LAND CAPABILITY ASSESSMENT

336 Glenrock Road
CAVAN NSW

28 August 2025 (V01)

FRANKLIN CONSULTING AUSTRALIA PTY LTD
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SOILANDWATER

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Limitations

This report has relied on the information provided by the client prior to this report, and from site investigation as undertaken on a specific date. The results provided are indicative of the sub-surface conditions only at the specific sampling or testing locations, and only to the depths investigated and at the time the inspection was carried out. It cannot be considered that these findings represent the actual state of the site at all points. The accuracy of the report may be limited by undetected variations in ground conditions between sampling locations. Should any site conditions be encountered during construction that vary significantly from those outlined in this report, Franklin Consulting Australia should be advised and further advice sought accordingly. Franklin Consulting Australia does not take responsibility for subsequent development design changes by the client or third parties. Franklin Consulting Australia Pty Ltd accepts no liability or responsibility for or in respect of any use of or reliance upon this report, or parts of this report, including its supporting material, by any party.

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This report is valid for 3 years from the date of issue, assuming no changes to the site or development design.

CONTENTS

SUMMARY

The development is a three into three lot Torrens subdivision to create new lots greater than 40ha each, as below:

Lot A 55.7 ha (residual dwelling)
Lot B 50.6 ha
Lot C 48.9 ha

Effluent treatment and dispersal recommendations

The site and soil conditions on Lots B & C were assessed as suitable for the installation of **secondary treatment systems linked to surface spray or drip irrigation.** The sites are generally unsuited to primary treatment systems and subsoil absorption beds due to the limited soil depth available across the nominated building areas.

The existing primary treatment system on the existing dwelling on proposed Lot A was assessed as requiring maintenance and upgrade or replacement, due to minor damage from burrowing animals and proximity of the subsoil absorption bed to drainage depressions.

Recommended management measures

To minimise any potential environmental impacts the following specific management measures are recommended for the newly created dwelling lots:

- on-site effluent management is to be ***limited to secondary treatment systems which include disinfection*** to maximise the quality of effluent produced and minimise potential detrimental impacts to surface and ground water systems and the surrounding environment.
- on-site effluent ***dispersal is to be limited to surface spray or drip irrigation*** to maximise evapotranspiration and evaporation and minimise potential drainage to groundwater systems.
- effluent dispersal areas should be ***restricted to areas which are not mapped as constrained and within or immediately adjacent to the proposed building areas*** *on Lots B and C*.
- dwelling and associated infrastructure construction shall be located within the indicative building areas which are not mapped as constrained for this purpose.
- ***remnant native vegetation should be retained*** in all parts of the property as far as practical to minimise groundwater recharge and potential dryland salinity issues.
- the ***area and vigour of perennial grazing pasture species should be maximised*** to reduce groundwater recharge and potential dryland salinity issues.
- areas of ***active erosion should be addressed*** through earthworks/revegetation as appropriate.

- ***groundcover should be maintained at >70%*** across the property to minimise future erosion risk.
- ***groundcover should be maintained at 100% in areas identified for effluent irrigation practices***.
- ***minimum tank storage requirements for the dwelling lots*** *should be sufficient to satisfy potable, non-potable and firefighting requirements and thereby reduce the need for each lot to develop individual additional non-potable water infrastructure such as dams and bores.*

REPORT SCOPE AND TECHNICAL REFERENCES

The report incorporates the results of an assessment of land capability for the proposed subdivision.

This assessment looks at the capability of the site to support the proposed development including:

- **Assessment of land capability for on-site effluent management,** based on Appendix C of ANZ Standard 1547:2012, *Site and Soil Evaluation for Planning, Rezoning and Subdivision of Land* and *The Silver Book*;
- **Assessment of land capability for dwelling construction,** based on excluding land within riparian buffer zones, areas of gully erosion or steep land; and
- **General land management recommendations** for constrained and sensitive areas. These will include effluent disposal areas, steep slopes, riparian zones, poorly drained waterlogged soils and areas of native vegetation. Recommendations will be general in nature and are designed to assist in determining appropriate land management practices for different parts of the site

The report also refers to, or relies on, standards and technical references listed below.

- *Onsite Wastewater Management Guidelines (April 2025) Department of Planning, Housing and Infrastructure, Office of Local Government*
- *On-site Sewage Management for Single Households* (The Silver Book) NSW Govt, 1998.
- *Soils and Construction: Managing Urban Stormwater - 4th Ed. Landcom NSW Government, 2004.*
- *ANZ Standard 1547:2012 On-site Domestic Wastewater Management.*
- *Soil Landscapes of the Goulburn 1:250,000 Sheet*. Hird,C. (1991) Soil Conservation Service of NSW.
- *Soil Landscapes of the Canberra 1:100,000 Sheet*. Jenkins, B.R. (2000) Department of Land and Water Conservation.
- *Yass Valley Environmental Plan (2013).*

LOCATION AND DEVELOPMENT INFORMATION

Address: 336 Glenrock Road, Cavan NSW.
LGA: Yass Valley Council.
Owner/Developer: C/- Jane Kerr, Council Approvals Group.

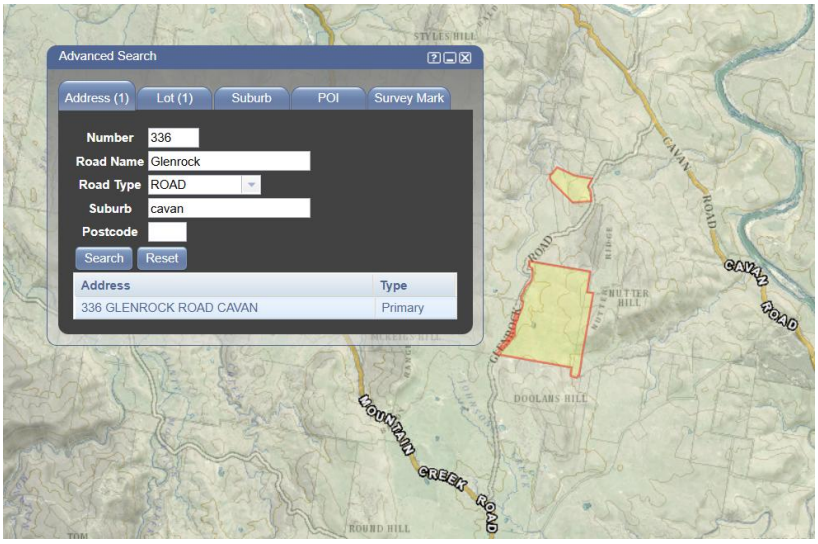

Figure 1: Regional location

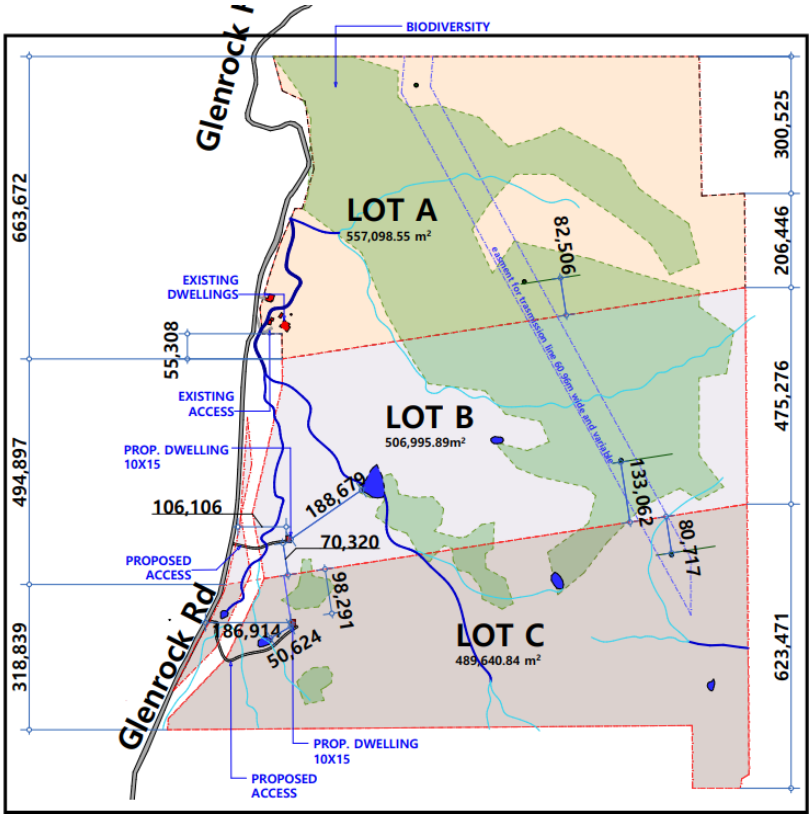

Figure 2: Proposed lot layout with indicative Building Areas– extract (refer to surveyed plans).

Intended water supply: Potable water is to be provided through roof catchment and tank storage. Non-potable water is to be provided through roof catchment and tank storage and existing dams.

It is recommended that the minimum tank storage requirements for the dwelling lots be sufficient to satisfy potable, non-potable and firefighting requirements and thereby reduce the need for each lot to develop individual additional non-potable water infrastructure such as dams and bores.

Proposed Effluent Management: The development will rely on the on-site treatment and disposal of effluent on the new dwelling lots.

Effluent disposal on the new dwelling lost will be restricted to unconstrained areas within or adjacent to the nominated building areas.

Effluent will be managed on-site by a combination of NSW Health accredited secondary treatment system with effluent dispersal via surface spray or drip irrigation.

Primary treatment and subsoil absorption systems are not considered appropriate for the development due to low permeability subsoil within the Building Areas.

Local experience: Many rural developments in the area share similar site and soil constraints. The constraints identified do not present any significant problems for the establishment of new dwellings.

Figure 3: Looking west over proposed building area on Lot C.

Figure 4: Looking east from proposed building area on Lot C.

Figure 5: Looking south over proposed building area on Lot C.

Figure 6: Looking north over proposed building area on Lot C.

Figure 7: Looking north over proposed building area on Lot B.

Figure 8: Looking west over proposed building area on Lot B.

Figure 9: Looking south over proposed building area on Lot B.

Figure 10: Looking east over proposed building area on Lot B.

Figure 11: Looking over bore adjacent to effluent dispersal area on Lot A

Figure 12: Looking south towards existing dwelling on proposed Lot A.

Figure 13: Existing septic tank servicing dwelling on proposed Lot A showing wombat damage.

Figure 14: Subsoil absorption area servicing dwelling on proposed Lot A.

Table 4–4. Constraint scale ranges *(Onsite Wastewater Management Guidelines, Department of Planning, Housing & Infrastructure, Office of Local Government, April 2025)*

Buffer distance range	Relevant site and system constraints	Constraint scale Low	High
Property Boundaries			
1.5m – 15.0m MOD RISK – 15m adopted	Effluent quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Slope	0-6% (surface effluent application), 0 -10% (subsurface effluent application)	>10% (surface effluent application), >30% (subsurface effluent application)
	Method of application	Subsurface or subsoil application	Surface/ above ground application
Buildings			
2.0m – 6.0m MOD RISK – 6m adopted	Effluent quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Slope	0-6% (surface effluent application), 0 -10% (subsurface effluent application)	>10% (surface effluent application), >30% (subsurface effluent application)
	Method of application	Subsurface or subsoil application	Surface/ above ground application
Retaining Wall/Embankment Cutting			
Greatest of 3.0m or 45° angle from toe of wall	Slope	0-6% (surface effluent application), 0 -10% (subsurface effluent application)	>10% (surface effluent application), >30% (subsurface effluent application
	Flood potential	Above 1 in 20-year flood contour	Below 1 in 20-year flood contour
	Geology/ Soil	Category 3 and 4 soils, low porosity regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, high porosity regolith
Path/Walkway			
1.5m – 6.0m MOD RISK – 6m adopted	Effluent Quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Fall direction	Downgradient of surface water body, property boundary, recreational area	Upgradient of surface water body, property boundary, recreational area
	Method of Application	Subsurface or subsoil application	Surface/ above ground application
Swimming Pool/ Recreational Area/ Market Garden			
3.0m – 15.0m MOD RISK – 15m adopted	Effluent Quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Fall direction	Downgradient of surface water body, property boundary, recreational area	Upgradient of surface water body, property boundary, recreational area
	Method of Application	Subsurface or subsoil application	Surface/ above ground application

Buffer distance range	Relevant site and system constraints	Constraint scale Low	High
In-ground water tanks and services (water, electrical, telecommunications and plumbing)			
3.0m – 15.0m MOD RISK – 15m adopted	Effluent Quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Fall direction	Downgradient of surface water body, property boundary, recreational area	Upgradient of surface water body, property boundary, recreational area
Permanent Surface Water Body			
50.0m – 100.0m MOD RISK – 100m adopted	Effluent Quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Surface water pollution hazard	Category 1 to 3 soils no surface water down gradient within 100m; low rainfall area	Category 4 to 6 soils permanent surface water <50m down gradient; high rainfall; high resource/ environmental value
	Slope	0-6% (surface effluent application), 0 -10% (subsurface effluent application)	>10% (surface effluent application), >30% (subsurface effluent application)
	Fall direction	Downgradient of surface water body, property boundary, recreational area	Upgradient of surface water body, property boundary, recreational area
	Drainage	No visible signs of saturation	Visible seepage; moisture tolerant vegetation; low lying area
	Flood Potential	Above 1 in 20-year flood contour	Below 1 in 20-year flood contour
	Application Method	Subsurface or subsoil application	Surface/ above ground application
Intermittent water bodies, farm dams, roadside drainage, drainage depressions			
15.0m – 40.0m MOD RISK – 40m adopted	Effluent Quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Surface water pollution hazard	Category 1 to 3 soils no surface water down gradient within 40m; low rainfall area	Category 4 to 6 soils intermittent surface water <20m down gradient; high rainfall; high resource/environmental value
	Slope	0-6% (surface effluent application), 0 -10% (subsurface effluent application)	>10% (surface effluent application), >30% (subsurface effluent application)
	Fall direction	Downgradient of surface water body, property boundary, recreational area	Upgradient of surface water body, property boundary, recreational area
	Drainage	No visible signs of saturation	Visible seepage; moisture tolerant vegetation; low lying area
	Flood Potential	Above 1 in 20-year flood contour	Below 1 in 20-year flood contour
	Application Method	Subsurface or subsoil application	Surface/ above ground application

Buffer distance range	Relevant site and system constraints	Constraint scale Low	High
Bore/ Well			
15.0m – 100.0m MOD RISK – 100m adopted	Effluent Quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Groundwater pollution hazard	Category 5 and 6 soils, low resource/ environmental value	Category 1 and 2 soils, gravel aquifers, high resource/ environmental value
	Geology / Soil	Category 3 and 4 soils, low porosity regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, high porosity regolith
Groundwater			
0.6m – 1.5m MOD RISK – 1.5m adopted	Effluent Quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Groundwater pollution hazard	Category 5 and 6 soils, low resource/ environmental value	Category 1 and 2 soils, gravel aquifers, high resource/ environmental value
	Drainage	No visible signs of saturation	Visible seepage; moisture tolerant vegetation; low lying area
	Geology/ Soil	Category 3 and 4 soils, low porosity regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, high porosity regolith
	Landform	Hill crests, convex side slopes, and plains	Drainage plains and incised channels
	Method of Application	Subsurface or subsoil application	Surface/ above ground application
Bedrock/ Hardpan			
0.6m – 1.5m MOD RISK – 1.5m adopted	Effluent Quality	Minimum of secondary treated effluent (with disinfection and contractual service agreement)	Primary treated effluent
	Groundwater pollution hazard	Category 5 and 6 soils, low resource/ environmental value	Category 1 and 2 soils, gravel aquifers, high resource/ environmental value
	Method of Application	Subsurface or subsoil application	Surface/ above ground application

Table 4–1. Site features – risk ratings for OWNS *(Onsite Wastewater Management Guidelines, Department of Planning, Housing & Infrastructure, Office of Local Government, April 2025)*. Sites with major limitations are generally not suitable for land application of effluent. Risk reduction measures have been highlighted to reduce to minor limitation.

Site feature	Relevant system(s)	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Geology/regolith	All EAA systems	n/a	n/a	Major geological discontinuities, fractured or highly porous bedrock or regolith	Groundwater pollution hazard
Shallow bedrock	In ground treatment systems and all EAA systems	n/a	n/a	Bedrock at shallower depth than tanks or effluent application systems	• Difficult excavation • Low saturated hydraulic conductivity • Shallow limiting layer (see Table 4–4)
Rocks and rock outcrops (% of land surface containing rocks (floaters) >0.2m diameter)	All EAA systems	< 10%	10% to 20%	> 20%	• Limits EAA system performance • Provides preferential flow paths • Difficult excavation
Fill	All OWMS	No fill	Fill present	n/a	• Subsidence • Variable permeability
Landform	All OWMS	Hill crests, divergent slopes and plains	Convergent slopes and foot slopes	Drainage plains and incised channels	• Groundwater pollution hazard • Resurfacing hazard
Slope %	Subsurface irrigation	0% to 20%	20% to 30%	> 30%	• Difficult installation • Linear Loading Rate (LLR) • Run-off • Erosion
Slope %	Surface irrigation	0% to 5%	5% to 10%	> 10%	• Difficult installation • Linear Loading Rate (LLR) • Run-off • Erosion
Slope %	Evapotranspiration Absorption (ETA)/ Absorption system: trench	0% to 10%	10% to 20%	> 20%	• Difficult installation • Linear Loading Rate (LLR) • Run-off • Erosion

Site feature	Relevant system(s)	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Slope %	ETA/ Absorption system: bed	0% to 5%	5% to 10%	> 10%	• Difficult installation • Linear Loading Rate (LLR) • Run-off • Erosion
Slope %	Mound	0% to 10%	10% to 15%	> 15%	• Difficult installation • Large volume of sand required. • Risk of toe seepage
Erosion potential	All EAA systems	• No signs of erosion potential present • Well vegetated	Absence of vegetation	Signs of erosion, e.g. rills, mass movement and slope failure present	• Soil degradation and Transport System failure
Run-on and upslope seepage	All EAA systems	None	Some - diversion possible	High - diversion not practical	• System inundation • Transport of effluent off-site
Flood potential	All treatment systems	Vents, openings, and electrical components above 1 in 100-year flood contour	n/a	Vents, openings, and electrical components below 1 in 100-year flood contour	• Transport of effluent off-site • System failure and electrocution hazard
Flood potential	All EAA systems	Rare; above 1 in 20year flood contour	n/a	Frequent; below 1 in 20-year flood contour	• System inundation. • Transport of effluent off-site
Site drainage	All effluent application systems	No visible signs of surface dampness	n/a	Visible signs of surface dampness, such as moisture-tolerant vegetation (sedges and ferns), seepages, soaks and springs	• Groundwater pollution hazard • Resurfacing hazard
Exposure	All effluent application systems	High sun and wind exposure	n/a	Low sun and wind exposure	• Poor evapotranspiration
Land area	All systems	Area is available	n/a	Area is not available	• Poor evapotranspiration
Buffer distance	All effluent application systems	(see Section 4.3.2 and Table 4–2)	n/a	n/a	• Health risk • Pollution risk

Table 4–5. Soil features – risk ratings for OWNS *(Onsite Wastewater Management Guidelines, Department of Planning, Housing & Infrastructure, Office of Local Government, April 2025)*. Sites with major limitations are generally not suitable for land application of effluent. Risk reduction measures have been highlighted to reduce to minor limitation.

Soil feature	Relevant system(s)	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Depth to bedrock or hardpan (m)	Subsurface irrigation	>1.0	0.75-1.0	<0.75	Possible waterlogging Increased risk of runoff May limit plant growth (trees)
	Surface irrigation	>1.0	0.6-1.0	<0.6	Possible waterlogging Increased risk of runoff May limit plant growth (trees)
	Absorption system	>1.5	1.2-1.5	<1.2	May restrict seepage Resurfacing hazard Groundwater pollution hazard
Depth to high episodic/ seasonal water table (as evidenced by mottling) (m)	Subsurface irrigation	>1.0	0.75-1.0	<0.75	Resurfacing hazard Groundwater pollution hazard
	Surface irrigation	>1.0	0.6-1.0	<0.6	Resurfacing hazard Groundwater pollution hazard
	Absorption system	>1.5	1.2-1.5[2]	<1.2	May restrict seepage Groundwater pollution hazard
Soil Category[3]	Subsurface irrigation Surface irrigation	2b, 3 and 4	1, 2a, 5 and 6		Excessive run-off, waterlogging Percolation
	LPED	2, 3 and 4	5	1 and 6	
	Evapotranspiration Absorption system	4 and 5	6[4]	1, 2 and 3	
	Absorption system	3 and 4		1, 2, 5, and 6	
Coarse fragments (%)	All land application systems	<20	20 - 40	>40	Preferential flow pathways through soil May restrict plant growth May impede installation
Bulk density (g/cm^3)	All EAA systems Sandy loam Clay loam Clay	<1.8 <1.6 <1.4		<1.8 <1.6 <1.4	Indicator of permeability May restrict plant growth
pH[5]	All EAA systems	>6.0	4.5-6.0	<4.5	May inhibit plant growth

Electrical conductivity (dS/m)	All EAA systems	<4	4-8	>8	Excessive salt may restrict plant growth
Sodicity (exchangeable sodium percentage)[5]	Subsurface irrigation Surface irrigation (0-0.4 m) Absorption system (0-1.2m)	<5	5-10	>10	Potential for structural degradation
Cation exchange capacity (cmol+/kg) (040cm)[5,6]	Subsurface irrigation Surface irrigation	>15	5-15	<5	Indicator of soil fertility Unable to hold plant nutrients
Phosphorus sorption (kg/ha)	All EAA systems (0-100cm for irrigation) 100cm below intended base of trench)	>6,000 (approximately 375 mg/kg)	2,000-6,000	<2,000 (approximately 125 mg/kg)	Unable to immobilise any excess P
Modified Emerson Aggregate Test (dispersion class)[5]	All EAA systems	Class 3, 7, 8	Class 2	Class 1	Potential for structural degradation

Notes

1. Sites with major limitations are generally not suitable for land application of effluent. Risk reduction measures must be applied to reduce to minor limitation.
2. Presence of soil water might indicate soil conditions that facilitate movement of nutrients and other contaminants into the groundwater.
3. See Table 4–6 for soil category information.
4. ETA systems are only suitable for use with a minimum of secondary treated effluent in category 6 soils.
5. May require soil amelioration where a moderate or major limitation is identified (see Figure 6–4).
6. Soil is likely to become more sodic with effluent application.

LOCAL SOIL ASSESSMENT

Depth to bedrock or hardpan:	**>1.0 m**
Depth to high soil water table:	>1.5 m
Hydraulic loading rate	
Soil texture:	Sandy **Clay Loam**
Soil structure:	**Weak** to **Moderate**
Permeability *(from table M1 of AS1547:2012)*:	0.12 – 1.5 m/day
Recommended design loading rate for irrigation system *(from table M1 of AS1547:2012)*:	3.5 mm/day
Coarse fragments:	< 5%
Bulk density (a):	1.6 t/m^3 topsoil, 1.5 t/m^3 subsoil
pH field (a)	5.4 in topsoil, 6.0 in subsoil
Electrical conductivity dS/m (a)	0.10 in topsoil, 0.11 in subsoil
Exchangeable sodium %(a)	0.10 in topsoil, 4.2 in subsoil
Cation exchange capacity (mequiv/100g) (a)	5.5 in topsoil, 11.4 in subsoil
Phosphorous sorption capacity mg/kg (a)	122 (1952 kg/ha) in topsoil, 447 subsoil (6705 kg/ha) in subsoil
Geological feature	
Discontinuities:	None
Fractured rock:	None
Soil landscape reference (a):	Canberra 1:100,000 (2000), Williamsdale Units – equivalent to Goulburn 1: 250,000 (1991), Barrenjack Unit
Dispersiveness EAT class (a):	3(2) topsoil, 2(1) subsoil

(a) extrapolated from Jenkins (2000) *Soil Landscapes of the Canberra 1:100,000 Sheet*. DLWC

SITE AND SOIL ASSESSMENT

Climate	Cool temperate climate with mean annual rainfall of approximately 650 mm, pan evaporation 1200 mm; large moisture deficit typically occurs in summer months, small moisture surplus typically occurs in winter months. ***Climate is well suited to dispersal by surface irrigation of secondary treated, disinfected effluent.***
Exposure	The indicative Building Areas have a high level of exposure being historically cleared for grazing with perennial grassland. Groundcover is perennial grassland. There is remnant native vegetation on the property outside the nominated building areas. ***The level of exposure within the indicative building areas is favorable for dispersal of secondary treated effluent via surface irrigation.***
Slope	The indicative building areas display a gentle slope gradients 5-10 %. ***The area proposed for the building area is not slope constrained for dwelling construction or effluent dispersal.***
Landscape/ Landform	The location of the indicative building areas has divergent slope form. This slope form is suited to the surface irrigation of treated effluent. ***The nominated building areas correspond to areas of divergent slope form which are unconstrained for dwelling construction and effluent disposal.***
Surface rock and outcrop	There are extensive areas of surface rock outcrops and associated scattered surface stone. ***Rock outcrop and surface stone is common but not a major constraint to effluent disposal within the identified building areas.***
Hydrology	The sandy to silty loam textured topsoil across the site has a moderate permeability, of 0.5 to 1.5 m/day. The clay loam to light clay subsoils have a lower permeability in the range of 0.06-0.5 m/day (from table M1 of ANZ STD 1547:2012).

Approximately 5-10% of annual rainfall forms surface runoff, although in individual high intensity storm events over 50% of rainfall may form runoff.

Rainfall that does not form surface runoff is either lost through evaporation and transpiration or infiltrates the soil. Rainfall which infiltrates soil generally drains vertically through the soil profile until it meets a less permeable subsoil layer (e.g. hard pan or clay layer), where a significant proportion drains laterally downslope as subsurface flows.

Subsurface lateral flow can exacerbate local seasonal waterlogging issues in lower parts of the landscape. Drainage in the lower parts of the landscape is inherently slower due to lower slopes. The cumulative impact of the concentration of surface water, groundwater discharge and subsurface flows in these parts of the landscape can be considerable seasonal waterlogging and salinity issues.

Development within catchments can change the hydrology by increasing the amount of compacted and non-permeable hard stand areas thereby reducing infiltration and subsurface flows. This is balanced by an increase in surface water runoff.

Hydrological factors are not a constraint to the construction of dwellings. The low number of additional dwelling lots to be created (2) and limited infrastructure required to service these lots, results in limited potential for changes to local hydrology.

Effluent disposal will need to be appropriately designed and located to minimise hydrological impacts from surface or shallow sub-surface irrigation such as effluent run-off or rapid effluent drainage through permeable soil profiles into groundwater systems. There is an adequate area of suitable soils within the nominated building areas on Lots B & C to mitigate these risks.

It is recommended that an area of suitable site and soil conditions for effluent dispersal be identified on or adjacent to the building areas nominated on the new dwelling lots in the individual Effluent System Design Report to be submitted as part of the Development Application to construct new dwelling(s).

Soils

A detailed soil profile description is provided in **Appendix 2** of this report.

Soils are mapped as the Barrenjack Creek Soil Landscape in the Goulburn 1:250,000 Sheet Soil Landscape Report (Hird, 1989). Soils are

predominantly Kandosols on the lower sloping lower hillslopes, comprising a sandy loam upper layer to around 20-40cm, overlying an earthy clay subsoil. Total soil depth ranges 40-60cm.

The representative analytical data in the survey report shows a moderate phosphorous sorption level, non-saline subsoils and low exchangeable sodium. As such the soils are free of any significant chemical limitations to effluent dispersal. The limited soil depth is a constraint to subsoil absorption.

Soils in the proposed building areas are generally unconstrained for effluent dispersal through surface irrigation. Limited soil depth is a moderate to major constraint for subsoil absorption which is not recommended for effluent disposal on the site.

The suitability of the soils within the building areas for dwelling construction should be determined by the Site Classification assessment required to support the Development Application for dwelling construction.

CONSTRAINTS ANALYSIS

SOIL EROSION

The soil types which dominate the site are a moderate to high erosion risk. Therefore, steeper slopes and areas where runoff is concentrated are highly susceptible to erosion.

Areas of erosion are constrained for the dispersal of effluent due to the potential of effluent irrigation practices to exacerbate erosion and the reduced capacity of eroded soil profiles to assimilate nutrients due to the loss of productive topsoil.

Areas of erosion also pose risk to dwelling construction due to potential instability and the undermining of dwelling foundations and associated infrastructure by erosion.

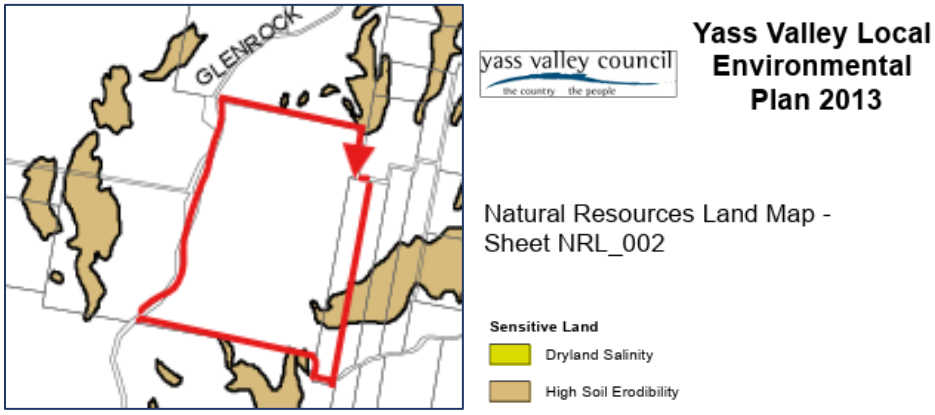

Figure 15: Yass Valley LEP Natural Resources Land Map

The indicative building areas do not include areas mapped as high soil erodibility in the Yass LEP 2013.

The are no areas mapped as constrained for effluent dispersal and/or dwelling construction due to soil erosion in the identified building areas on Lots B &C, refer **Figures 19 & 20.**

However, many of the drainage depressions on the property include areas of active sheet, rill and gully erosion. These areas of active erosion will require stock and groundcover management and/or erosion control earth works and revegetation to assist stabilisation.

RECOMMENDATIONS

- Greater than 80% groundcover be maintained across gentle to moderately sloping areas of the property (refer **Figure 19 & 20**).
- Groundcover by maintained at 100% in areas nominated for effluent irrigation.
- Erosion control measures should be implemented to address any areas of active erosion.
- Effluent disposal should not occur in areas of active erosion
- The construction of dwellings or other buildings or infrastructure should not occur in areas of active erosion.

SALINITY

Dryland salinity is a significant issue across many parts of the Yass Valley Council area and is related to changed landscape hydrology, climate, geology, soils and land management.

Salinity impacts grazing and crop production, water quality and contributes to increased erosion which in turn further reduces production and water quality.

It is caused by changed land use, including clearing of native perennial deep-rooted vegetation and agricultural land management activities, resulting in increased accessions (recharge) to groundwater tables from rainfall. This results in groundwater tables rising and bringing salts which are contained in geology and subsoil stores into the root zone of vegetation impacting growth and production. In certain parts of the landscape groundwater tables may discharge on the surface in what are called discharge sites. These are particularly vulnerable to reduced vegetative growth and can eventually deteriorate until they are denuded of groundcover and become saline scalds. Once bare, these sites are prone to erosion, particularly given they often coincide with drainage lines and areas of overland flow.

Salinity management often involves the reinstatement of deep-rooted perennial vegetation in recharging parts of the landscape in conjunction with reinstating or maintaining good groundcover on saline discharge areas to prevent erosion.

There is no area of mapped salinity within the building areas proposed Lots B & C. Refer **Figure 15**.

There were no areas of salinity affected land identified during the site inspection.

The elevated areas of the property are considered to be recharge areas where rainfall enters the soil and drains to join the groundwater system which drives the dryland salinity issue which expresses on the surface as waterlogging and saline scalds.

RECOMMENDATIONS

- The area of deep-rooted perennial species should be maintained across the property including retaining existing trees and shrubs.

GROUNDWATER

The site is mapped as low groundwater vulnerability on the Department of Land and Water Conservation (2001) Groundwater Vulnerability Map of the Murrumbidgee Catchment.

No part of the property is mapped on the Yass Valley LEP 2013 Groundwater Vulnerability Map, see **Figure 16** below.

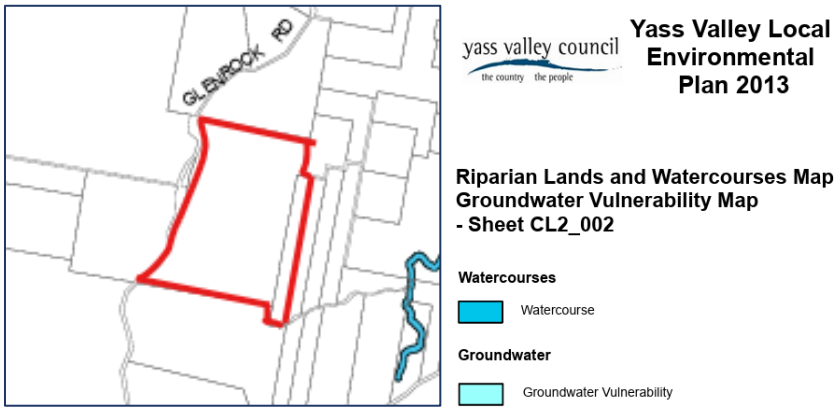

Figure 16: Yass Valley Environmental Plan 2013 - Groundwater

Figure 17: Bores https://realtimedata.waternsw.com.au/water.stm

There are no bores within 500m of either indicative building areas, refer **Figure 17**. The closest bore is GW007745 which is approx. 2.6km west of the indicative Building Areas. This bore is 17.6 metres deep with no further information.

The risk of contamination or any other adverse impacts to quantity and quality of groundwater available for other users resulting from the on-site effluent dispersal practices related to the development, are limited due to:

- horizontal separation of >2km,
- vertical separation of greater than 17 metres to water bearing zones level in the nearest bore,
- relatively low application rate of secondary treated disinfected effluent,
- application of high-quality effluent to the surface through irrigation maximizing evapotranspiration and minimising opportunity for deep drainage,
- low number of additional dwelling lots (2),
- recommended measures available to mitigate impacts (as detailed below).

RECOMMENDATIONS

- Maintain a minimum 250m buffer between any future bores and the effluent dispersal areas associated with the proposed building areas.
- Require a water supply work approval to be sought prior to constructing a bore or well.

RIPARIAN LANDS

The indicative building areas on Lots B & C do not include any mapped watercourses on the Riparian Lands and Watercourses Map-Sheet CL2_005 (refer **Figure 16**).

The property does contain an extensive network of minor drainage depressions including 1st, 2nd and 3rd order streams NSW DPI Office of Water (Guidelines for riparian corridors on waterfront land) defines the riparian corridors required for different stream orders, to maintain the integrity of these sensitive riparian areas, refer **Figures 18 & 20.**

Figure 2. The Strahler System

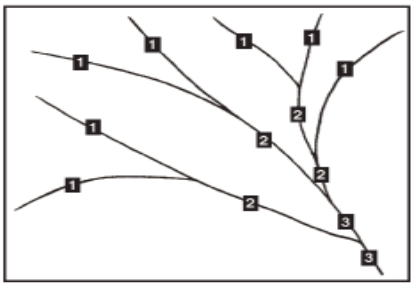

Table 1. Recommended riparian corridor (RC) widths

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1st order	10 metres	20 m + channel width
2nd order	20 metres	40 m + channel width
3rd order	30 metres	60 m + channel width
4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

Figure 18: Stream ordering and riparian corridor widths (NSW DPI Water Guidelines)

Construction of dwellings and associated infrastructure within the required riparian corridors is inconsistent with guidelines for good riparian management.

The building areas nominated on Lots B & C are not located within the buffers required from the adjacent 1st and 2nd Order Streams. The access roads to the proposed building areas on Lots A & B cross 1st and 2nd Order streams.

The existing dwelling on Lot A is partially within the riparian corridor of the adjacent 3rd Order Stream.

RECOMMENDATIONS

- No dwelling or related infrastructure construction is to occur within the 10m/20m buffer from 1st/ 2nd or higher Order Streams respectively (mapped in **Figure 15**).

- Any watercourse crossings of 1st and/or 2nd Order Streams should be designed in accordance with NRAR guidelines and necessary approvals.
- Should the existing dwelling be replaced with a new dwelling consideration should be given to locating any future dwelling outside the riparian corridor.

DRAINAGE BUFFERS – EFFLUENT DISPERSAL

The *ANZ Standard 1547:2012 On-site Domestic Wastewater Management and Onsite Wastewater Management Guidelines (April 2025) Department of Planning, Housing and Infrastructure, Office of Local Government*, require appropriate buffers between drainage depressions, creeks and rivers and effluent dispersal areas. These include a 100metre buffer from permanent surface waters including rivers, streams and major creeks, and a 40m buffer from any other water including intermittent waterways, dams and drainage channels.

The property includes an extensive network of minor drainage depressions and 1st, 2nd and 3rd order streams including some small farm dams. All of these drainage features require buffers from effluent disposal practices.

Approximate locations for drainage buffers are shown in **Figure 19**. The nominated building areas on Lots B & C are located outside these buffers.

These buffers do not present a constraint to dwelling construction.

The effluent disposal practices associated with the existing dwelling on Lot A are located within buffer required from the adjacent watercourse (3rd Order Stream).

RECOMMENDATIONS

- No effluent disposal is to occur within the 40m buffers from minor drainage depressions, dams or the 1st and 2nd Order Streams as mapped in **Figure 19**.
- No effluent disposal is to occur within the 100m buffers from watercourses (3rd Order Streams) as mapped in **Figure 19**.
- The area of land designated for effluent dispersal on Lots B & C should be nominated outside the areas mapped as constrained in **Figure 19,** in the lot specific *site and soil assessment for on-site effluent management* required at the time of submitting building plans to Council for the construction of new dwellings on Lots B & C.

- The buffers required between effluent dispersal practices and drainage depressions and dams do not apply to dwellings or other built infrastructure.
- Should the effluent management system servicing the existing dwelling be upgraded or replaced, consideration should be given to locating any future system outside the buffer required from the adjacent watercourse.

MANAGEMENT OF EFFLUENT

Summary This report assesses the general availability of an adequately sized area of land within and adjacent to the proposed new building areas identified on Lots B & C.

A minimum area of 1500 m^2 has been used as the benchmark for the area required for the effluent dispersal. The minimum effluent disposal area is based on an irrigation area for a six-bedroom dwelling being around 520 m^2 plus an allowance for an equal size reserve area. The location of future buildings, paths, tanks, pools and other infrastructure will also need to allow for the required buffers from the nominated effluent disposal areas within the building areas.

Key constraints to effluent dispersal on the lot are dam and drainage depression buffers of 40m on Lots B & C.

The proposed building areas on Lots B & C have adequate areas of adjacent land suited to effluent dispersal and an adequate remaining area that is available for the construction of dwellings and associated infrastructure, including an allowance for the necessary buffers between these features, refer **Figures 19 & 20**.

The most widely used form of effluent treatment on relatively unconstrained rural residential developments in the region is a NSW Health accredited aerated wastewater system, with the secondary treated, disinfected effluent irrigated onto the surface. Reliability and maintenance issues with such systems are well known and the risk of failure is relatively low.

There are a number of more innovative options for effluent treatment and disposal. The most promising of these is the Wisconsin sand mound, of which there are a small number in the region. These systems have a small footprint, (less than 150m^2), have a high degree of reliability and have a low energy requirement. There is however a lack of experienced installers for such systems in the region and the climate presents some issues in terms of maintaining grass cover through hot dry summers if effluent is not being regularly loaded into the mound. This is generally only an issue if the attached dwelling is not permanently or fully occupied.

In general, the area is not suited to the subsoil absorption of primary treated effluent due to the limited soil depth available across the building areas on Lots B & C. As a result, both subsoil absorption and evapotranspiration/absorption beds for primary treated effluent are not recommended for the site.

The use of subsoil irrigation beds for dispersal of wet composting closet treatment systems (eg worm farms) are also considered unsuited to the site.

The following section addresses the specific requirements for a number of suitable effluent management options in order to show that on-site effluent can be achieved sustainably on the subdivision.

This report assumes that a detailed planning for effluent management will occur at the time of submitting building plans to council. At this stage the exact location, footprint, occupancy and usage patterns of the proposed dwelling will be known. These are all critical elements of the final design process which cannot be addressed by this report.

Secondary treatment system and surface irrigation

NSW Health accredited systems treat effluent to a minimum secondary standard, suitable for disposal by surface or subsurface irrigation (see list at http://www.health.nsw.gov.au/PublicHealth/environment/water/wastewater.asp). This includes aerated wastewater treatment systems (AWTS), sand and textile filters and biological filters.

The sizing of the effluent irrigation area is based on nutrient balance which gives a general guide to a sustainable area required for irrigation.

It is preferable that effluent irrigation systems be fixed installations. Surface spray irrigation systems can be significantly improved by having at least two or three lines of sprinklers on risers attached to rigid supports, 30-50cm above ground level, with each riser tied into the delivery line. A manual valve on each line allows all or some of the lines to be used. The buried distribution lines with risers minimises the risk of damage by mowing and encourages the irrigation area to be better managed than current practice.

The size of the area required for effluent irrigation will vary according to the number of bedrooms in the dwelling, which determines the design effluent loading. Based on the hydraulic and nutrient balance shown in **Appendix 3**, the sizing of the irrigation area is shown below:

Three bedrooms	300m^2
Four bedrooms	370m^2
Five bedrooms	450m^2
Six bedrooms	520m^2

Council also requires adequate suitable land for a reserve effluent dispersal area. Additionally, buffers of 15m are required from dwellings (for surface spray), 6m from downslope buildings, property boundaries and driveways and 3m if these features are located upslope. A 40-metre buffer is required between effluent disposal practices and any minor drainage depressions and dams, and a 100-metre buffer from watercourses, refer to the buffer assessment **Table 4-4**.

Primary treatment and subsoil absorption

Generally, not suitable due to shallow soils and dryland salinity

Innovative effluent management systems

A Wisconsin mound pump dosed from a septic tank may be suited to the site and soil conditions. Mound design would need to be developed on a site-by-site basis, including a soil profile at the mound site. Indicatively, based on the soil profiles for this assessment, the Basal Loading Rate would be 16mm/day and Linear Loading rate 47mm/day. The footprint would be slightly less than 150m^2 on a flat or gently sloping site.

Effluent management

RECOMMENDATIONS

- A lot specific *site and soil assessment for on-site effluent management* will be required at the time of submitting building plans to Council for the new dwelling entitlement on Lots B & C and the prescriptions of this report should be applied to the design process of the lot.
- The effluent dispersal system should be located within or adjacent to the nominated building area, refer **Figure 19**.
- Buffers to be applied to effluent dispersal areas will include:
  - 40 m from all dams and drainage depressions
  - 100 m from any existing or future upslope bores
  - 250 m from future bores
  - 15 m from dwellings (for surface spray irrigation)
  - 6 m from property/lot boundaries (3 m if these are upslope)
  - 6 m from buildings and driveways (3 m if these are upslope)

- The effluent management system suitable for the lot include an aerated wastewater treatment system (including disinfection) with NSW Health accreditation, dispersing effluent to a designated effluent surface or shallow subsurface irrigation area. The irrigation area size should be based on potential occupancy derived from bedroom number.
- As a guide, the following areas would be appropriate for the soil and site conditions of the site:
  - Three bedrooms.....300m^2
  - Four bedrooms.....370m^2
  - Five bedrooms.....450m^2
  - Six bedrooms.....520m^2
- To ensure effective distribution of treated effluent, and provide protection of irrigation lines, the minimum requirement for irrigation dispersal should be buried distribution lines with decoupling sprinkler heads. There should be a minimum of two runs of distribution lines connected by a manual valve to allow for alternating dispersal areas.
- More innovative systems such as a Wisconsin sand mound treating primary effluent from a septic tank, or a recirculating sand filter with a subsurface irrigation field, are also suitable.
- A subsoil absorption bed receiving primary treated effluent is generally not considered suitable for the site.

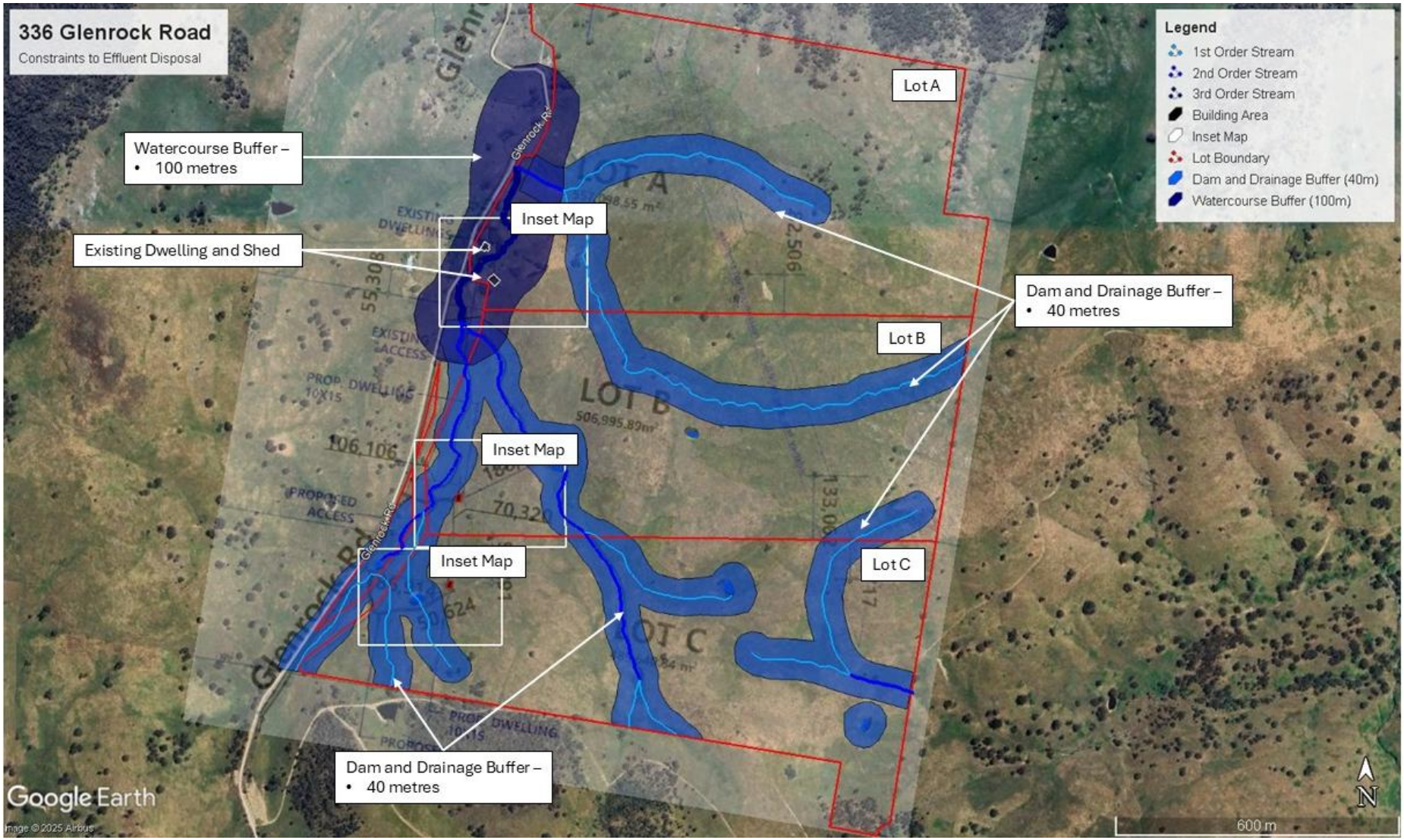

Figure 19a: Subdivision layout and constraints to effluent dispersal.

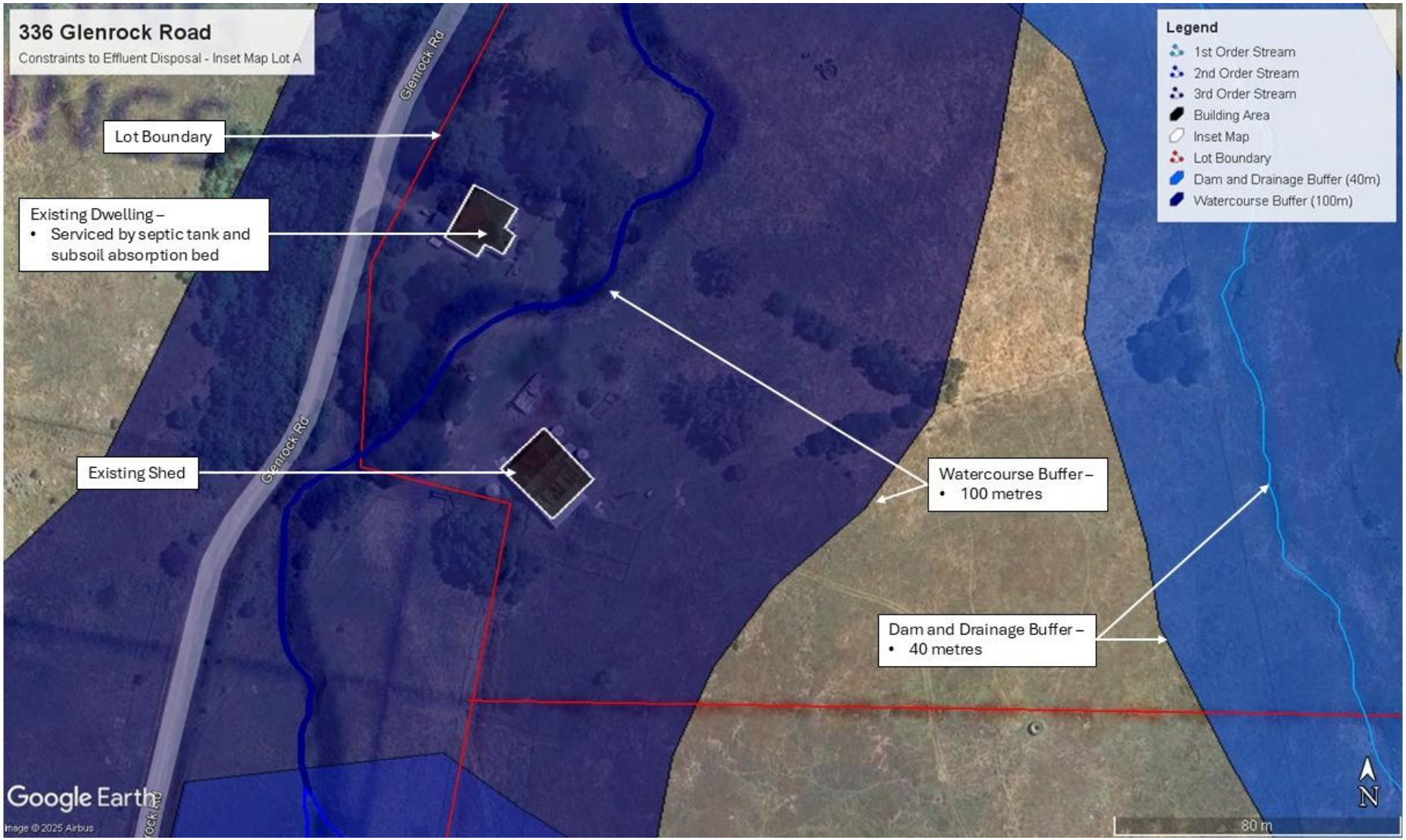

Figure 19b: Lot A constraints to effluent dispersal.

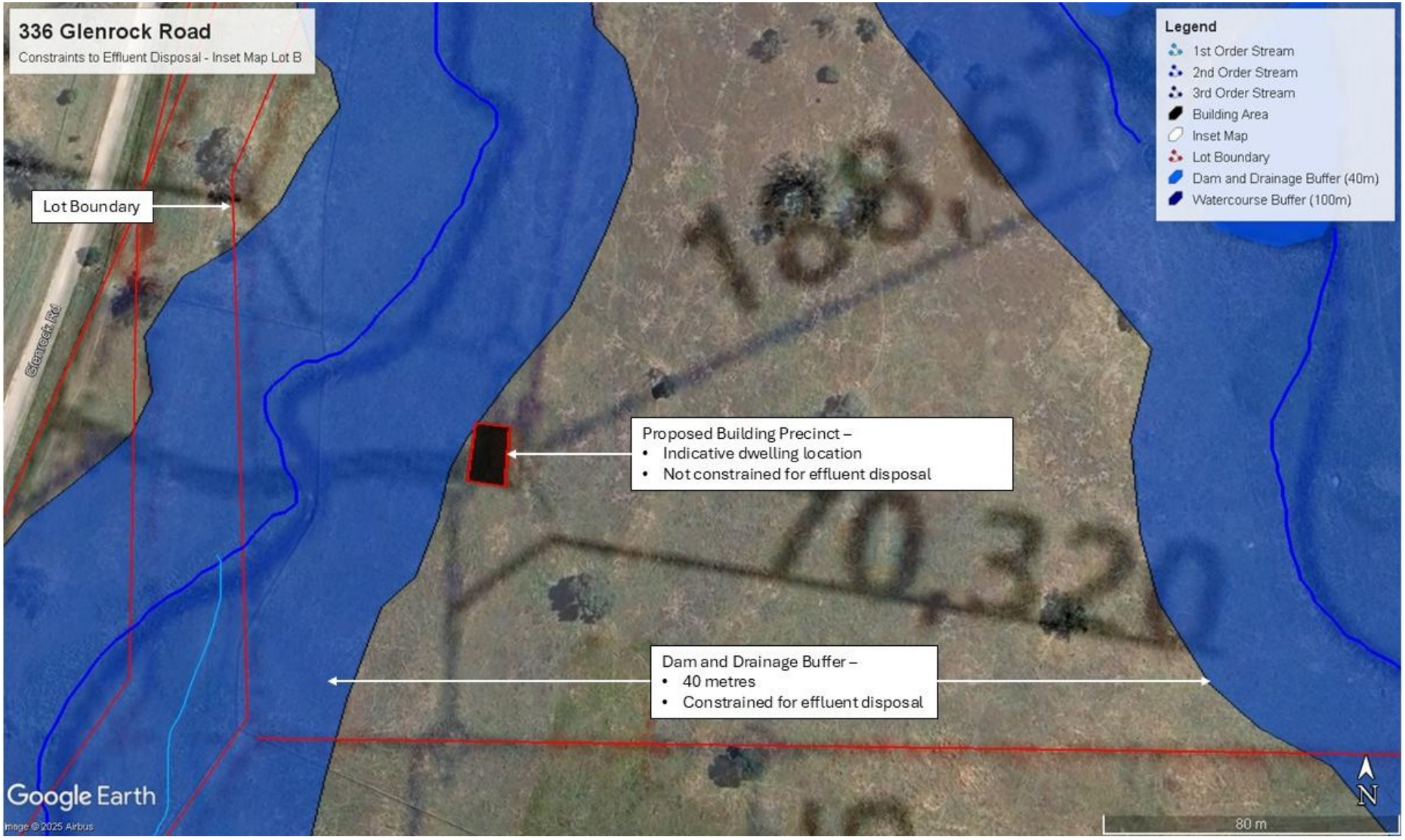

Figure 19c: Lot B constraints to effluent dispersal.

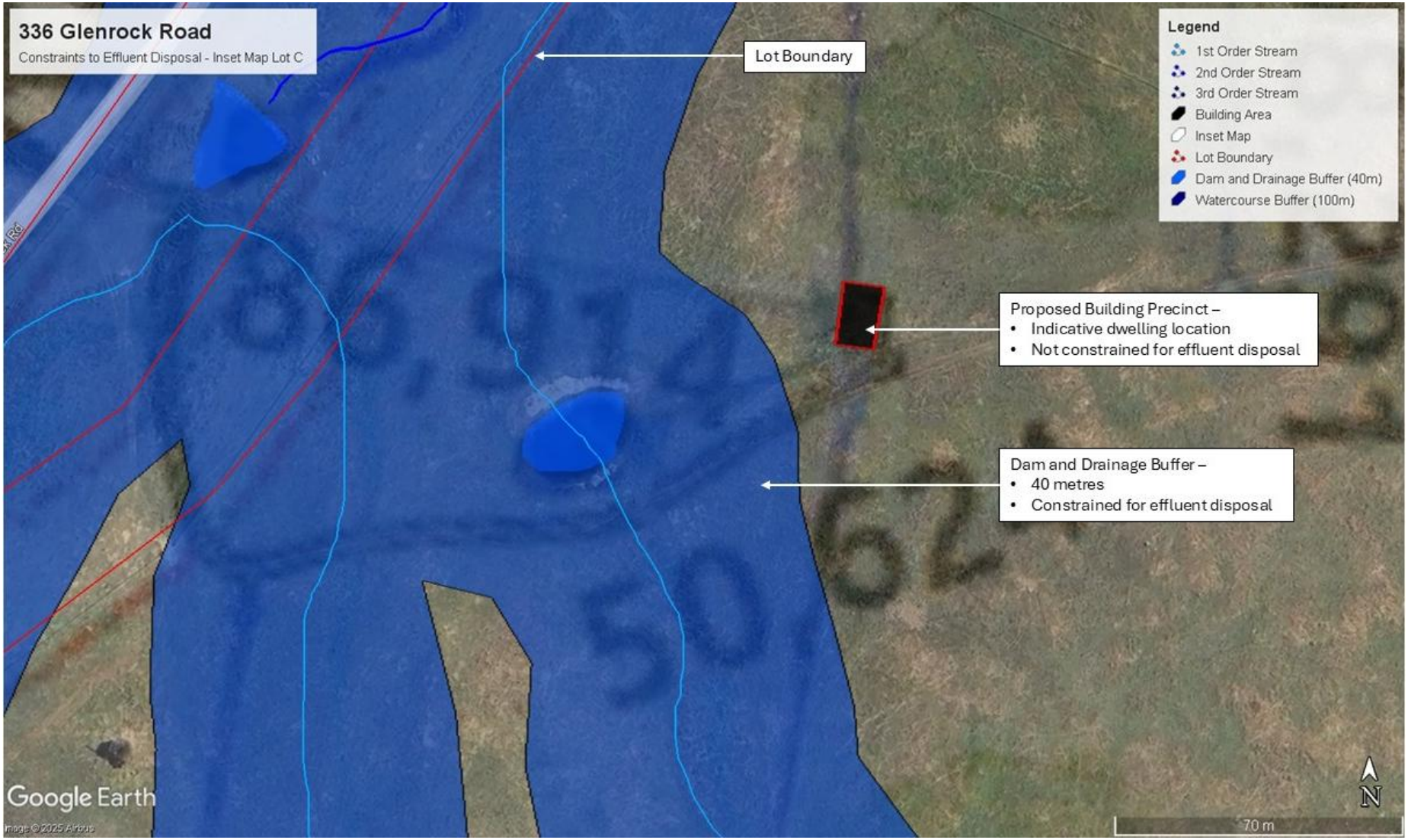

Figure 19d: Lot C constraints to effluent dispersal.

CAPABILITY FOR DWELLING CONSTRUCTION

Summary

Land considered unsuitable or constrained for the construction of dwellings generally consists of areas with the following attributes:

- a slope grade of 15% - the threshold is consistent with many building codes and Council requirements and also corresponds to the slope above which erosion hazard significantly increases (Landcom, 2004),
- seasonally waterlogged or flood prone land - including the minor flow lines which drain the site and dams,
- unsuitable soils – including highly erodible dispersive soils, low wet bearing strength soils and unstable soils prone to movement,
- areas within riparian corridors consistent with NSW DPI Office of Water Guidelines for riparian zone management, refer **Figure 20**.

The 40m buffer on minor drainage lines, 100m buffer from watercourses, and the 40m buffer from dams required for effluent disposal areas, do not apply to dwelling construction.

The building areas nominated on Lots B & C are generally unconstrained for dwelling construction. The access tracks on Lots B & C cross riparian corridors and may require approval for the construction of creek crossings.

Dwelling construction

Recommendation

- Building areas will be restricted to land within the nominated building areas which are shown in this report as unconstrained, refer **Figure 20**.
- A Site Classification shall be conducted prior to the construction of dwelling on Lots B & C which confirms the suitability of soil within the building area for construction.
- A Controlled Activity Approval (CAA) should be sought for the construction of access track crossings on 1st/2nd Order Streams.

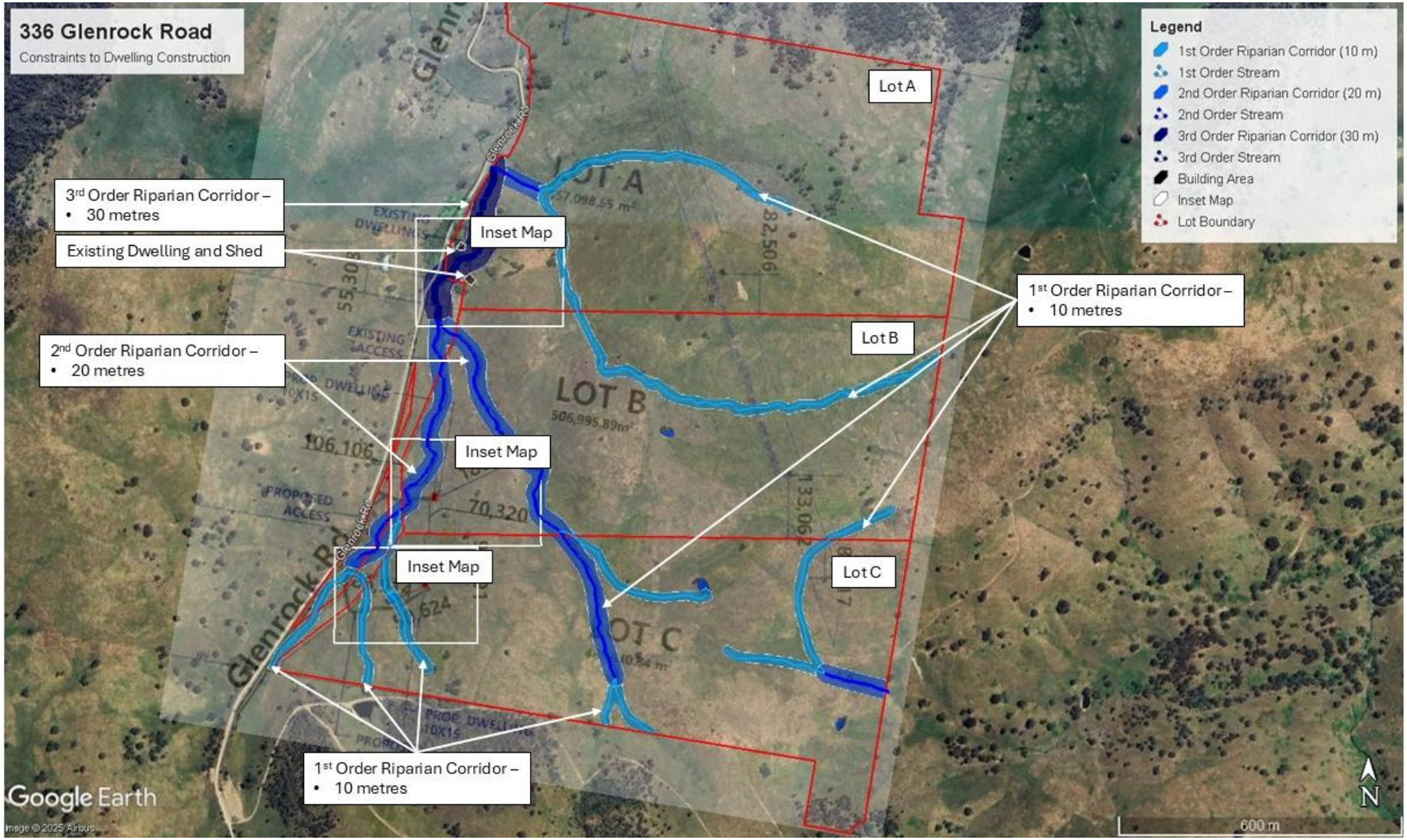

Figure 20a: Subdivision layout and constraints to dwelling construction.

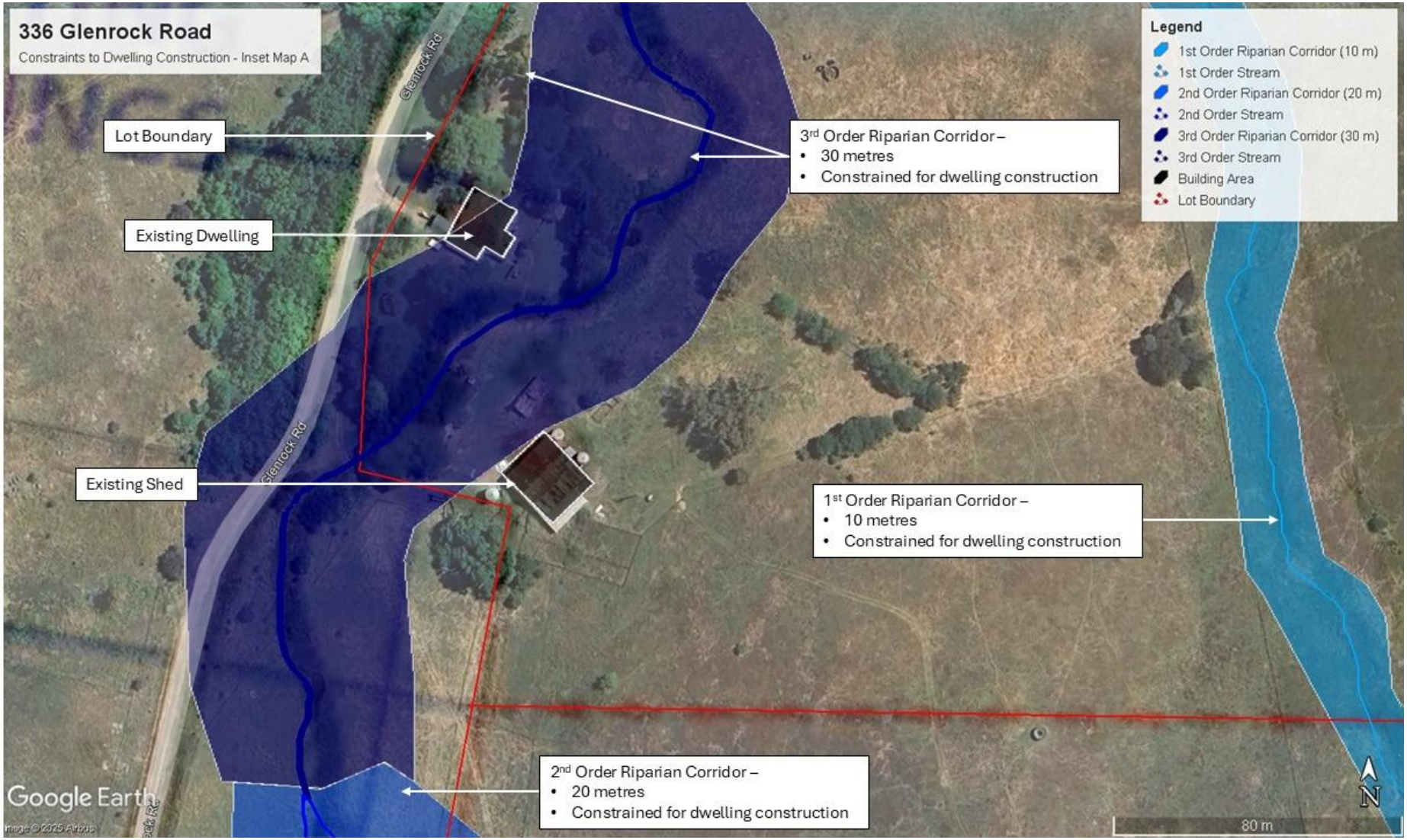

Figure 20b: Lot A constraints to dwelling construction.

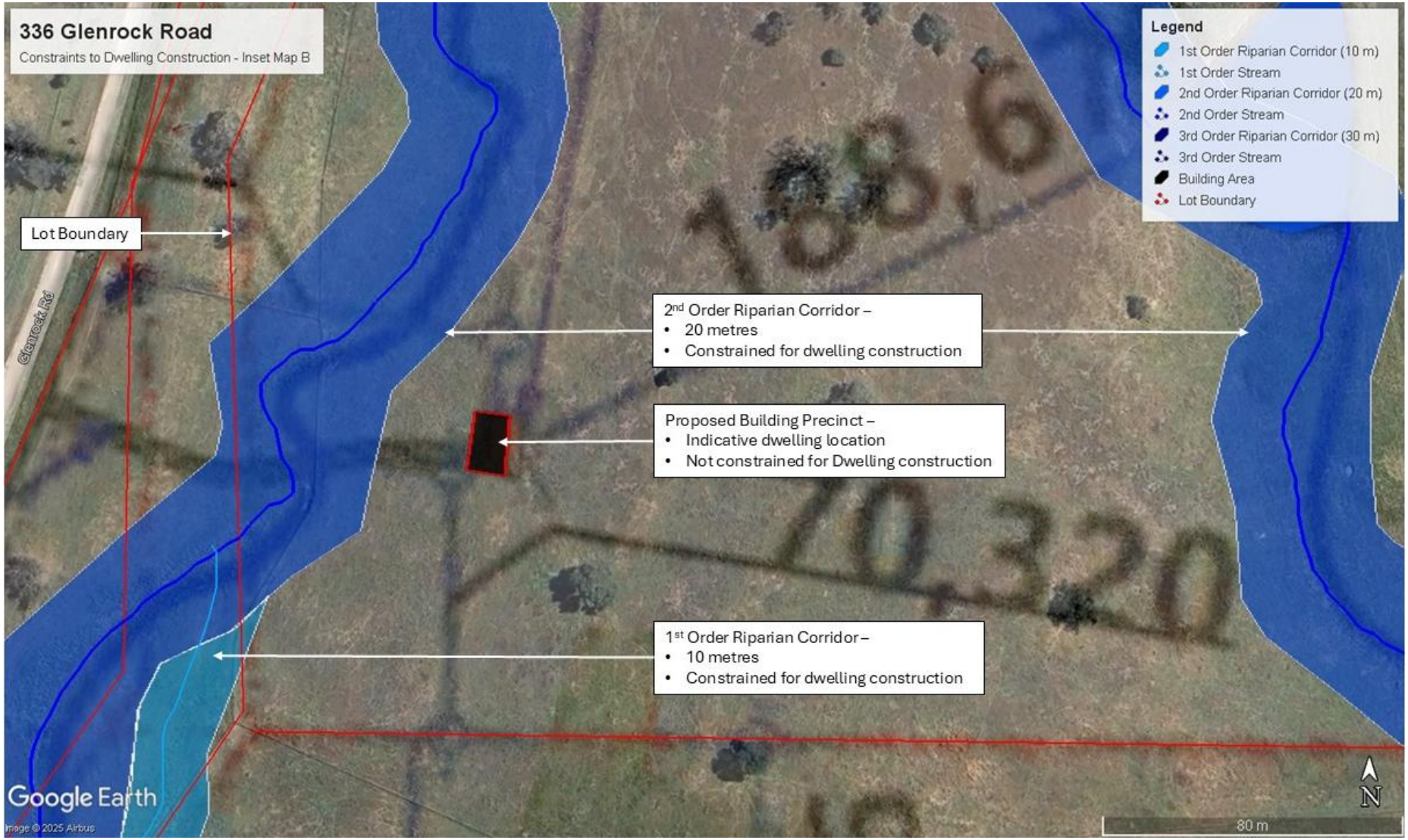

Figure 20c: Lot B constraints to dwelling construction.

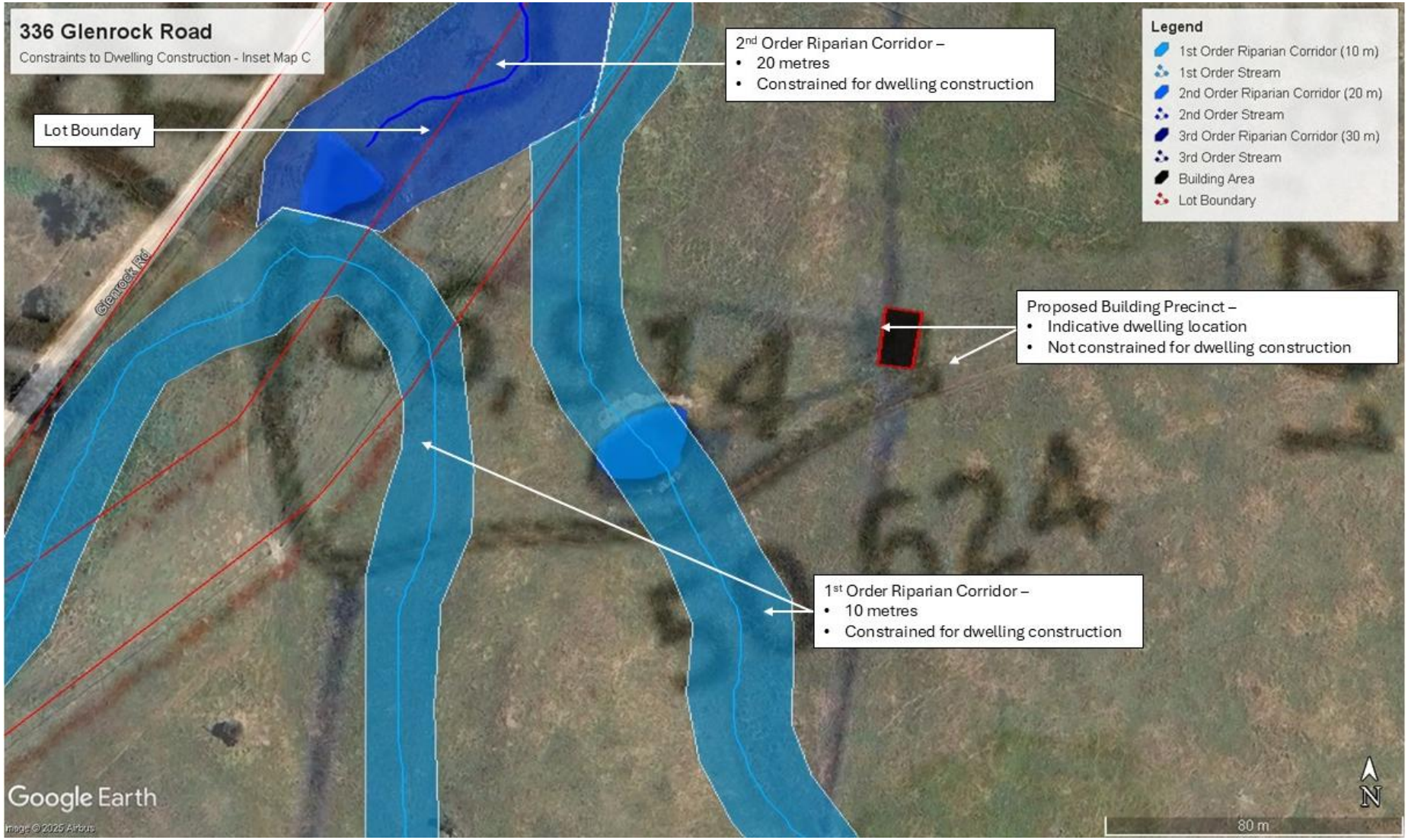

Figure 20d: Lot C constraints to dwelling construction.

APPENDIX 1: SITE AND SOIL LIMITATION ASSESSMENT

The following two limitation tables are a standardised guide to the site and soil characteristics which may limit the suitability of the site for effluent disposal and which would require attention through specific management practices. The tables have been reproduced from *On-site Sewage Management for Single Households* (tables 4 and 6, Anon, 1998). The highlighted categories represent site and soil conditions of the land covered in this report. The tables show that the land designated for effluent application has slight to moderate limitations, but no severe limitations.

Site limitation assessment

Site feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Flood potential	All land application systems	> 1 in 20 yrs.		Frequent, below 1 in 20 yrs	Transport in wastewater off site
	All treatment systems	components above 1 in 100 yrs.		Components below 1 in 100 yrs.	Transport in wastewater off site, system failure
Exposure	All land application systems	High sun and wind exposure		Low sun and wind exposure	Poor evapo-transpiration
Slope %	Surface irrigation	0-6	6-12	>12	Runoff, erosion potential
	Sub-surface irrigation	0-10	10-20	>20	Runoff, erosion potential
	Absorption	0-10	10-20	>20	Runoff, erosion potential
Landform	All systems	Hillcrests, convex side slopes and plains	Concave side slopes and foot slopes	Drainage plains and incised channels	Groundwater pollution hazard, resurfacing hazard
Run-on and seepage	All land application systems	None-low	Moderate	High, diversion not practical	Transport of wastewater off site

Site feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Erosion potential	All land application systems	No sign of erosion potential	Minor stabilized sheet and gully erosion	Indications of erosion e.g. rills, mass failure	Soil degradation and off-site impact
Site drainage	All land application systems	No visible signs of surface dampness		Visible signs of surface dampness	Groundwater pollution hazard, resurfacing hazard
Fill	All systems	No fill	Fill present		Subsidence
Land area	All systems	Area available		Area not available	Health and pollution risk
Rock and rock outcrop	All land application systems	<10%	10-20%	>20%	Limits system performance
Geology	All land application systems	None	Small areas of isoclinal fractured regolith outcrop	Major geological discontinuities, fractured or highly porous regolith	Groundwater pollution hazard

Soil limitation assessment

Soil feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Depth to bedrock	Surface and sub surface irrigation	> 1.0	.5-1.0	< 0.5	Restricts plant growth
or hardpan (m)	Absorption	> 1.5	1.0-1.5	< 1.0	Groundwater pollution hazard
Depth to seasonal water table (m)	Surface and sub surface irrigation	> 1.0	0.5-1.0	< 0.5	Groundwater pollution hazard
	Absorption	> 1.5	1.0-1.5	< 1.0	Groundwater pollution hazard
Permeability	Surface and sub surface irrigation	2b, 3 and 4	2a, 5	1 and 6	Excessive runoff and waterlogging
Class	Absorption	3, 4		1, 2, 5, 6	Percolation
Coarse fragments %	All systems	0-20	20-45	>40	Restricts plant growth, affects trench installation
Bulk density (g/cc) **SL** **L, CL** **C**	All land application systems	 < 1.8 < 1.6 < 1.4		 > 1.8 > 1.6 >1.4	restricts plant growth, indicator of permeability
pH	All land application systems	> 6.0	4.5-6.0	-	Reduces plant growth
Electrical conductivity (dS/m)	All land application systems	<4	4-8	>8	Restricts plant growth

Soil feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Sodicity (ESP)	Irrigation 0-40cm; absorption 0-1.2mtr	0-5	5-10	> 10	Potential for structural degradation
CEC mequiv/100g	Irrigation systems	> 15	5-15	< 5	Nutrient leaching
P sorption kg/ha	All land application systems	> 6000	2000-6000	< 2000	Capacity to immobilise P
Aggregate stability	All land application systems	Classes 3-8	class 2	class1	Erosion hazard

APPENDIX 2: SOIL PROFILE DESCRIPTIONS

Soil Profile 1: Lot B – effluent dispersal area

Soil classification	Depth (cm)	Properties
CHROMOSOL	0-15	A1 Brown silty loam, moist and friable consistency, massive to weak structure, no coarse fragments.
	15-25	A2 Bleached grey silty loam, moist & friable, massive to weak structure, no coarse fragments.
	25-60	B Orange grey silty clay loam, moist & firm, moderate structure, <5% coarse.

Figure 21: Soil profile – Lot B effluent dispersal area.
NB: Soil profiles are presented as expanded profiles (expansion factor approximately X2)

Soil Profile 1: Lot C – effluent dispersal area

Soil classification	Depth (cm)	Properties
TENOSOL	0-50	A1 Silty clay loam, moist and friable consistency, massive to weak structure, no coarse fragments. Terminates in rocky colluvial material.

Figure 22: Soil profile – Lot C effluent dispersal area.
NB: Soil profiles are presented as expanded profiles (expansion factor approximately X2)

APPENDIX 3: EFFLUENT AREA DESIGN

Using the DIR for irrigation on clay loam soils of 3.5 mm/day and adopting the design loading of 480 L/day, the following land application areas are required to manage additional hydraulic loading, nitrogen and phosphorous generated:

Water balance

- **Sizing based on hydraulic loading:**

A = Q (l/day)/DIR (mm/day)
where A = area; Q = 480 l/day; DIR = 3.5 mm/day
A = 480/3.5 = 137 m^2
Area required = 150 m^2

Nitrogen balance

- **Sizing based on nitrogen balance:**

A = Q(l/day) X TN (mg/l)/L_n (critical loading of TN, mg/m^2/day)
where A = area; Q = 480 l/day; TN = 25mg/l (from Silver Book)
Assume 20% loss by denitrification; 25mg/l – (25 X .2) = 20mg/l
L_n = 15,000mg/m^2/yr (ie 150kg/ha/yr, for introduced species)
A = 480 X 20 X 365/15,000 = 234m^2
Area required = 250 m^2

Phosphorous balance

- **Sizing based on phosphorous balance**

A = P_{gen}/(P_{uptake} + P_{sorb}) [P sorption capacity in upper 50cm & 50 year design period]
P_{gen} = 10mg/l X 480 X 365 X 50 = 87.6kg
P_{uptake} = 4.4mg/m^2/day X 365 X 50 = .080kg/m^2
P_{sorb} = 2,164kg/ha = .216kg/m^2
A = 87.6/(.08+ .216) = 296 m^2
Area required = 300 m^2

Design effluent disposal area

Therefore, a land application area of **300 m^2** will account for phosphorous, nitrogen and water applied based on estimated connections and usage patterns associated with the construction of a 3-bedroom house.
An allowance of a reserve land application area will double this area to **600m^2**.

Alternative Dwellings

The size of the effluent irrigation area required to service dwellings with 4, 5 & 6 bedrooms are provided below:

- 4 bedrooms – 370 m^2
- 5 bedrooms – 450 m^2
- 6 bedrooms – 520 m^2

SOILANDWATER

www.soilandwater.net.au