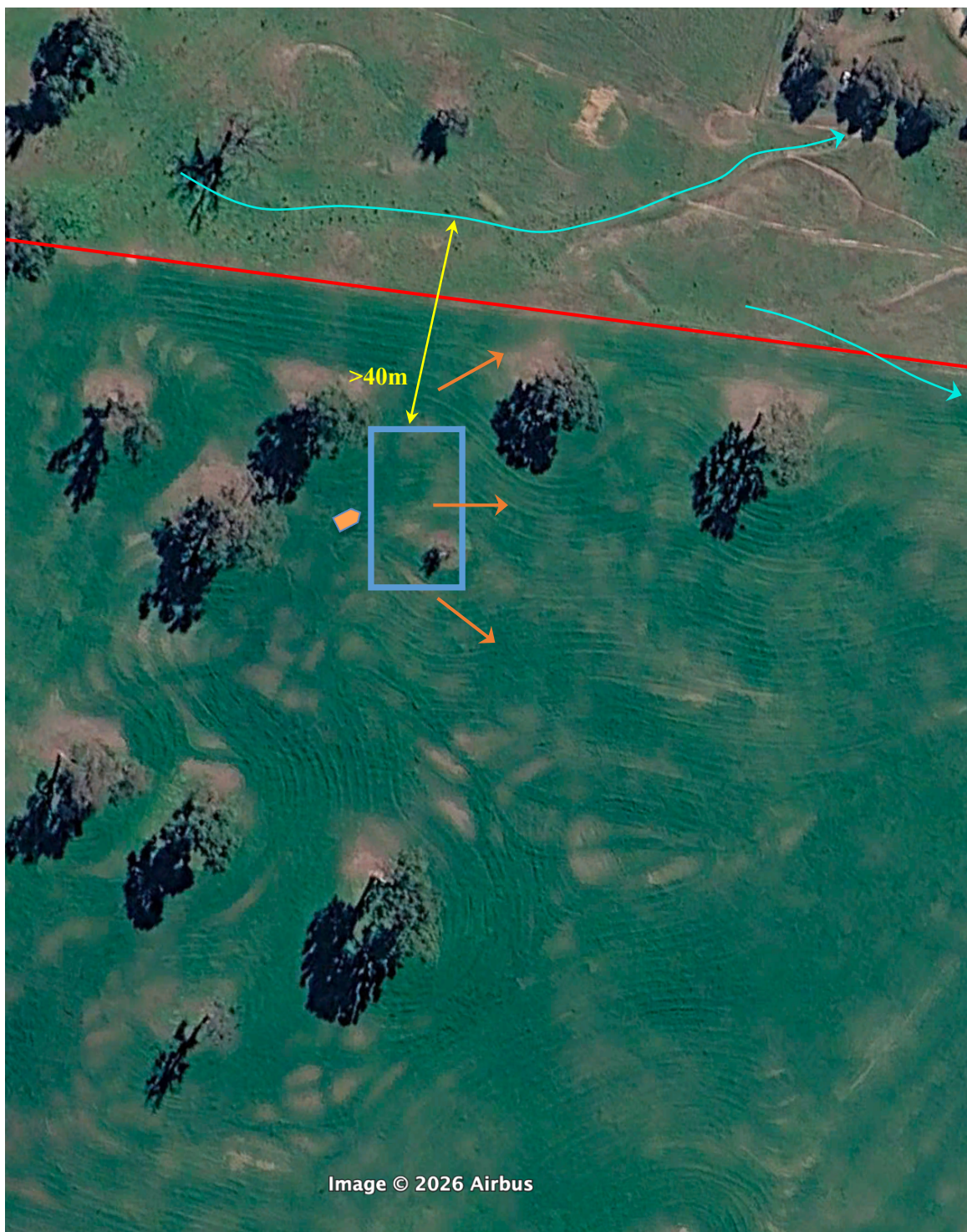


Photo point 

Slope direction 

Drainage line 

WATER BALANCE

A water balance model is helpful in assessing the sensitivity of the design to various input and output characteristics.

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Nominated Land Application Area		L	450	m ²												
Crop Factor		C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type ²											
Rainfall Runoff Factor		RF	1.0	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff											
Mean Monthly Rainfall Data		Canberra Airport (070014)			BoM Station and number											
Mean Monthly Pan Evaporation Data		Canberra Airport (070014)			BoM Station and number											
Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall	R		mm/month	58.5	56.4	50.7	46	44.4	40.4	41.4	46.2	52	62.4	64.4	53.8	616.6
Evaporation	E		mm/month	260.4	207.2	176.7	111	68.2	48	52.7	80.6	114	161.2	198	248	1726
Crop Factor	C		unitless	0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	208	166	124	78	41	29	32	48	80	129	158	198	1290.73
Percolation	B	DIRxD	mm/month	62.0	56	62.0	60.0	62.0	60.0	62.0	62.0	60.0	62.0	60.0	62.0	730.0
Outputs		ET+B	mm/month	270.3	221.76	185.7	137.7	102.9	88.8	93.6	110.4	139.8	191.0	218.4	260.4	2020.7
INPUTS																
Retained Rainfall	RR	RxCF	mm/month	58.5	56.4	50.7	46	44.4	40.4	41.4	46.2	52	62.4	64.4	53.8	616.6
Applied Effluent	W	(QxD)/L	mm/month	49.6	44.8	49.6	48.0	49.6	48.0	49.6	49.6	48.0	49.6	48.0	49.6	584.0
Inputs		RR+W	mm/month	108.1	101.2	100.3	94.0	94.0	88.4	91.0	95.8	100.0	112.0	112.4	103.4	1200.6
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month			mm/month	-162.2	-120.6	-85.4	-43.7	-8.9	-0.4	-2.6	-14.6	-39.8	-79.0	-106.0	-157.0	
Cumulative Storage			mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area			mm	0.00												
			L	0												
LAND AREA REQUIRED FOR ZERO STORAGE				m ²	105	122	165	236	381	446	427	348	246	174	140	108
MINIMUM AREA REQUIRED FOR ZERO STORAGE:					447.0	m ²										

Based on a potential quantity of 720 litres/day of wastewater, spread across 450 m² of irrigation area, the effluent application rate of 1.6mm/day results in a moisture deficit in all months of the year. Importantly, the deficit is theoretical and it should be noted that saturation is possible at any time following periods of extended wet weather.

The application rate of 1.6mm/day is comparatively conservative, against the rate of 2mm/day for a heavy clay determined from table M1 from AS1547:2012.

NUTRIENT BALANCE

The nutrient balance examines the discharge of nitrogen and phosphorus against the capacity of plants and soil to assimilate those nutrients. Excess nutrients may eventually impact upon watercourses via surface run-off or groundwater.

Nitrogen Balance									
Site Address:		Lot 3 in 613 Tallagandra Lane, Sutton							
SUMMARY - LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE								350	m ²
INPUT DATA¹									
Wastewater Loading					Nutrient Crop Uptake				
Hydraulic Load	720	L/day	Crop N Uptake	180	kg/ha/yr	which equals	49.32	mg/m ² /day	
Effluent N Concentration	30	mg/L							
% N Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal							
Total N Loss to Soil	4320	mg/day							
Remaining N Load after soil loss	17280	mg/day							
NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES									
Minimum Area required with zero buffer			Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)						
Nitrogen	350	m ²	Nominated LAA Size	450	m ²				
			Predicted N Export from LAA	-1.79	kg/year				
			Minimum Buffer Required for excess nutrient	0	m ²				

720 litres/day wastewater quantity at 30mg/l total N concentration
 = 7.9 kg Nitrogen discharged per year, applied over an irrigation area of
 450 m² = 176 kg/ha/yr.

The establishment of improved grasses should provide a rate of nitrogen uptake of around 180kg/ha/yr.

Total nitrogen loss to soil processes should account for 35kg/ha/yr.

Therefore the discharge of nitrogen should be balanced by plant uptake and soil processes.

Phosphorus Loading

720 litres/day wastewater quantity at 10 mg/l of P
 = 2.6 kg P discharged per year, applied over an irrigation area of 450m²
 = 58kg/ha/yr.

Native & improved grasses should provide a rate of P uptake of around 20kg/ha/yr.

Balance of 38kg/ha/yr. applied to P sorption capacity of soil;

P sorption capacity of in-situ soil 5710 kg/ha. ¹

Lifetime of irrigation area 150 years in terms of P sorption capacity.

¹ SCA "Design and Installation of On-site Wastewater Systems", P. Sorption Uptake Values (Typical)

Soil Survey Sheet

ICS

Land Capability Services

Date: 14.5.26

Site Address: Lot 3 in 613 TALLAHANDRA LANE, SUTTON

Client: Capello

	Depth	Boundary	Texture	Structure	Colour	Mottles	Coarse Frag	Consistence	Plasticity
A ₁	0-120		fine sandy clay loam	weak	Moist yellowish brown	-	10% to 30%	dry loose	moderate
A ₂	120-400	unknown	fine sandy clay loam	loose	light brown yellow	-	20% to 50%	dry loose	moderate
B ₁	400-1000+	SLUMP	heavy clay clay	moderate	deep red brown	-	-	strong moist firm	very

APPENDIX 1: SOIL SURVEY SHEET

APPENDIX 2: NSW HEALTH ACCREDITED AWTS

AWTS Model	Company/Agent	Contact
Ultra Clear ST8, ST10	Highland Tanks	1800 049 911
ECO PRO	Eco-septic	1800 808 135
TAYLEX – various models	Taylex	1300 660 225
Fuji Clean ACE 1200,	Fuji Clean Australia	1300 733 619
BioSeptic Performa, S-Ten	Bioseptic	1300 658 111
BioCycle Pro	Eco-septic	1800 808 135
Aqua Advanced	Everhard Industries	131 926
Garden Master Elite Advanced	Garden Master	02 4932 1011
Ozzi Kleen RP10	Suncoast Waste Water	1800 450 767
Envirocycle Oxyfix	Envirocycle	1800 688 588
Super-Treat SE 10, SB 10	Super-Treat Systems	02 4422 3861
Turbojet Single Advanced	Icon-Septech	1300 557 143
Alpha Treat DP10	Alpha Treat	07 3205 3666
Earthsafe SS10	Earthsafe Australia Pty Ltd	1800 043 635
UBI Aqua	Global Tanks	07 4697 7099
Kingspan BioFicient	Kingspan Water & Energy	1300 736 562
Rivatec RWT10	Rivatec Environmental	1300 327 847

Appendix 3: Important Reading

Phone Office/Lab (02) 6775 1157
Fax (02) 6775 1043
ABN: 72 212 385 096
email: rob@lanfaxlabs.com.au
Website: <http://www.lanfaxlabs.com.au>
493 Old Inverell Road
(P.O. Box W90) Armidale NSW 2350
Director: Dr Robert Patterson FIEAust, CPSS, CPAg
Soil Scientists and Environmental Engineers

Lanfax Laboratories

Performance certified by Aust. Soil & Plant Analysis Council

LAUNDRY PRODUCTS RESEARCH

Laundry products were purchased by *Lanfax Labs* from supermarkets in Armidale, NSW and a number of boutique products were provided by manufacturers. A total of 41 liquids and 54 powders were tested by mixing each product at the manufacturer's recommended dose for either front loading or top loading automatic washing machines. The dose was calculated at the full cycle load, that is 75 L for front loaders and 150 L for top loaders. The full cycle accounts for the water used in the wash, spin, rinse, deep rinse and spin rinse cycle. The quantities of 75 L for front loaders and 150 L for top loaders were taken from averaged rates for those machines (Patterson, 2004).

Each sample was mixed with cold (20°C) deionised water (to replicate good quality rainwater). Where town water supplies are used, the values reported for sodium concentrations may increase because of sodium in the reticulated water – that will vary from location to location, usually higher in inland than coastal towns. Each sample was shaken for 30 minutes to replicate the washing action.

The concentrations of sodium and phosphorus (and other elements) were measured on the samples using Inductively Coupled Plasma (ICP) technology in accordance with current Good Laboratory Practices at *Lanfax Labs*.

Only sodium (g/wash) and phosphorus (mg/L) are reported in the graphs presented here.

Additional information on this unique research may be obtained at: www.lanfaxlabs.com.au/laundry.htm

Other papers on laundry detergents can be found at: www.lanfaxlabs.com.au/publications.html

HOW TO READ THE GRAPHS

Each product is represented by two bars: the top bar (if present) shows the phosphorus concentration (mg/L); while the lower bar shows the sodium load (g/wash). The graph is arranged in ranked order of sodium load. Figure F1 is for 54 detergents at the front loader rate, Figure T1 is for 89 detergents at the top loader rate.

Sodium Load

For all on-site systems that apply the effluent by surface or subsurface application, the levels of sodium in the discharge are critical to long term absorption. Choose the product with the lowest sodium load (g/wash). Levels above 20 g/wash are likely to be detrimental to plants and the soil although plant tolerance and soil types will vary. The shorter the bar, the lower the load. When in doubt, choose the lower sodium load.

The detergents with long sodium bars (greater than 20 g/wash) should not be thrown onto your favourite garden as the sodium may be detrimental to the plants. High pH (see the website for pH data) is also detrimental to plants and soil. The pH of liquids (average pH 8) is generally lower than pH of powder detergents (average pH 10.5).

Phosphorus Concentration

The choice of a suitable level of phosphorus in the greywater (laundry water discharge) will depend upon the soil type and the use of the effluent. In some soils, phosphorus is not a real concern because of the natural ability of the soil to immobilize the phosphorus and limit its leaching from the disposal site. In other soils, phosphorus is likely to build up to high levels and leach from the soil. It is preferable to choose the lower phosphorus values as well as the low sodium values. The load of phosphorus for each product is available in the website data.

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This material may only be reproduced in full (three pages) for educational purposes. None of the graphs should be construed as an endorsement of one product over another, or that one product is superior or inferior to another. The data are presented as measurements of fact, ranked in order of sodium.

This research was funded by Lanfax Labs and was independent of any manufacturer or other organisation.

Caution: Formulations may have changes since these products were purchased in 2005.

Soil survey and analytical assessments, landscape analysis and plant nutrient relationships
Independent research and commercial analytical laboratories. Environmental management consultants

Figure F1 - FRONT LOADING MACHINE CYCLE

Full wash cycle: Front loader = 75 L

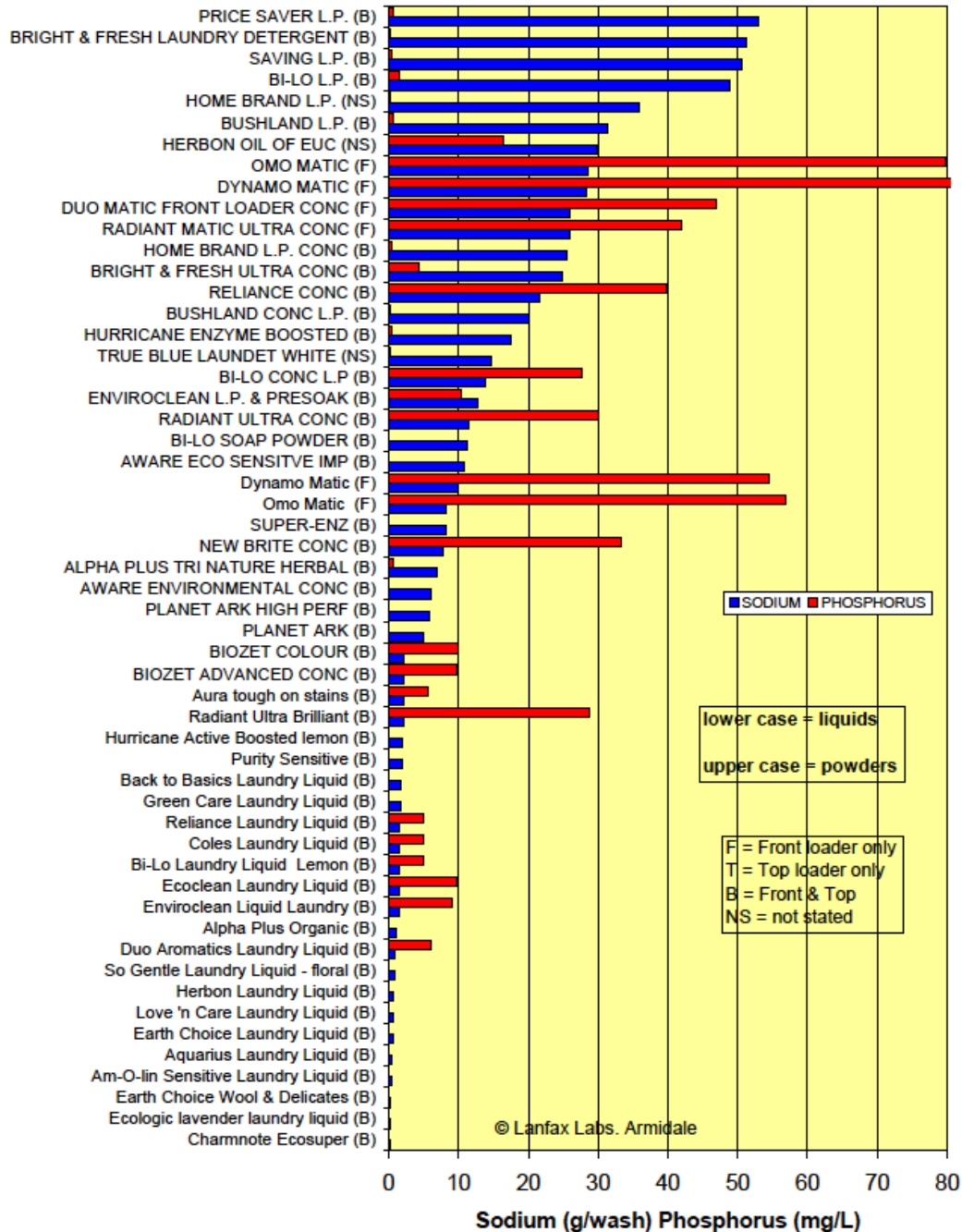
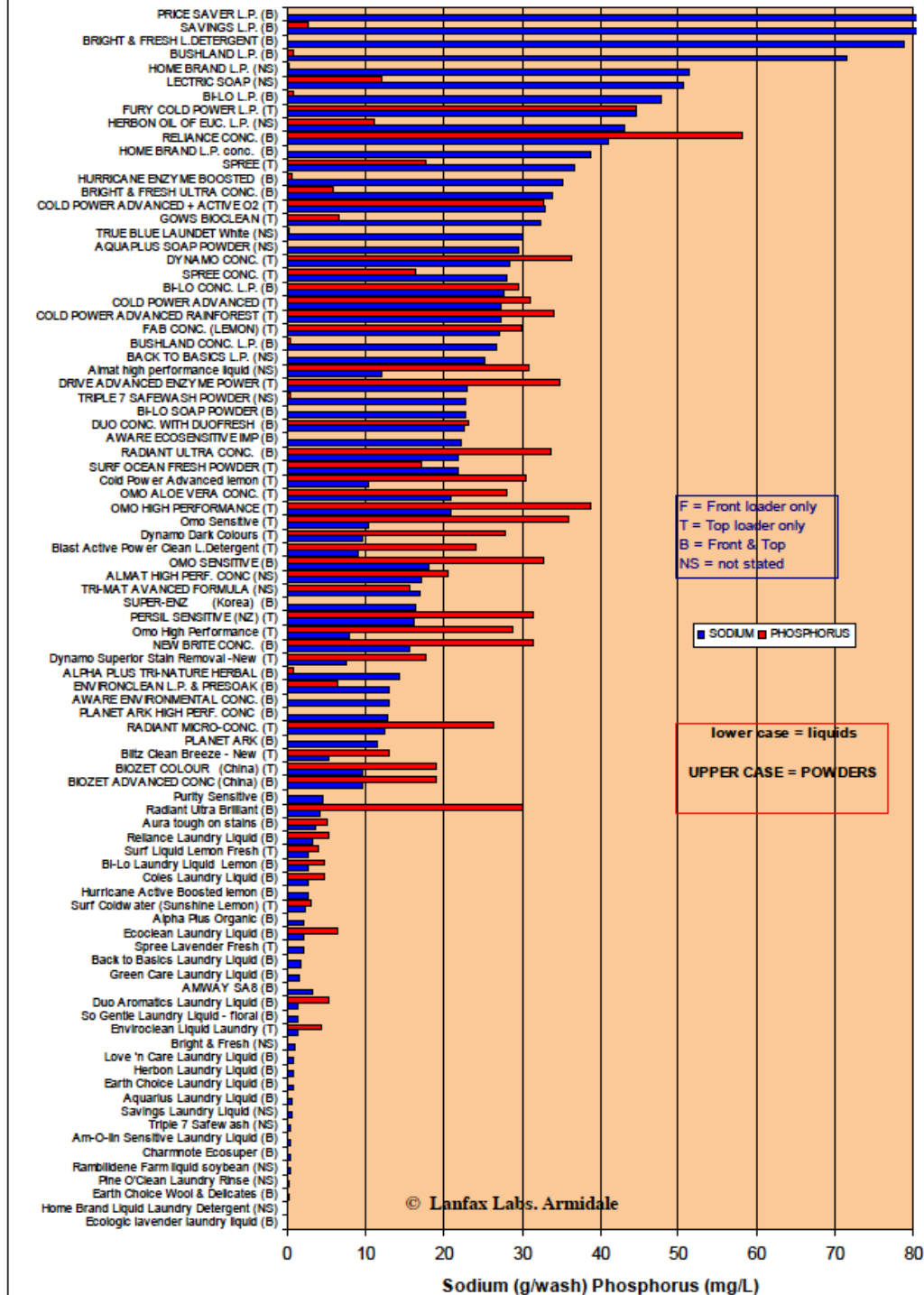


Figure T1 - TOP LOADING MACHINE CYCLE

Full wash cycle: Top loader = 150 L



NOTES