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**LAND CAPABILITY ASSESSMENT
FOR
ON-SITE WASTEWATER MANAGEMENT
AT
710 MT RIDLEY ROAD, MICKLEHAM**

REPORT No. A251108 REVISION 2
By

MAY 2026

Paul Williams, B.App.Sc.
Paul Williams & Associates Pty Ltd
CONSULTANTS IN THE EARTH SCIENCES

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IMPORTANT NOTE

The land capability assessment report consists of this cover sheet, two written sections, three drawings and five appendices.

The report elements are not to be read or interpreted in isolation.

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ASSESSOR'S ACADEMIC & PROFESSIONAL QUALIFICATIONS

Paul Williams is the Director and principal earth scientist at Paul Williams & Associates Pty Ltd.

He has a Degree of Bachelor of Applied Science (Geology and Land Use) (awarded in 1978) and has since specialised in vadose zone hydrology, soil science, land-soil risk assessment and engineering geology.

All fieldwork and analyses are undertaken by, or directly supervised by Paul Williams.

ASSESSOR'S PROFESSIONAL INDEMNITY INSURANCE

Policy Number:	NPP-13384
Period of Cover:	14/2/2026 – 14/2/2027
Geographical Coverage:	Worldwide (excluding U.S.A.)
Retro-active Date:	Unlimited
Limit of Indemnity:	\$4,000,000
Underwriting Company:	Certain Underwriters at Lloyd's

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EXECUTIVE SUMMARY

The proposed development at 710 Mt Ridley Road, Mickleham, is suitable for sustainable on-site effluent disposal.

The site is 13.14 hectares (approximately) is zoned Green Wedge.

The site contains a 4-bedroom residence, as shown in Drawing 2.

It is proposed to construct a school with an anticipated population of 400 students and 50 staff.

with effluent treated to the 10/10/10 standard (Class B) via two 5,000 litre capacity AWTs, located in proximity to the proposed buildings. Where raw sewage cannot be gravity fed to the AWTs, raw sewage can be pretreated in a series of septic tanks and pumped to the AWTs.

For the proposed development the available area is not limiting and increases in effluent volume above the design daily flows are possible.

Peak flows are based on the data presented in Appendix E, i.e., 225 kL for August monthly flow, 9.9 kL/day and 7.6 kL/day (load-balanced).

The site is not sewered and mains water (or equivalent) is assumed for design purposes.

Table 1
Description of Development

Parameter	Site specific element
SPI Number	61P92893
Property Address	710 Mt Ridley Road, Mickleham
Owner	My College Pty Ltd
Contact	Edwina Laidlaw (Glossop Town Planning) 0421 045 598 edwina@glossop.com.au
Locality	Mickleham
Zoning and Overlays	Green Wedge
Area	13.14 hectares.
Usable Lot Area	At least double land application area requirement.
Soil Texture	Category 6 (Clay loam) over Category 6 (heavy clay).
Soil Depth	1.2 to 1.5m+.
Soil Structure	Poorly structured.
Soil Constraints	Nil for low pressure surface sprinkler.
Permeability	0.035m/day (<i>insitu</i> clays), 0.6m/day (topsoil).
Slope	2.5% downslope average
Distance to Surface Waters	100+m to surface waters.
Water Supply	Mains equivalent (assumed for design purposes).
Wastewater Load (daily)	Up to 9.9 kL.
Availability of Sewer	Not available

The assessment has been made in the context of prioritising public and environmental health with a design compromise between rational wastewater reuse and sustainable wastewater disposal.

Our field testing which included soil profile logging and sampling, terrain modelling using LiDAR derived contours, laboratory testing and subsequent reporting including water and nutrient balance modelling and risk assessment has revealed that on-site effluent disposal via land application is rational.

Regarding density of development and cumulative risk the assessment has considered risk associated with subsurface flows and surface flows.

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Regarding subsurface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained the risk to surface and ground waters is negligible.

Regarding surface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained, the risk to surface and ground waters is no greater than for a sewered development.

Where risk is defined as the product of consequences and frequency, the risk can be reduced to negligible levels if effluent is treated to the 10/10/10 (Class B) standard and disposed via low pressure (low throw) sprinkler irrigation, as described in Section 2 of the land capability assessment.

For unplanned and any planned increases in daily effluent volume, the land application area can be duplicated. In addition, increases in daily effluent flow can be accommodated by increasing the density of planting within the proposed land application area.

The LCA recommends a conservative, scientifically based, well-founded wastewater management system with inherent multiple barriers of safety.

Cumulative risk from the development is extremely low. The risk of serious or irreversible damage is extremely low.

All requirements of *Environment Protection Regulations, 2021* and ancillary documents can be met.

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A251108 REVISION 2 – MAY 2026

**LAND CAPABILITY ASSESSMENT
FOR
ON-SITE WASTEWATER MANAGEMENT
AT
710 MT RIDLEY ROAD, MICKLEHAM
SECTION 1. SITE INVESTIGATION**

1.1 INTRODUCTION

1.1.1 General. On instruction from the land owner, a preliminary investigation was undertaken to assess land capability for on-site effluent disposal at the 710 Mt Ridley Road, Mickleham.

The site is 13.14 hectares (approximately) is zoned Green Wedge.

The site contains a 4-bedroom residence, as shown in Drawing 2.

It is proposed to construct a school with an anticipated population of 400 students and 50 staff.

with effluent treated to the 10/10/10 standard (Class B) via two 5,000 litre capacity AWTS, located in proximity to the proposed buildings. Where raw sewage cannot be gravity fed to the AWTS, raw sewage can be pretreated in a series of septic tanks and pumped to the AWTS.

For the proposed development the available area is not limiting and increases in effluent volume above the design daily flows are possible.

Peak flows are based on the data presented in Appendices D and E, i.e., 235 kL for August monthly flow, 9.9 kL/day and 7.6 kL/day (load-balanced).

The assessment has been made in the context of prioritising public and environmental health.

1.1.2 EPA Licence. This report is intended to be used in support of an EPA Licence application.

1.1.3 Existing Onsite Effluent Disposal System. The existing onsite effluent disposal system (residence) is to be decommissioned with all household wastewater treated via the proposed school onsite system.

1.2 INVESTIGATION METHOD

The site investigation was carried out in accordance with the *Environment Protection Act, 2017, as amended* and where relevant, *ancillary documents* including *Guideline for Onsite Wastewater Management (GOWM)*, EPA, May 2024 and *Guideline for Onsite Wastewater Effluent Dispersal and Recycling Systems (GOWEDRS)*, EPA, May 2024 and *AS/NZS 1547:2012*. Guidance has also been sought from *Approaches for Risk Analysis of Development with On-site Wastewater Disposal in Open, Potable Water Catchments*, Dr Robert Edis, April 2014, *Guidelines for Wastewater Irrigation*, E.P.A. Publication 168.3,

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October 2022, AS 2223, AS 1726, AS 1289, AS 2870 and *Australian Laboratory Handbook of Soil and Water Chemical Methods*.

The onsite use of reclaimed water has been guided by *1910.2 Victorian guideline for water recycling*, *1911.2 Technical information for Victorian guideline for water recycling*, *Victorian guideline for irrigation with recycled water*, E.P.A. Publication 168.3, October 2022 *Code of Practice for Small Treatment Plants*, EPA Publication 500, June 1997 and *Sustainable Effluent-Irrigated Plantations: An Australian Guideline*, B. J. Myers, W. J. Bond et al, CSIRO, 1999.

Our capability assessment involved the mapping of unique land-soil unit(s) which were defined in terms of significant attributes including; climate, slope, aspect, vegetation, soil profile characteristics (including colloid stability, soil reaction trend and electrical conductivity), depth to rock, proximity to surface waters and escarpments, transient soil moisture characteristics and hydraulic conductivity.

Soils profiles will be logged and sampled via push-tube methods.

Water and nutrient balance analyses were based on the 9th decile wet year rainfall for Greenvale Reservoir and mean evaporation data for Melbourne and were undertaken with guidance from *Victorian guideline for irrigation with recycled water*, E.P.A. Publication 168.3, October 2022 (Part), AS/NZS 1547:2012 and in-house methods.

The rainfall and evaporation data were obtained from the National Climate Centre, Bureau of Meteorology. The data was subsequently analysed and applied to our water and nutrient balance analyses. The results of the water and nutrient balance analyses are given in Appendix B, to this report.

1.3 CAPABILITY ASSESSMENT

We have used the attributes determined by the investigation to define one (1) land-soil unit, as follows:-

1.3.1 Land-Soil Unit A. This land-soil unit consists of gently sloping terrain, as shown in Drawing 2 and Figure 1.

The salient land-soil attributes and constraints are summarised in Appendix C.

1.3.1.1 Climate. The general area receives a mean annual rainfall of 593mm, a 9th decile annual rainfall of 730mm and a mean annual evaporation of 1168mm. 9th decile rainfall exceeds the mean evaporation June through August (i.e., for 3-months).

Rainfall and evaporation data are presented in Appendix B, to this report.

1.3.1.2 Slope and Aspect. The unit (proposed effluent area and downslope) slopes to the east and north at 1.5% to 2.5%, as shown in Drawing 2.

Average slope downhill of the site is less than 2.5%.

The unit is exposed to the prevailing winds and is subject to full year-round sunshine.

1.3.1.3 Vegetation and Land Use. The unit is vegetated with dense pasture grasses, as shown in Figure 1 and Drawing 2.

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The current land use (pond and proposed land application area is grazing).

For use in the water and nutrient balance we have used water and nitrogen uptake estimates representative of a rye/clover mix pasture, as shown in Appendix B.

1.3.1.4. Slope Stability. For the encountered subsurface conditions, slope degree and geometry and for the proposed range of hydraulic loadings, the stability of the ground slopes will not be compromised.

1.3.1.5 Subsurface Profile. The following interpretation of the general subsurface profile assumes conditions like those encountered in the boreholes are typical of the investigation area.

Note: If subsurface conditions substantially different from those encountered in the investigation are encountered during soil renovation works, all work should cease, and this office notified immediately.

The unit is underlain by residual materials formed on basalt rocks of Quaternary Age.

The general subsurface profile consists of:-

- A topsoil (A-horizon) layer of light grey-brown, moist, moderately well-structured, dispersive silt with some clay of low plasticity (**clay-silt loam**), with a soil reaction trend of 5.9 to 6.1 pH, electrical conductivity of 0.09 to 0.22 dS/m and free swell of 5% to 30%, containing a root mat and root zone to depths of 0.1 to 0.2m, overlying,
- A residual soil (B-horizon) layer of grey-brown and orange, dispersive silty clay of high plasticity (**medium clay**), with a soil reaction trend of 6.5 pH, electrical conductivity of 0.22 dS/m and free swell of 40% to 60%, to depths of 0.25 to 0.35m, overlying,
- A residual soil (B-horizon) layer of brown, moist, poorly structured, dispersive clay of high plasticity (**heavy clay**), with a soil reaction trend of 7.5-7.6 pH, electrical conductivity of 0.19 to 0.48 dS/m and free swell of 90% to 100%, to depths of 1.2m to at least 1.5m, containing calcrete at depth, overlying,
- An extremely weathered layer of grey-brown and grey, moist poorly structured, dispersive clay of high plasticity (heavy clay), to a depth of at least 1.45m, overlying,
- Weathered basalt in the form of cobbles, boulders and rock.

1.3.1.6 Soil Permeability. *In-situ* permeability tests were not undertaken due to the dispersive nature of the soil.

A conservative estimate of permeability has been deduced as follows:

Profile analysis in accordance with AS/NZS 1547:2012 and our laboratory determined swell potential (including our including our Melbourne and environs data base), shows the residual soils are poorly structured, dispersive heavy clays (Category 6 soil) with saturated hydraulic conductivity less than 0.06m/day.

The permeability of the topsoil materials is conservatively estimated to be up to 0.5m/day.

1.3.1.7 Basement Rock Permeability. From the literature and from examination of rock profiles and rock mass defect character in the vicinity, the hydraulic conductivity of the basement rocks would be more than 0.05m/day (adopt 1 m/day for buffer design).

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1.3.1.8 Colloid Stability. The results of the Emerson Crumb and dispersion index tests and observations of any discolouration of water in the boreholes suggest that the topsoil materials are non-dispersive to dispersive, while the residual clay soils are dispersive with a moderate to high shrink-swell potential.

1.3.1.9 AS1547:2012 Soil Classification. In accordance with AS/NZS1547:2012 the residual materials can be classified as Category 6 soils (dispersive, swelling clays), while the topsoils can be classified as Category 6 soils (dispersive clay loam).

1.3.1.10 Surface Drainage. Site surface drainage is to the east and north-east, as shown in Drawings 1 and 2.

The proposed land application area and storage ponds are located more than 100m from surface waters, as shown in Drawing 2.

1.3.1.11 Groundwater. No seepage was encountered in any of the boreholes. The nearest water bore is more than 50m distant from the proposed land application area.

The Victorian groundwater data base indicates groundwater is deeper than 10 metres.

Regionally the groundwater is contained in fractured basalt and underlying sedimentary rocks and is of low yield and low quality (1,000 to 3,500 mg/litre TDS) with limited beneficial use.

1.3.1.12 Nutrient Attenuation. Clayey soils (as found on this site) can fix large amounts of phosphorous. Phosphate-rich effluent seeping through these soils will lose most of the phosphorous within a few metres.

The limiting nutrient for this site is nitrogen. No phosphorous balance is required.

Nitrogen, contained in organic compounds and ammonia, forms nitrate-N and small amounts of nitrite-N when processed in an aerated treatment plant. Several processes affect nitrogen levels within soil after irrigation. Alternate periods of wetting and drying with the presence of organic matter promotes reduction to nitrogen gas (denitrification). Plant roots absorb nitrates at varying rates depending on the plant species, however nitrate is highly mobile, readily leached, and can enter groundwater via deep seepage and surface waters via overland flow and near-surface lateral flow.

Based on the water and nutrient balance, and assuming 30mg/litre N in the effluent, a denitrification rate of 20%, with N uptake of 220 kg/ha/year for an established grass cover of a rye/clover equivalent, a conservative estimate can be made of the nitrogen content in the deep seepage and lateral flow.

Without considering further expected denitrification below the root zone and in the groundwater (reported to be in the vicinity of 80%), denitrification in the lateral flow (external to the effluent areas but within the curtilage of the allotment) and plant uptake in the lateral flow, the effluent loading rate should not exceed 2.5mm/day.

On-site effluent disposal systems designed, constructed, operated and maintained in accordance with the following recommendations cannot adversely impact on the beneficial use of surface waters and groundwater in the area.

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1.4 RISK MANAGEMENT & MITIGATION

The *Environment Protection Regulations, 2021* and ancillary documents requires that the site be assessed on a risk-weighted basis and that cumulative impacts are assessed.

Guidance on risk reduction has been taken from, *1910.2 Victorian guideline for water recycling*, *1911.2 Technical information for Victorian guideline for water recycling*, *Victorian guideline for irrigation with recycled water*, E.P.A. Publication 168.3, October 2022, the *Mansfield Shire Onsite Wastewater Management Plan* and *AS/NZS 1547:2012. Guidance has also been sought from Approaches for Risk Analysis of Development with On-site Wastewater Disposal in Open, Potable Water Catchments*, Dr Robert Edis, April 2014.

For Class B wastewater and land application disposal via low pressure, low throw surface irrigation with high-level management the risk is considered negligible.

The risk has been assessed by considering the surficial and subsurface physical, chemical and biochemical conditions of the site and surrounds and climatic conditions affecting the site along with the sensitivity and proximity of the receiving environment.

Where risk is defined as the product of consequences and frequency, insertion of properly designed, constructed and maintained low pressure, low throw sprinkler irrigation system with high level management would reduce the risk to the integrity of surface water and ground water to negligible levels.

A multiple risk reduction approach is used in assessing this development, with components listed below:

1.4.1 Water Usage. The daily effluent peak influent load (during school terms) of up to 9,900 litres has been calculated from client provided patronage and EPA water usage estimates and assumes mains water (equivalent)-for details see Appendix E1.

1.4.2 Effluent Treatment. The LCA recommends treatment via AWTS and a pond system for winter (aerobic) storage producing Class B wastewater.

1.4.3 Block Size. In the subject site, size is not a constraining factor. Treatment ponds and land application area can be duplicated/extended. In addition, increases in daily effluent flow can be accommodated by extending the land application area

1.4.4 Management Plan. The onsite use of reclaimed water has been guided by *1910.2 Victorian guideline for water recycling*, *1911.2 Technical information for Victorian guideline for water recycling*, *Victorian guideline for irrigation with recycled water*, E.P.A. Publication 168.3, October 2022, *Code of Practice for Small Treatment Plants*, EPA Publication 500, June 1997 and *Sustainable Effluent-Irrigated Plantations: An Australian Guideline*, B. J. Myers, W. J. Bond et al, CSIRO, 1999.

A management plan is to be provided by a designated irrigation manager, to be appointed.

1.4.5 Sizing of Treatment Systems. It is proposed to construct an onsite effluent disposal system to accord with current regulations and best practice with effluent pretreated to the 10/10/10 standard (Class B) via AWTS with winter storage, located as shown in Drawing 2.

The treatment system has been sized to treat up to 9,900 litres/day.

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1.4.6 Load Balancing. Load-balancing tanks are not required if the chosen AWTS has a load-balancing function to provide temporary storage should the plant fail or if there is a power outage.

Alternatively, a balance tank placed upstream of the AWTS can provide temporary storage.

We recommend at least 3 days storage volume plus ballast and freeboard volumes, say, 50,000 litres

1.4.7 Reserve Area. The expected design life of fifteen years may vary due to construction and maintenance vagaries and possible effluent volume increases through the chain of ownership.

In this instance there is sufficient land available for duplication of the the land application area and storage pond.

1.4.8 Buffer Distances. Buffer distances are set out in the *Guideline for Onsite Wastewater Management (GOWM)*, EPA, May 2024 and *1910.2 Victorian guideline for water recycling*, *1911.2 Technical information for Victorian guideline for water recycling* to allow for attenuation of pathogens and nutrients, should an effluent surcharge occur (e.g., a damaged system element), either overland or subsurface.

The onsite use of reclaimed water has been guided by *1910.2 Victorian guideline for water recycling*, *1911.2 Technical information for Victorian guideline for water recycling*, *Sustainable Effluent-Irrigated Plantations: An Australian Guideline*, B. J. Myers, W. J. Bond et al, CSIRO, 1999 and *Guidelines for Wastewater Irrigation*, E. P. A. Publication 168.3, October 2022.

Buffer distances have been assessed in the context of *1910.2 Victorian guideline for water recycling*, *1911.2 Technical information for Victorian guideline for water recycling* and where relevant, AS/NZS1547:2012, Appendix R1 and R2.

The land application area and storage pond are located at least 100m from any surface water and 50m from any boundary, as shown in Drawing 2.

1.4.8.1 Groundwater Flow. Regardless of irrigation management and scheduling, treated effluent can be transported via deep seepage and water table, as a surface expression (spillage) and/or as perched groundwater in the topsoil.

The time taken for groundwater to reach the nearest surface waters can be estimated by using the Darcy equation.

From the literature, the regional groundwater gradient is less than 0.005.

For a conservative basement hydraulic conductivity of 1m/day^1 with a hydraulic gradient of 0.005, the time taken for groundwater to flow 100m is more than 50 years.

For a surface effluent discharge on a 2.5% slope (average down-grade slope) and for the prevailing soil hydraulic characteristics, the estimated maximum travel distance of effluent (before reabsorption) is less than 1m^2 .

¹ This is a conservatively high figure to demonstrate maximum possible flow rates within fractured basalt rock. A conservatively low figure was used for calculation of effluent application rates (see recommendations) to demonstrate irrigation sustainability.

² Source: *Approaches for Risk Analysis of Development with On-site Wastewater Disposal in Open, Potable Water Catchments* (Dr Robert Edis April 2014).



For perched groundwater on a 2.5% slope, an estimated hydraulic conductivity of 0.5m/day, and effective composite porosity of 0.2, the treated effluent takes more than 4 year to travel 100m.

1.4.8.2 Viral Die-off. In treated effluent, viruses are more persistent than coliforms and other bacteria.

A relationship between viral die-off and temperature has been established by Cromer WC, et al³. (see Appendix D)

The attenuation of viruses increases with increased temperature.

Soil temperature varies with air temperature but is rarely less than air temperature. Variation reduces rapidly with distance from the surface.

Hence, the lowest mean air temperature for Melbourne Airport (9.9°C) has been used.

Knowing the time required for an appropriate order of viral die-off, and key parameters including hydraulic conductivity, porosity and gradient, the distance travelled during the die-off period can be estimated using the Darcy equation.

The worst case is for flow as perched groundwater, where the steeper gradient (ground slope) profoundly influences (increases) the perched water velocity.

Where measurement of hydraulic conductivity has not been made, conservative estimates of hydraulic conductivity for topsoil, residual soil and fractured, weathered rock have been estimated from the soil descriptions given in the LCA, our local data base and AS/NZS1547:2012.

Similarly, as the actual fluid velocity $V_{actual} = \frac{V_{Darcy}}{Porosity}$ an appropriate value of porosity within the published range for similar materials has been selected.

In this instance, a viral die-off time of 99 days has been estimated.

The distance travelled during this period is estimated at about 6m see Appendix D.

Hence, the proposed minimum (available) buffer distances to surface waters (100m) coupled with Class B wastewater and disposal via low pressure, low throw sprinkler irrigation represent a negligible risk to public health.

1.4.9 System Failure. A properly designed and constructed onsite effluent system can suffer degrees of failure.

Failure can take the form of mechanical (pumps), accidental (toilet blockages, damaged pipes, high BOD influent), operational (power outage, overloading) and maintenance (failure to check filters, failure to participate in maintenance programme).

1.4.9.1 Mechanical Breakdown. Mechanical plant breakdown typically involves compressor and pump malfunction causing no aeration and high-water levels, respectively. Both situations are alarmed (both audible and visual). The proposed plants will benefit from a service contract providing 24-hour repair cycles. If the alarms were ignored (or malfunctioned) and the establishment continued to produce waste until the load balancing tank and plant capacities were exceeded (at least 3 days), a mixture of septic and raw effluent would surcharge through

³ Cromer WC, Gardner EA and Beavers PD (2001) An improved viral die-off method for estimating setback distances, in Patterson RA and Jones MJ eds, Proceedings of On-site '01 Conference: Advancing On-site Wastewater Systems, Armidale.



the pump station/tank hatches. It is difficult to imagine how this outcome could be allowed to manifest.

1.4.9.2 Accidents. Toilet blockages and accidentally damaged irrigation lines could allow localised surface surcharge of treated effluent. This is why appropriate buffers to surface waters have been maintained. High BOD influent (e.g., dairy or orange juice) can realise a lesser quality than 10/10/10 standard for some weeks. Provided the high BOD influent is not continuous, the system will continue to satisfactorily renovate the effluent.

1.4.9.3 Operational Breakdown. Operational failures including power outages and transient hydraulic overloading are accommodated by the load balancing facility, as described in Section 1.4.6, above.

1.4.9.4 Maintenance Breakdown. It is essential to undertake continuous maintenance on all treatment components.

Refusal to participate in the management programme would be acted on by the responsible authority within one maintenance cycle.

Pumped systems have mechanical components which can malfunction and will age. The management plan including the maintenance and monitoring programmes are essential to ensure safe onsite effluent disposal.

1.4.10 Risk Summary. Regarding density of development and cumulative risk the assessment has considered risk associated with subsurface flows and surface flows.

Regarding subsurface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained (see items 1.4.1 through 1.4.12.4), the risk to surface and ground waters is negligible. Once the effluent is placed underground, the extraordinary long travel times via ground water to surface waters ensures adequate nutrient attenuation.

Regarding surface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained (see items 1.4.1 through 1.4.12.4), the risk to surface and ground waters is no greater than for a sewered development.

The LCA recommends a conservative, scientifically based, well founded wastewater management system with inherent multiple barriers of safety. Cumulative risk from the development is also extremely low. The risk of serious or irreversible damage is extremely low.

Our risk assessment has shown that the instance of an accidental/unintended discharge of treated effluent travelling via perched groundwater is the limiting design condition. All treatment elements have been placed at least 100m from surface waters.

All requirements of the *Environment Protection Regulations, 2021* have been met.

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Figure 1: Proposed land application area (typical).



Figure 2: Proposed land application area (typical).

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SECTION 2. RECOMMENDATIONS

2.1 APPLICATION

The following recommendations are based on the results of our assessment, and are made in accordance with the *Environment Protection Act, 2017*, The onsite use of reclaimed water has been guided by *1910.2 Victorian guideline for water recycling*, *1911.2 Technical information for Victorian guideline for water recycling*, *Sustainable Effluent-Irrigated Plantations: An Australian Guideline*, B. J. Myers, W. J. Bond et al, CSIRO, 1999, *Victorian guideline for irrigation with recycled water*, E.P.A. Publication 168.3, October 2022, AS/NZS 1547:2012, AS 1289 and *Australian Laboratory Handbook of Soil and Water Chemical Methods*.

The system has been designed to treat (via AWTS) a peak daily hydraulic load of up to 9,900 litres, with treated water stored in a lined winter storage dam.

Two AWTS (ABS5000) or similar can treat up to 10,000 litres/day.

All irrigation water will be drawn from the winter storage dam. And irrigated at a rate not exceeding 11,600 litres/day (2mm/day).

2.2 LOW PRESSURE (LOW THROW) SPRINKLER IRRIGATION

2.2.1 General. Based on the results of the water balance analysis and considering the prevailing surficial and subsurface conditions including soil profile thickness and slope and on condition that adequate site drainage is provided (as described in Section 2.4, below), on-site irrigation systems with AWTS treatment and winter storage are appropriate for effluent disposal at this site.

2.2.2 Effluent. Effluent will be generated from a school and residence and will include black and grey water (all wastes).

2.2.2.1 Effluent Quality. Effluent should be treated via AWTS to a standard that meets or exceeds the water quality requirements of the 10/10/10 standard for BOD/SS/cfu/100mL.

2.2.2.2 Effluent Quantity. The daily peak effluent volume of up to 9,900 litres has been calculated from client provided patronage and EPA water usage estimates and assumes mains water (equivalent)-for details see Appendix E1.

2.2.2.3 Load Balancing. Load balancing is provided by the storage dam and the ability to vary demand irrigation rates.

2.2.3 Application Rates and Irrigation Areas. An irrigation area and application rate has been determined from the results of the water and nutrient balance analyses and published general water requirements for pasture grass (rye/clover mix or equivalent).

The water balance demonstrates the surface (low pressure, low throw) irrigation rate and the winter (non-irrigation period) storage requirement for pasture grass.

2.2.3.1 Hydraulic Loading. To satisfy the requirement for no surface discharge in the 9th decile wet year and allowing for slope, effluent shall be applied at an application rate not exceeding the pasture water uptake requirements for October through March.

2.2.3.2 Nutrient Loading. The requirements of the *Environment Protection Act, 2017* would be satisfied with effluent applied at an application rate not exceeding 2.5mm/day.

2.2.3.3 Design Loading. To satisfy the requirement for no surface discharge in the 9th decile wet year and on-site attenuation of nutrients, the effluent shall be applied at an average rate not exceeding about **2mm/day** and at variable rates determined by the irrigation manager.



2.2.3.4 Land Application Areas. For 9th decile rainfall and typical occupancy, a land application area of 0.58 hectares has been calculated.

2.2.4 General Requirements. For surface irrigation, it is assumed that the design, construction, operation, and maintenance are carried out in accordance with AS/NZS1547:2012 and a “system specific” JAS/ANZ accreditation, as appropriate.

2.2.5 Surface Distribution System. It is anticipated that the pasture grass will be irrigated by a low pressure, low throw boom spray or similar.

2.2.5.1 Ground Preparation and Excavations. Preparation of the ground is to include the redistribution of topsoil to form a smooth and gently sloping surface. Pipe excavations shall only be undertaken in drier periods when soil moisture contents are relatively low and when heavy rainfall and storms are not normally expected.

2.2.5.2 Pump System and Pipe works. Uniform delivery pressure of the effluent throughout the distribution system is essential. Spray rates shall not vary by more than 10% from the design rate over the whole of the system.

2.2.6 Irrigation Scheduling. Irrigation scheduling is to be controlled by the soil-moisture deficit on a daily basis. An experienced manager will determine the irrigation days and duration of irrigation by regular inspection and monitoring. It may be appropriate to initially determine scheduling using gravimetric moisture, matric suction, or neutron meter measurements.

The inspection regime described in Section 2.2.7, below, is to be strictly adhered to.

2.2.7 Inspections and Monitoring. For the land application area and treatment infrastructure, we recommend that the mandatory testing and reporting as described in 1910.2 Victorian guideline for water recycling, 1911.2 Technical information for Victorian guideline for water recycling and Victorian guideline for irrigation with recycled water, E.P.A. Publication 166.3, October 2022 include an annual (post spring) report on the functioning and integrity of the distribution system and on the functioning and integrity of any cut-off drains and outfall areas.

For the treated effluent, we recommend that a monitoring and testing programme, as described in 1910.2 Victorian guideline for water recycling and 1911.2 Technical information for Victorian guideline for water recycling (and suitable for Class B recycled water) and as required by the EPA licence conditions, be adopted.

An annual testing programme to establish the efficacy of soil amelioration is required.

Daily inflow to the storage pond is to be monitored and recorded against occupancy.

It is expected that the frequency of inspections and monitoring will intensify as systems age.

2.2.8 Soil Renovation. Our laboratory testing has shown that soil amelioration is required to improve soil structure and permeability and to achieve an appropriate (for plant health) cation balance.

2.2.8.1 Colloid Stabilisation. Laboratory analysis of A and upper B-horizon soils indicate that the topsoils range from non-dispersive to dispersive while the subsoils are dispersive. To improve and maintain stable soil colloids and to achieve a suitable cation balance (not necessarily optimum cation balance), gypsum will be needed to be added to the soil.

A summary of the laboratory tests (part) is presented in Appendix A4, to this report.

Our soil amelioration programme is necessarily integrated with the ground preparation, as described in Section 2.6, below.

2.2.8.2 Total Fertiliser Requirement. Fertiliser requirements and recommendations will be supplied as a supplementary certificate.

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Note: Any added fertilisers must not contain sodium and magnesium.

2.2.9 Treatment System. Treatment will be via a septic tank, series of balance tanks and AWTS with a winter storage pond. It is assumed that the design, construction, operation, and maintenance of all treatment elements are carried out in accordance with AS/NZS1547:2012, a current JAS-ANZ accreditation and in the instance of pond construction/renovation, best engineering practice.

2.2.9.1. Hydraulic Load. The design daily hydraulic load is up to 9,900 litres peak.

2.2.10 Effluent Treatment Stream. All-wastes effluent from school ablutions and residence shall be gravity fed or pumped to the AWTS (2 x 5,000 litre capacity). All treated wastewater is then pumped to the storage pond. All irrigation water shall be sourced from the top 1m depth of the third (downslope) storage pond.

It is understood that the kitchen effluent stream will include a triple interceptor grease trap.

2.2.11 Storage Pond. The storage pond is designed to store treated (10/10/10 standard) effluent generated during peak flow and the non-irrigation period of June through September.

The proposed storage pond (1248m³) is to be designed to contain effluent to a maximum depth of 1m with a free-board of at least 0.5m.

Storage capacity assumes irrigation drawdown from the top 1m depth for deeper ponds.

The ponds shall be lined with an impervious (welded) membrane to achieve zero seepage into the subsoil and water table.

2.3 RESERVE AREA

The expected design life of fifteen years may vary due to construction and maintenance vagaries and possible effluent volume increases through the chain of ownership.

There is sufficient available land to extend or duplicate the land application area, as required.

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2.4 SITE DRAINAGE.

Our recommendations for on-site effluent disposal have allowed for incident rainfall only and are conditional on the installation of cut-off drains or surface regrading to ensure that surface water cannot enter the irrigation areas.

The owner shall also ensure that any upslope site works do not divert and/or concentrate surface water flows onto the disposal area. Any intercepted waters are to be discharged well away and downslope of the disposal field.

2.5 BUFFER DISTANCES

2.5.1 Land Application Area. The water balance analysis has shown that potential surface (rain water) flows from the plantation area would be restricted to episodic events.

The estimated hydraulic properties of the upper soil materials and hydraulic gradient have been used to evaluate (via Darcy's Law) the buffer distances with respect to (any) subsurface flows.

Our analysis and evaluation including viral die-off distances have shown that the default setback distances given in 1910.2 *Victorian guideline for water recycling*, 1911.2 *Technical information for Victorian guideline for water recycling* and *Victorian guideline for irrigation with recycled water, E.P.A. Publication 168.3*, October 2022 and *Approaches for Risk Analysis of Development with On-site*

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Wastewater Disposal in Open, Potable Water Catchments, Dr Robert Edis, April 2014 are conservative and can be applied without amendment.

For low pressure, low throw surface Irrigation, a buffer distance of at least 50m to the nearest property is achievable.

2.5.2 Storage Pond. Assuming influent of 10/10/10 treated effluent, a buffer distance of at least 20m to the nearest property is recommended.

Note: Eutrophication of the stored water can be expected at least once per year. Subsequent odours can be attenuated by chemical treatment.

2.6 LAND APPLICATION AREA DEVELOPMENT

2.6.1 Effluent Volume. The disposal system has been designed for client based occupancy and 9th decile rainfall. The design demonstrates that the site can sustainably store/dispose of up to 9,900 litres wastewater daily under 9th decile rainfall conditions.

2.6.2 Soil Renovation Programme. To reduce sodium and magnesium and to increase calcium in the soil, the addition of gypsum is required.

The laboratory determined gypsum requirement is expected to be between 15 and 20 tons/hectare

Gypsum can be added to the soil as follows:

1. Prior to planting and pipe works, apply 0.25 kg/m² (over the whole 0.67 hectare land application area,
2. Subsequent required gypsum applications can be applied as “liquid” gypsum through the irrigation network at a rate of 13 litres per 1kg/m² dry gypsum requirement.

Note: Application rates are related to water (irrigation and mean rainfall) available to dissolve the gypsum. The water required to dissolve 1 kilogram of gypsum is 400 litres.

In this instance, available water is sourced from mean rainfall plus irrigation water.

Dry gypsum must be fine-grained agricultural quality.

Proprietary “liquid” gypsum is typically CaCl + polyacrylamide + wetting agent + water.

Depending on the proprietary product, 1 litre of liquid “gypsum” is approximately equivalent to 95kg dry gypsum.

The gypsum requirement and application techniques will be provided in a supplementary certificate.

2.7 SUMMARY OF RECOMMENDATIONS

Our capability assessment has shown that at least one rational and sustainable on-site effluent disposal method (10/10/10 standard surface low pressure, low throw spray irrigation) with onsite treatment (via AWTS) and with winter storage is appropriate for the proposed development, subject to specific design criteria

Paul R. WILLIAMS B.App.Sc.
PRINCIPAL HYDROGEOLOGIST
& ENGINEERING GEOLOGIST

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LOCATION OF SITE SHOWING CONTOURS

710 MT RIDLEY ROAD, MICKLEHAM

MY COLLEGE PTY LTD

Scale: 1:10,000

Drawn: P.R.W.

Report Number: A251108

Contour Interval: 10m

Date: April 2026

Drawing Number: 1

SUFFICIENT AREA EXISTS FOR
DUPLICATION OF EFFLUENT
IRRIGATION AREA DUE TO
CONTINGENCIES THROUGH
THE CHAIN OF OWNERSHIP



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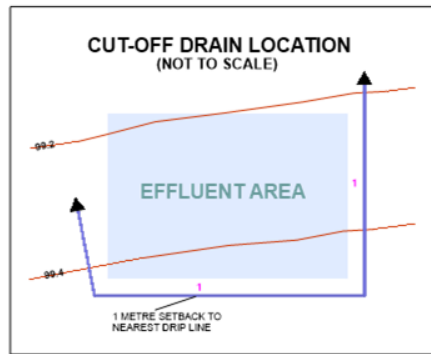


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TERRAIN MODELLING DERIVED FROM LIDAR (VIC GRID 2020)

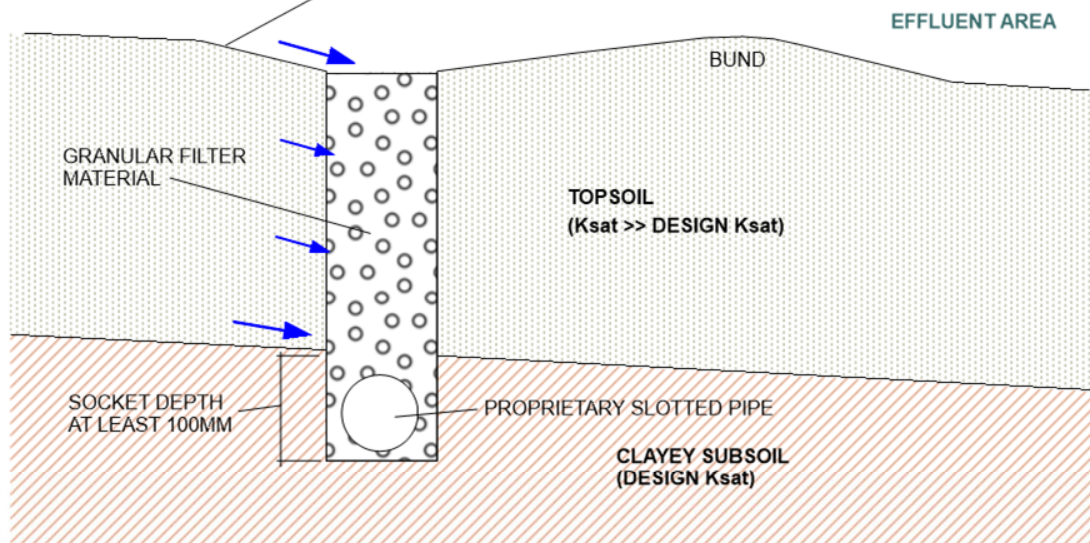
DATE OF REVISION 2: 08/05/2026
DATE OF REVISION 1: 05/05/2026

LOCATION OF PROPOSED DEVELOPMENT SHOWING CONTOURS		
710 MT RIDLEY ROAD, MICKLEHAM		
MY COLLEGE PTY LTD		
Scale: 1:2,000	Drawn: P.R.W.	Report Number: A251108
Contour Interval: 1m	Date: April 2026	Drawing Number: 2 REVISION 2



NOTE: CUT-OFF DRAIN LOCATION IS SCHEMATIC ONLY. FINAL LOCATION TO BE DETERMINED BY DESIGN ENGINEER AS PART OF SITE DRAINAGE DESIGN.

SURFACE REGRADED BY CUTTING TO FACILITATE COLLECTION OF SURFACE FLOWS - DEGREE OF CUT SLOPE LIMITED BY REQUIREMENTS FOR SAFE & EFFICIENT MOWING/MAINTENANCE



NOTES:

1. DRAIN TO BE DESIGNED, CONSTRUCTED & MAINTAINED TO ENSURE THAT NO SURFACE & PERCHED GROUNDWATER FLOWS ENTER THE IRRIGATION AREA.
2. DRAIN TO BE LOCATED ON ALL UPSLOPE SIDES OF EFFLUENT AREA (NO CLOSER THAN 1m FROM NEAREST DRIP LINE).
3. DRAIN TO HAVE UNSPECIFIED FALL.
4. MINIMUM SOCKET DEPTH OF 100mm INTO CLAY SUBSOIL (WHERE ENCOUNTERED) OR AT LEAST 300mm DEEP.
5. DRAIN CROSS SECTIONAL AREA RELATED TO DESIGN FLOWS AS DETERMINED BY A SUITABLY QUALIFIED AND EXPERIENCED ENGINEER.
6. OFF-SITE DRAIN OUTFALL TO LEGAL POINT OF DISCHARGE SUBJECT TO LOCAL AUTHORITY REQUIREMENTS.
7. ON-SITE DRAIN OUTFALL TO INCLUDE APPROPRIATE ENERGY DISSIPATION TO AVOID EROSION.
8. ALL DRAINS AND OUTFALL AREAS SUBJECT TO POST-SPRING INSPECTION.

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NOTE: DRAWING NOT TO BE USED FOR SET-OUT PURPOSES

CUT-OFF DRAIN DETAIL FOR SECONDARY STANDARD EFFLUENT IRRIGATION FIELDS

DUPLEX/GRADATIONAL SOIL PROFILES

Scale: 1:10 (Approximately)

Drawn: P.R.W.

Report Number: A251108

Contour Interval: N/A

Date: 2026

Drawing Number: 3

APPENDICES

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APPENDIX A1

SOIL PERMEABILITY

In-situ permeability tests were not undertaken.

A conservative estimate of permeability has been deduced as follows:

Profile analysis in accordance with AS/NZS 1547:2012 and our laboratory determined swell potential (including our local data base- shows the residual soils are poorly structured, dispersive heavy clays (Category 6 soil) with saturated hydraulic conductivity less than 0.06m/day.

The permeability of the topsoil materials is conservatively estimated to be up to 0.5m/day.

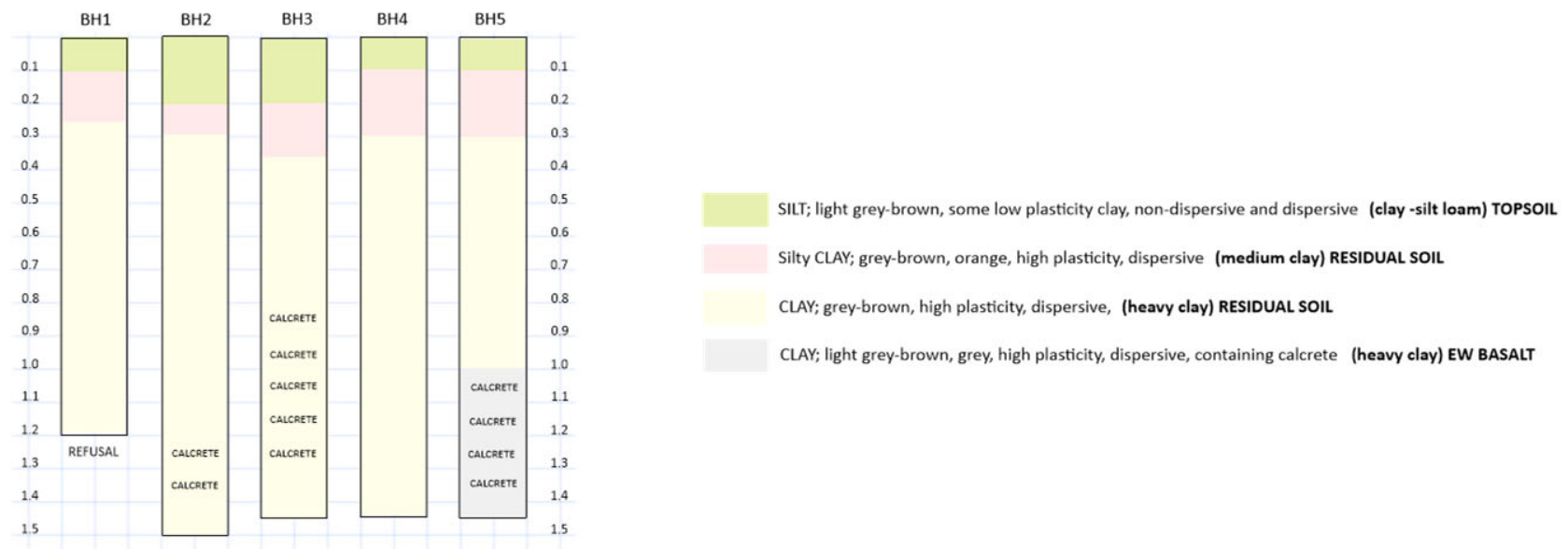
The permeability of the fractured basalt is conservatively estimated to be up to 1m/day.

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APPENDIX A2
LOGS OF BOREHOLES

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APPENDIX A3
SOIL PROFILE PHOTOGRAPHS



Borehole BH1



Borehole BH2



Borehole BH3

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Borehole BH4



Borehole BH5

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APPENDIX A4
SUMMARY OF LABORATORY TEST RESULTS

COMPOSITE RESIDUAL CLAY PROFILE

Property	LAND-SOIL UNIT A			
Depth (average)	0-100mm	100-300mm	800+mm	Desirable
Horizon	A	B ₁	B ₂	-
pH	5.9-6.1	7.5	7.5-7.6	-
EC (µS/cm)	0.09-0.22	0.22	0.19-0.48	-
Exchangeable Sodium %	*	*	*	0.5%-5%
CEC (cmol ⁺ /kg)	*	*	*	15+
Calcium/Magnesium Ratio	*	*	*	2-4
Gypsum Req (t/ha)	*	*	*	
Emerson	4,1	1	1	
Dispersion Index	0-14	14-15	14	
Free Swell (%)	5-30	40-60	90	
Ksat (m/day) ¹	0.06	<0.06	<0.06	
Soil Permeability Category ¹	6	6	6	
AS/NZS 1547 Classification	Clay loam	Heavy clay	Heavy clay	

1. After renovation including gypsum application. Estimated by visual tactile methods, AS/NZS1547, AS1289 and database or by insitu measurement.

* Pending: Separate certificate to be supplied.

All test results in green highlight from SWEP Analytical Laboratories.

All test results in blue highlight from in-house laboratory.

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APPENDIX B

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A251108 02

WATER/NITROGEN BALANCE - PASTURE GRASS (20/30 irrigation): With winter storage.

Rainfall Station: [Greenvale Reservoir](#)/ Evaporation Station: [Melbourne](#)

Location: [Mickelham](#)

Date: [April, 2026](#)

Client: [My College Pty Ltd](#)

ITEM		#	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Days in month:		D	31	28	31	30	31	30	31	31	30	31	30	31	365
Days in month with effluent generation:		DE	31	28	31	30	31	30	31	31	30	31	30	31	365
Evaporation (mean)	mm	A	180	146	121	75	50	33	37	53	78	112	135	161	1168
Rainfall (9th decile)	mm	B1	53	45	41	62	48	58	47	61	72	81	95	67	730
Effective rainfall	mm	B2	40	34	31	47	36	44	35	46	54	61	71	50	548
Peak seepage Loss ¹	mm	B3	0	0	0	0	0	0	0	0	0	0	0	0	0
Evapotranspiration (XA)	mm	C1	126	102	85	45	25	15	15	24	43	73	95	113	759
Waste Loading (C1+B3-B2)(Irrig'n req'ment)	mm	C2	86	68	54	0	0	0	0	0	0	12	23	62	306
Net evaporation from lagoons (10(0.8A-B1)x(lagoon area(ha)))	kL	NL	114	90	70	-2	-10	-39	-22	-23	-12	11	16	77	268
Volume of Wastewater	KL	E	55	205	190	118	217	207	127	226	189	163	207	145	2048
Total Irrigation Water(E-NL)	KL	F	-59	116	120	120	227	246	149	249	201	152	191	68	1780
Irrigation Area(F/10C2)annual.	ha	G													0.58
Storage:	mm	H	-77	-33	-21	20	37	36	22	39	33	16	12	-38	215
Direct Crop Coefficient:		I	0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	Pasture:
Rainfall Retained:	100%	K	1. Seepage loss (peak) equals deep seepage plus lateral flow: 0mm												
Lagoon Area:	0.1248	L	CROP FACTOR - PASTURE GRASS												
Seepage Loss (Peak):	0	N	0.78	0.78	0.75	0.65	0.55	0.55	0.55	0.55	0.55	0.65	0.75	0.78	Olives: 250
Dam storage requirement:	1248	TT	0.95	0.95	0.9	0.8	0.65	0.65	0.65	0.65	0.8	0.9	0.95	0.95	Olives: 350
Dam area (1m deep, 1:1 trap):	1248	DA	0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	Pasture:
Available water (F+B2)	3.4	AW	1	1	1	1	1	1	1	1	1	1	1	1	Woodlot

PART 2 RAINFALL DATA & 9TH DECILE REDISTRIBUTION

REDISTRIBUTION OF RAINFALL															
Rainfall to be redistributed (9th decile) =			730.4	mm/yr											
Minimum mean rainfall =			40.7	mm											
9th decile (annual) - mean rainfall (annual) =			147	mm											
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Mean rainfall (mm)			46	43	41	49	44	47	43	49	53	57	62	51	583.4
Deviation from minimum mean (mm)			5	2	0	8	3	7	2	8	12	16	21	10	95
Redistributed rainfall (mm) (1)			53	45	41	62	48	58	47	61	72	81	95	67	730

1. The distribution is adjusted in proportion to the deviation of means from the minimum mean.

Station: Greenvale Reservoir	Number: 86305	Opened: 1972	Now: Open
	Lat: 37.63° S	Lon: 144.91° E	Elevation: 160 m

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	45.7	42.5	40.7	49.1	43.6	47.3	43.1	48.8	52.9	56.7	61.9	51.1	593.1
Lowest	1.4	0.6	1.4	6.8	6.4	2.6	7.6	9.0	10.6	5.8	13.4	0.0	373.8
5th %ile	7.9	3.2	12.8	10.0	12.0	12.8	14.2	19.4	16.6	9.6	20.8	10.5	402.4
10th %ile	11.2	5.4	15.9	16.8	16.4	20.4	16.8	23.4	17.4	18.5	22.7	12.6	430.4
Median	42.3	28.8	35.9	39.5	43.0	40.6	40.8	44.6	49.7	50.8	57.0	43.6	608.2
90th %ile	80.2	107.8	69.6	86.1	69.8	79.2	69.3	79.2	91.2	101.8	113.0	94.7	730.4
95th %ile	90.0	132.1	79.2	115.8	91.1	100.6	77.1	84.0	103.6	128.1	134.4	111.7	767.8
Highest	114.4	179.6	136.2	147.6	116.2	128.2	110.6	112.4	104.6	169.2	146.8	146.6	838.7

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APPENDIX C

LAND CAPABILITY ASSESSMENT TABLE (Non-potable water supply catchments)

LAND FEATURE	LAND CAPABILITY		RISK RATING		AMELIORATIVE MEASURE & RISK REDUCTION
	LOW	MEDIUM	HIGH	LIMITING	
Available land for LAA	Exceeds LAA and proxy duplicate LAA requirements	Meets LAA and duplicate LAA requirements	Meets LAA and partial duplicate LAA requirements	Insufficient LAA area	Non-limiting for trenches & beds. Non-limiting for surface spray irrigation.
Aspect	North, north-east and north-west	East, west, south-east, south-west	South	South, full shade	East and north east, north-west.
Exposure	Full sun and/or high wind or minimal shading	Dappled light (partial shade)	Limited light, little wind to heavily shaded all day	Perpetual shade	Full sun and wind exposure.
Slope Form	Convex or divergent side slopes	Straight sided slopes	Concave or convergent side slopes	Locally depressed	Suitable for land application areas.
Slope gradient:					
Trenches and beds	<5%	5% to 10%	10% to 15%	>15%	Up to 2.5%: Non-limiting for trenches.
Bunded bubbler irrigation	<10%	10% to 30%	30% to 40%	>40%	Up to 2.5%: Non-limiting for surface spray irrigation.
Site drainage: runoff/run-on	LAA backs onto crest or ridge	Moderate likelihood	High likelihood	Cut-off drain not possible	Cut-off drain and bund required (see Section 2.2, above).
Landslip ⁴	Potential	Potential	Potential	Existing	Unremarkable
Erosion potential	Low	Moderate	High	No practical amelioration	If undisturbed. All regraded areas to be stabilised with gypsum and vegetation.
Flood/inundation	Never		<1% AEP	>5% AEP	Unremarkable
Distance to surface waters (m)	Buffer distance complies with 1910.2 & 1911.2 requirements		Reduced buffer distance acceptable	Reduced buffer distance not acceptable	LAA at least 100m from watercourses. Viral die-off estimated within 6m-see Section 1.4.8 and Appendix D.
Distance to groundwater bores (m)	No bores on site or within a significant distance	Buffer distances comply with 1910.2 & 1911.2	Buffer distances do not comply with 1910.2 & 1911.2	No suitable treatment method	No bores within a significant distance.
Vegetation	Plentiful/healthy vegetation	Moderate vegetation	Sparse or no vegetation	Propagation not possible	Existing grass suitable.
Depth to water table (potentiometric) (m)	>2	2 to 1.5	<1.5	Surface	Water table 10+m (1,000 to 3,500mg/L).
Depth to water table (seasonal perched) (m)	>1.5	<0.5	0.5 to 1.5	Surface	Perching possible.
Rainfall ⁵ (9 th decile) (mm)	<500	500-750	750-1000	>1000	Non-limiting for trench systems. Non-limiting for surface irrigation.
Pan evaporation (mean) (mm)	1250 to 1500	1000 to 1250	750 to 1000	<750	Design by water balance.
SOIL PROFILE CHARACTERISTICS					
Structure	High or moderately structured	Weakly structured	Structureless, massive or hardpan		Improve and maintain structure by gypsum application.
Fill materials	Nil or mapped good quality topsoil	Mapped variable depth and quality materials	Variable quality and/or uncontrolled filling	Uncontrolled poor quality/unsuitable filling	No fill present.
Thickness: (m)					
Trenches and beds	>1.4		<1.4	<1.2	Low risk to high risk for trench systems
Subsurface irrigation	1.5+	1.0 to 1.5	0.75 to 1.0	<0.75	Low risk to medium risk for irrigation
Permeability ⁶ (limiting horizon) (m/day)	0.15-0.3	0.03-0.15 0.3-0.6	0.01-0.03 0.6-3.0	>3.0 <0.03	After renovation; design by water balance
Permeability ⁷ (buffer evaluation) (m/day)	<0.3	0.3-3	3 to 5	>5.0	Evaluate flow times via Darcy's Law (assume 1m/day for fractured basalt)
Storiness (%)	<10	10 to 20	>20		Low risk for land application.
Emerson number	4, 5, 6, 8	7	2, 3	1	Limiting for trench systems, non-limiting for irrigation.
Dispersion Index	0	1-8	8-15	>15	Limiting for trench systems, non-limiting for irrigation.
Reaction trend (pH)	5.5 to 8	4.5 to 5.5	<4.5>8		Within suitable range
E.C. (dS/m)	<0.8	0.8 to 2	2-4	>4.0	Within suitable range
Free swell (%)	<30	30-80	80-120	>120	Low to high shrink-swell potential-non-limiting for irrigation.

There are no limiting factors for surface spray irrigation systems.

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⁴ Landslip assessment based on proposed hydraulic loading, slope, profile characteristics and past and present land use.

⁵ 9th decile monthly rainfalls used in water balance analyses.

⁶ Saturated hydraulic conductivity from insitu testing and data base.

⁷ Saturated hydraulic conductivity estimated from AS/NZS1547:2012 and data base.

APPENDIX D
VIRAL DIE-OFF & AMENDED BUFFER DISTANCE

1. Determine time for viral die-off¹:

$$M_t/M_o = e^{-kt}, \text{ and,}$$

$$k = (T - 8.5)/20$$

where T is the mean low temperature for the nearest BOM station,

M_t/M_o is the ratio of viral concentration, and,

k is the first order rate of viral die-off.

2. Calculated horizontal buffer distance (via the Darcy Equation):

$$d_g = t - (d_v P)/K / (P/Ki)$$

9.9	Mean temperature (annual low)-Melbourne airport (2025).
0.07	First order rate of viral die-off (k).
0.00001	Ratio of viral concentration (greywater)
0.0000001	Ratio of viral concentration (primary)
0.0001	Ratio of viral concentration (20/30)
0.001	Ratio of viral concentration (10/10/10)
99	Time for viral die-off (t).
0.2	Distance to water table/restricting layer.
0.2	Effective porosity (P) (within range for soil type- used to determine actual fluid velocity).
0.5	Hydraulic conductivity (K) (local data base and AS/NZS1547): conservative value.
0.025	Slope (average ground slope for perched water table) (%).
6	Distance travelled during viral die-off period (d_g).

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References

1. Cromer WC, Gardner EA and Beavers PD (2001) An improved viral die-off method for estimating setback distances, in Patterson RA and Jones MJ eds, Proceedings of On-site '01 Conference: Advancing On-site Wastewater Systems, Armidale.

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APPENDIX E

DAILY & ANNUAL WASTE WATER FROM ALL SOURCES (2027 SCHOOL YEAR)

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STUDENTS	400	400	400	400	0	0	400	400	400	400	400	400	0	0	400	400	400	400	400	400	400	400	400	400	0	0	400	400	400	400	7200		
STAFF	50	50	50	50	0	0	50	50	50	50	50	50	0	0	50	50	50	50	50	50	50	50	50	50	0	0	50	50	50	50	900		
TRANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
HOUSE	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	150		
Total	455	455	455	5	5	455	455	455	455	455	455	455	5	5	455	455	455	455	455	455	455	455	455	455	5	5	455	455	455	455	8250		
Daily Efflux	9900	9900	9900	9900	900	900	9900	9900	9900	9900	9900	9900	900	900	9900	9900	9900	9900	9900	9900	9900	9900	9900	9900	900	900	9900	9900	9900	9900	189000		6300

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STAFF	0	0	0	0	0	0	0	0	0	0	50	50	50	50	50	0	0	50	50	50	50	50	0	0	50	50	50	50	50	0	0	750		
TRANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
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Total	5	5	5	5	5	5	5	5	5	5	455	455	455	455	455	5	5	455	455	455	455	455	5	5	455	455	455	455	455	5	5	6905		
Daily Efflu	900	900	900	900	900	900	900	900	900	900	9900	9900	9900	9900	9900	900	900	9900	9900	9900	9900	9900	900	900	9900	9900	9900	9900	9900	900	900	162900		5255

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday								
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TRANS HOUSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							0	
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Daily Efflu	9900	900	9900	9900	9900	900	900	9900	9900	9900	9900	9900	900	900	9900	9900	9900	9900	9900	900	900	9900	9900	9900	9900	9900	900	900	9900	900	0						27000	6677

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HOUSE	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	155		
Total	455	455	455	5	5	455	455	455	455	455	455	5	5	455	455	455	455	455	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6005		
Daily Effort	9900	9900	9900	900	900	9900	9900	9900	9900	9900	9900	900	900	9900	9900	9900	9900	9900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	14490	4674	

STUDENTS: 20 litres; STAFF: 20 litres; HOUSE: 180 litres/person © Paul Williams 2021

ADVERTISED PLAN