Broadcrest Environmental Pty Ltd

253 Bundabah Road, Bundabah

On-Site Wastewater Report

February 2025

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DOCUMENT CONTROL

Approval and Authorisation

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Signed:	
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1 INTRODUCTION

1.1 Foreword

An On-Site Wastewater Report is a technical document which specifies how the sewage produced on-site will be managed, treated, and then disposed. An On-Site Wastewater Report considers the environment, health, cost, and long-term management options for the on-site management of sewage.

1.2 Background

Broadcrest Pty. Ltd. was engaged by Tea Garden Farms Pty Ltd c/- HWL Ebsworth Lawyers to produce an On-Site Wastewater Management Report at 253 Bundabah Road, Bundabah (the site). The report will accompany plans for a Proposed Subdivision. A site inspection was carried out on 31 October 2024 which involved a visual assessment of the site and soil sampling. The assessment of the results, system design and recommendations are detailed in this report.

1.3 Objectives

The performance objectives of the On-Site Wastewater Assessment are to:

- Protect human health
- Protect ground and surface water
- Maintain and enhance the quality of the land and vegetation
- Maintain and enhance community amenity
- Ensure maximum re-use of resources
- Promote an ecologically sustainable development.

1.4 Scope of Works

The scope of works included the following:

- A site inspection
- Soil sampling and analysis
- Wastewater management assessment
- Drafting of the proposed system
- Reporting in accordance with the associated legislations and guidelines.

1.5 Compliance

This report has been produced in accordance with the following guiding documents:

- MidCoast Council 2020, MidCoast Council On-Site Sewage Development Assessment Framework (DAF)
- MidCoast Council 2023, On-Site Wastewater Management Strategy
- DLG 1998, On-site Sewerage Management for Single Households
- SCA 2012, Designing and Installing On-Site Wastewater Systems
- Australian Standard AS 1546.1-3:2008 On-site domestic wastewater treatment units
- Australian Standard AS 1547:2012 On-site domestic wastewater management.

1.6 Proposed development

The investigation was conducted as part of due diligence for a proposed subdivision of land into nine (9) rural-residential lots with linked private road access.

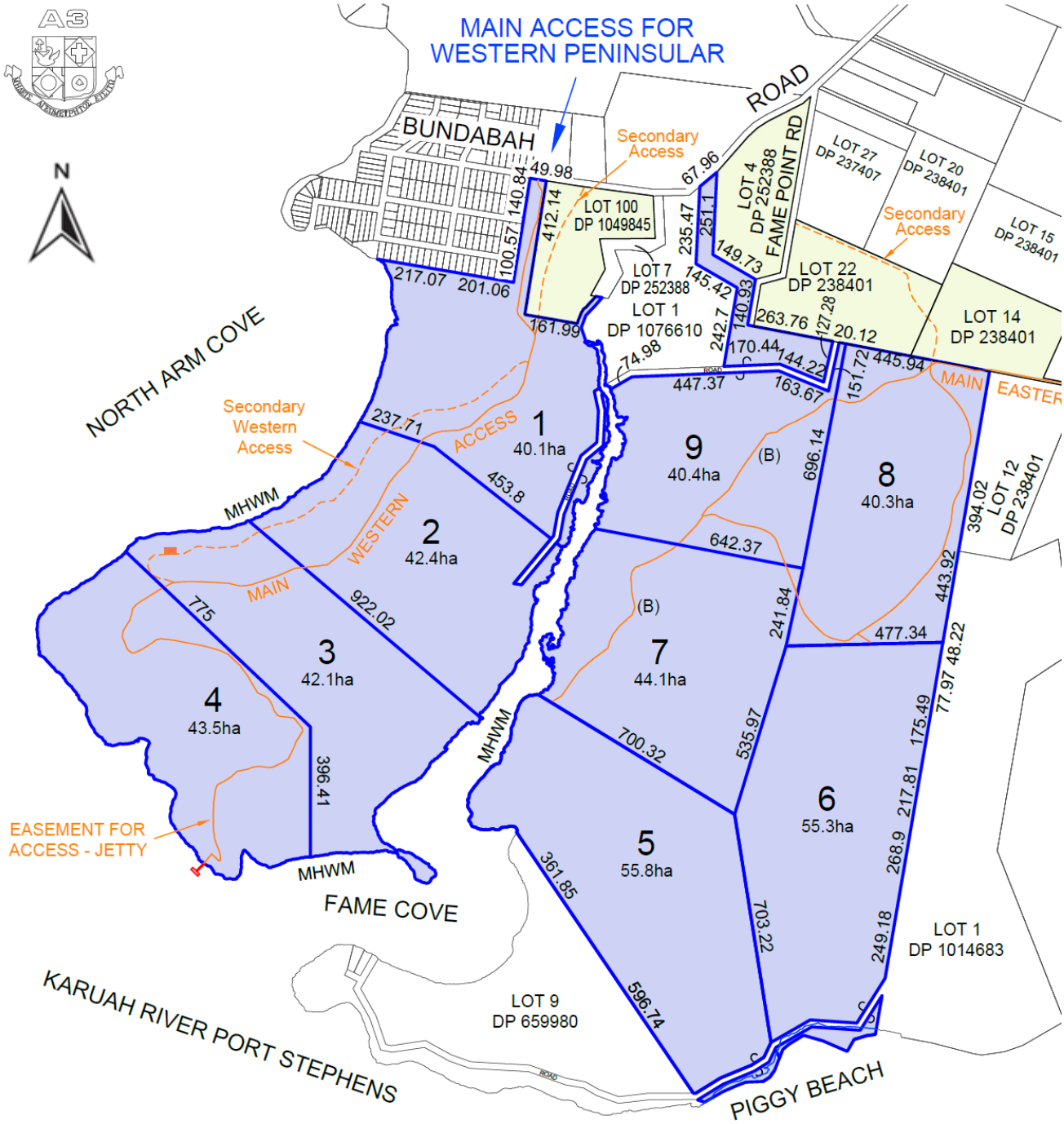


Figure -1 Proposed Plan of Subdivision

2 SITE ASSESSMENT & INVESTIGATION

2.1 Site Information

Address / Locality	253 Bundabah Road, Bundabah
Lot Area:	Lot 100 / DP 1049845: 10.16 Ha Lot 101 / DP 1049845: 62.24 Ha Lot 103 / DP 1049845: 131.61 Ha Lot 104 / DP 1049845: 104.41 Ha Lot 2 / DP1076610: 105.77 Ha Total: ≈ 430.03 Ha
Zoning:	RU2 – Rural Landscape
Council / LGA:	MidCoast Council
Intended Water Supply:	Tank Water
Inspection Officer:	C. Hudson - 31/10/2024

2.2 General

At the time of inspection, the site was largely undeveloped, consisting of heavily vegetated bushland dissected by earth or crushed sandstone meandering access roads. Accessibility to much of the site was limited by dense native vegetation and / or difficult terrain.

The landform consisted of undulating rises and hills with radial drainage - primarily towards Fame Cove or North Arm Cove to the south and east of the site respectively. There are numerous drainage depressions across the property and several small dams which have been avoided for the purposes of effluent management.

The site is proposed for subdivision consisting of nine (9) rural-residential lots. For the purpose sizing and designing effluent management areas (EMAs), it has been assumed that each lot will be developed with five (5) bedroom dwellings. It has been assumed that effluent will be treated to a secondary standard via a newly installed AWTS units (subject to separate development applications). The proposed dispersal method consists of sub-surface drip irrigation in all instances.

Wherever possible, suitable effluent management areas (EMAs) have been located within proposed Asset Protection Zones (APZ) - which will require clearing and thinning of forest or forest regrowth, improving exposure to sun and wind. However, in some circumstances, EMAs have had to be positioned further from the home site to avoid difficult terrain and / or localised rock outcropping. Indicative site photos have been provided in Figures 2-1 to 2-7.

It is noted that a home site has already been Development Approved on proposed Lot 3 and as such, it has not been assessed. It is also noted that access to the proposed home site on Lot 6 was not possible on the day, so some assumptions have been made. Due to similiarty in

landscape, Lot 6 has been presumed to be most similar to Lot 8 and all calculations have taken this into consideration. Targetted assessment should be undertaken for clarification during individual lot development.

Figure 2-1: Approximate Location of EMA 1

Figure 2-2 Approximate Location of EMA 2

Figure 2-3 Approximate Location of EMA 4

Figure 2-4 Approximate Location of EMA 5

Figure 2-5 Approximate Location of EMA 7

Figure 2-6 Approximate Location EMA 8

Figure 2-7 Approximate Location of EMA 9

2.3 Assessment Methodology

The assessment methodology of this report follows that prescribed in DLG (1998), whereby the restriction imposed by a site/soil features are categorised by severity, and their impact forms the basis for subsequent system selection, design, and recommendations (Table 2.3.1).

Table 2.3.1 - Site / soil limitation assigned per DLG (1998)

Limitation	Description
Minor	This feature has been assessed and deemed to pose no obstacle to OSSM, given the recommended system and measures are implemented.
Moderate	This feature requires consideration. It may typically be overcome by site modifications or by appropriate selection, design and sizing of treatment / application systems.
Major	This feature precludes the use of a given treatment, land application method, or Effluent Management Area (EMA). Particular Major Limitations may prevent OSSM entirely, require an off-site management approach, or re-evaluation of the development scope.

2.4 Site Assessment Summary

A summary of limitations pertinent to the suitability of the site for On-Site Sewerage Management (OSSM) is provided in Table 2.4.1 below.

Table 2.4.1 – Assessment summary of site features

Factor Assessed	Description	Limitation
Hazard Classification	Site is classified as Med - High Hazard per MidCoast Council Development Application Framework (DAF). Comprehensive and highly detailed engineering & environment evaluation has been undertaken to ensure compliance with MidCoast Council DAF.	Moderate
Climate	Monthly evaporation exceeds rainfall for all months of the year.	Minor
Temperature	Annual mean daytime maximum > 15°C.	Minor
Flood Potential	Flood levels determined via Port Stephens Floodplain Risk Management Study. The proposed home sites have been positioned above any anticipated flood level.	Minor
Exposure	Moderate wind and solar exposure – will improve to excellent wind and solar exposure upon clearing for asset protection and/or EMA construction.	Moderate
Slope	Lots 1, 4, 6, 8 and 9: <10%	Minor
	Lots 2 and 7: 15-20%	Minor
	Lot 5: 23%	Moderate
Landform	Lots 1, 8 and 9: Linear Planar	Minor
	Lot 2: Waxing Divergent	
	Lots 4, 5, 6 and 7: Waning Divergent	
Run-on and Seepage	Sites subject to significant stormwater run-on from upslope catchment, ranging from minor to moderate run-on. Stormwater diversion berm to be installed upslope of proposed EMA on all sites.	Moderate
Site-drainage	No signs of soil saturation or ponding observed	Minor
Erosion Potential	Lots 1, 2 and 6 – 9: No erosion in proposed EMAs identified.	Minor

	Lots 4 and 5: Moderate Surface Flow erosion hazard. Ensure proposed EMAs re-vegetated via establishment of dense (>85% coverage) perennial groundcover prior to commissioning.	Moderate
Site and Soil Disturbances	Removal of forest or forest regrowth will be required for construction of EMAs.	Moderate
Groundwater Bores	No domestic groundwater bores have been identified within 250 m of the proposed EMAs.	Minor
Rock Outcropping	Lots 1, 2 and 6- 9: No outcropping identified.	Minor
	Lot 4: Located on rocky outcropping crest, adequate soil depth achieved approximately 40m north-east of proposed home site.	
	Lot 5: Located on rocky outcropping crest, approximately 400mm additional soil depth required. Soil should be sourced from on-site excavations by the developer for access road construction and made available to the new allotment owner.	Moderate
Geology / Regolith	No geological discontinuities, fractures, or highly porous regolith are expected within and surrounding the EMA	Minor
Buffer Distances & Available land area	All minimum required buffers have been satisfied	Minor
Usable Land	Min. 7000m^2 of usable land required per lot has been applied due to interaction of Zone 1 and Zone 3 lands per MidCoast Council Development Application Framework (DAF) within overall site footprint.	Minor

2.5 Hazard Classification

Per the Mid Coast Council Development Application Framework (DAF), the site is classified as either Medium Hazard (Lots 8 and 9) or High Hazard (Lots 1-2 and 4 – 7). As a conservative measure, all lots have been designed to the standard of High Hazard and are considered highly constrained with respect to on-site sewage management and require a highly detailed environmental evaluation. All necessary criteria per Section 2.3 High Hazard Allotments (Rezoning / Subdivision / Increasing Dwelling Entitlements) have been applied to the following site-specific assessment and design to ensure a high level of human health and ecosystem protection has been achieved (*Moderate Limitation*).

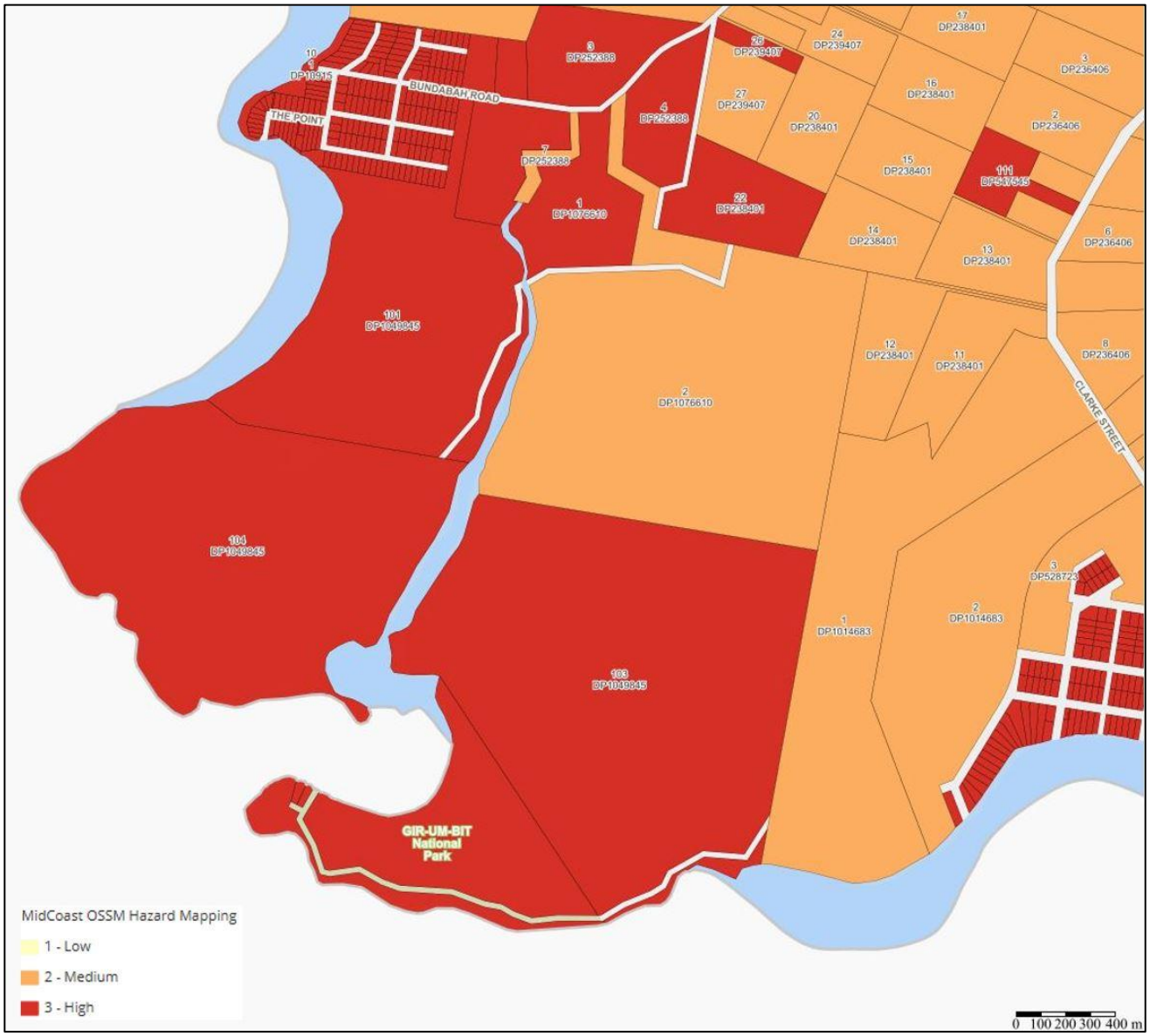


Figure 2-8 MidCoast OSSM Hazard Mapping (MCC Public GIS)

2.6 Climate

Bundabah has a temperate climate, with mild to hot dry summers, with a cooler wetter winter. Median annual rainfall is 1154.3 mm and evaporation 1752 mm. Monthly evaporation exceeds rainfall for majority of the year. (Appendix B1) (*Minor Limitation)*.

Average maximum temperatures range from 17.2 °C to 28.3 °C in July to January respectively. The average temperatures range from 6.4 °C to 18.2 °C in July to January respectively. The mean annual daytime maximum of 23.2°C proves suitable for biological wastewater treatment systems (i.e. AWTS) (*Minor Limitation*).

2.7 Flood potential

Flood levels determined via Port Stephens Foreshore (Floodplain) Risk Management Study GLLEP. The proposed home sites lie above any anticipated flood level *(Minor Limitation)*.

2.8 Exposure

The proposed effluent management areas (EMAs) are moderately exposed to sun and wind (*Moderate Limitation*). It is anticipated this will improve excellent wind and solar exposure upon clearing of forest regrowth for asset protection and / or EMA construction (subject to approval for tree clearing) (*Moderate Limitation*).

Table 2.8.1 Site Exposure

Landform Feature	Aspect	Solar Exposure	Wind Exposure	Limitation
EMA 1 - 9	-	Moderate	Moderate	Moderate

2.9 Slope

Slope has the potential to become a restrictive landform feature for OSSM with increased slope increasing the risk of run-off and/or erosion. Slope across proposed effluent management areas (EMAs) was determined to range from 3.4% to 23% (*Minor Limitation).*

Table 2.9.1 Percentage Slope and Land Application Limitations

Landform Feature	Approximate Slope Tangent (%)	Slope Classification	Limitation
EMA 1	7.1%	Gently Inclined	Minor
EMA 2	19.7%	Moderately Inclined	Minor
EMA 4	4.6%	Gently Inclined	Minor
EMA 5	23.2%	Steeply Inclined	Moderate
EMA 6	3.4%	Moderately Inclined	Minor
EMA 7	16.2%	Gently Inclined	Minor
EMA 8	8.8%	Gently Inclined	Minor
EMA 9	5.4%	Gently Inclined	Minor

Table 2.9.2 - Percentage Slope and Land Application Limitations

Slope Range [%]	Slope Classification	Limitation				
		Surface Irrigation (Spray & Drip)	Absorption Systems	Mounds	Conventional Trenches & LPEDs	Sub-surface Irrigation
0 – 1	Level	Minor	Minor	Minor	Minor	Minor
1 – 3	Very Gently Inclined	Minor	Minor	Minor	Minor	Minor
3 – 10	Gently Inclined	Minor	Minor	Minor	Minor	Minor
10 – 15	Moderately Inclined	Major	Major	Moderate	Moderate	Minor
15 – 20		Major	Major	Major	Moderate [2]	Minor
> 20	Steeply Inclined	Major	Major	Major	Moderate [3]	Moderate [1]

[1] 30% maximum slope without specific design (AS 1547:2012, p.133)
[2] >15% slope increase difficulty in construction (AS 1547:2012, Table K1)
[3] >25% slope creates difficulty in trenching, risk of erosion during construction (AS 1547:2012, Table K1)

2.10 Landform

The landform describes the surface shape and topographic position at the proposed EMAs. Typical landform descriptors per AS1547:2012 are detailed below.

Table 2.10.1 Landform Configuration

Landform Feature	Slope Configuration	Limitation
EMA 1	Linear planar	Minor
EMA 2	Waxing divergent	Minor
EMA 4	Waning divergent	Minor
EMA 5	Waning divergent	Minor
EMA 6	Waning divergent	Minor
EMA 7	Waning divergent	Minor
EMA 8	Linear planar	Minor
EMA 9	Linear planar	Minor

2.11 Surface Water and Seepage

Surface water and seepage flow is determined by the catchment preceding the EMA and the prevailing landform features. General assessment of the likely surface water interaction with the landform and EMA has been provided. Stormwater diversion berms are proposed up-slope of all effluent management areas to mitigate potential impacts by up-slope stormwater run-on.

Table 2.11.1 Site surface water

Landform Feature	Catchment		Surface Flow		Soil Moisture	Seepage Potential	Limitation
	Size	Coverage	Run-on	Run-off			
EMA 1	Moderate	Vegetation	Moderate	Minor	Dry	Minor	Moderate
EMA 2	Moderate	Vegetation	Moderate	Minor	Dry	Minor	Moderate
EMA 4	Minor	Vegetation	Minor	Minor	Dry	Minor	Minor
EMA 5	Minor	Veg / Rock Outcropping	Minor	Moderate	Dry	Moderate	Moderate
EMA 6	Minor	Vegetation	Moderate	Minor	Dry	Minor	Moderate
EMA 7	Moderate	Vegetation	Moderate	Minor	Dry	Minor	Moderate
EMA 8	Minor	Vegetation	Minor	Minor	Dry	Minor	Minor
EMA 9	Minor	Vegetation	Minor	Minor	Dry	Minor	Minor

2.12 Site drainage

The proposed effluent management areas appeared to consist of free draining soils with no soil saturation present, no noted presence of macrophytes were observed (i.e. sedges, ferns, juncus) *(Minor Limitation).*

2.13 Erosion potential

Erosion and surface soil movement results from the interaction of the existing landform, surface flows and surface coverage. The following existing erosion conditions were identified and assessed in proposing additional hydraulic loading in the form of effluent.

Table 2.13.1 Site erosion potential

Landform Feature	Surface Flow Type	Erosion Hazard		Limitation
		Surface Flow	Wind	
EMA 1	Unconcentrated	Slight	Low	Minor
EMA 2	Unconcentrated	Slight	Low	Minor
EMA 4	Unconcentrated	Moderate	Low	Moderate
EMA 5	Unconcentrated	Moderate	Low	Moderate
EMA 6	Unconcentrated	Slight	Low	Minor
EMA 7	Unconcentrated	Slight	Low	Minor
EMA 8	Unconcentrated	Slight	Low	Minor
EMA 9	Unconcentrated	Slight	Low	Minor

Note that soils are potentially erodible where surface cover is broken and as such, the EMAs should be appropriately preserved and where necessary, re-vegetated via establishment of dense (>85% coverage) perennial groundcover prior to commissioning (*Moderate Limitation*).

2.14 Site & Soil Disturbances

Aerial imagery and site inspection indicates re-growth and / or remnant forest growth covering much of the site. It is proposed to clear forest on and adjacent to the EMAs to improve exposure to sun and wind. Wherever possible, EMAs have been located within presumed APZ zoning for the proposed building envelopes where vegetation management is required for asset protection. Where located outside of the presumed APZ, clearing / cropping will be required and establishment of dense surface coverage.

Soil depth was skeletal and highly variable at home site 5. Therefore, an additional 400+ mm of site-won soil must be spread over the nominated EMA to ensure adequate soil depth (minimum 600mm) for moisture and nutrient sorption. Post spreading of soil, a dense coverage of non-invasive low growing vegetation should be established prior to commissioning *(Moderate Limitation).*

2.15 Domestic Bore

WaterNSW Realtime data indicated no domestic potable groundwater bores located within a 250m radius of the site (Minor Limitation).

2.16 Rock Outcropping

Localised rock outcropping and surface boulders were identified across the site. For the most part, these localities have been avoided. However, sites 4 and 5 were situated on crests with a high level of rocky outcropping.

A potential EMA location with minimal rock outcropping and adequate soil depth was identified approximately 40m north-east of proposed home site 4. However, proposed home site 5 was considerably rockier, and an additional 400+mm of soil coverage will be required. Soil should be sourced from on-site excavations by the developer for access road construction and made available to the new allotment owner. A minimum 600mm of soil depth is required across each effluent management area (*Moderate Limitation)*.

2.17 Geology / Regolith

No geological discontinuities, fractures, or highly porous regolith are expected within and surrounding the EMA (*Minor Limitation*).

2.18 Buffer Distances & Available Land Area

Minimum offset distances are designated by local approval authorities within their guiding documents to ensure the ongoing protection of community health, sensitive ecosystems, and the maintenance of community amenity. Where LGA guidance on a constraint is not available, appropriate offsets have been nominated in accordance with AS1547:2012 and Table 5 DLG (1998).

The site-specific constraints for the proposed EMA and land application method have been assessed as per Table 2.17.1.

Table 2.18.1 – Minimum buffer distances from sensitive site features

Site Feature	Minimum Setback		Proposed Setback: EMA Upslope/Downslope	Limitation
	If EMA is upslope of feature	If EMA is downslope / level with feature		
Dwellings (Surface Spray	15m		>15m	Minor
Dwellings (Subsurface Absorption)	6m	3m	>6/3m	Minor
Property Boundaries (Surface Spray)	6m	3m	>6/3m	Minor
Property Boundaries (Subsurface Absorption)	12m	6m	>12/6m	Minor
Driveways	6m	3m	>6/3m	Minor
Buildings	6m	3m	>6/3m	Minor
Pools	6m		>6m	Minor
Watercourses	100m		>100m	Minor
Domestic Bore / Well	250m from high water level		>250m	Minor
Dam / Drainage Depression	40m from high water level		>40m	Minor

2.19 Usable Land

Under MidCoast Council DAF, the site falls partially within Zone 1 – Sensitive Ecological Catchments (requiring 7,000 m^2 of useable land) and partially within Zone 3 – Aquaculture Lease Areas (requiring 4,000m^2 of usable land). As a conservative measure, a minimum 7,000 m^2 of *usable land*, per section 2.9 of the Mid Coast Council DAF, has been applied to all lots (See Appendix F).

It is noted that useable land is defined in this instance as land meeting all necessary setback distances (Table 2.18) and of gradient less than 30%.

3 SOIL ASSESSMENT

3.1 Soil Assessment Summary

Investigation of the site for suitability for OSSM was accompanied by soil assessment within the proposed EMAs. Representative samples from Boreholes BH1, BH4, BH7 and BH8 were sent to ALS Laboratory for effluent re-use analysis. A summary of the results is presented in Table 3.7.1, and a copy of the Lab results is provided in Appendix D. The soil characteristics assessed per AS 1547:2012, AS 1289.3.8.1:2006, and NSW DLG (1998) methodologies. The summary of the soil investigation is presented in Table 3.1.1.

Table 3.1.1 – Assessment summary of site features

Factor Assessed	Description	Limitation
Depth to bedrock / hardpan[1]	600+ mm.	Minor
Depth to bedrock / hardpan[2]	200mm	Moderate
Depth to high watertable	NIL free water or waterlogging characteristics	Minor
Coarse Fragments	< 10% across all upper strata	Minor
pH	>5.5 across all samples	Minor
Electrical Conductivity (EC)	< 4 dS/m across all samples.	Minor
Dispersiveness (EAT_m)	3+. Non-critical with respect to OSSM	Minor

[1] All with exception of home site 5A.

[2] Lot 5. An additional 400+mm of soil coverage will be required

3.2 Soil Landscape Map

The site occurs over several soil landscapes, each proposed EMA is situated within the following:

Proposed Lots 1 and 9

1:100,000 Soil Landscape Mapping indicates the lots occur on the North Arm Cove Soil Landscape. The Landscape features undulating hills on ignimbrites of the Nerong Volcanics. Local relief to 50 m and slope gradients <15%. Broad crests, gently inclined slopes and narrow drainage lines. Minor rocky peaked crests. Partially cleared to extensively cleared Eucalypt / Angophora open-forest to Eucalypt tall closed-forest.

Soils typically moderately deep (50–150 cm), imperfectly drained Yellow Podzolic Soils on crests and upper slopes: moderately deep (50–150 cm), poorly drained Soloths and minor imperfectly

drained Yellow Podzolic Soils on lower slopes and drainage lines. Dominant Soil Materials include:

- A1 – Variable, brownish-black loamy sand to more commonly light sandy-clay-loam, occasionally clay-loam
- A2 – Highly variable colour, light medium clay to a heavy clay

Proposed Lot 2, 4, 5 and 7

1:100,000 Soil Landscape Mapping indicates the lots occur on the Gan Gan Soil Landscape. The Landscape features steep hills on ignimbrites of the Nerong Volcanics. Slope gradients >25%, local relief 100–200 m, elevation 60–260 m. Crests are peaked, upper slopes occasionally precipitous, rocky and narrow; slopes are steep, uneven, and boulder strewn, drainage lines are narrow. Cliffs, scarps and in situ rock outcrop are occasionally present. Predominantly uncleared open forest.

Soils typically shallow (<30 cm), well-drained Lithosols on crests; shallow to moderately deep (<80 cm) Lithosols and imperfectly drained Soloths with deep (>200 cm), poorly drained Soloths on foot-slopes. Dominant Soil Materials include:

- A1 – brownish black to greyish yellow-brown sandy-loam
- A2 – Bleached, light sandy clay loam to sandy-clay-loam, occasionally increasing to a sandy clay with depth

Proposed Lot 6 and 8

1:100,000 Soil Landscape Mapping indicates the site occurs on the Pindimar Road Soil Landscape. The Landscape features undulating to rolling low hills on mudstones and minor interbeds of lithic sandstones of the Wootton Beds. Local relief 30–60 m. Slope gradients up to 25%. Broad crests, gently to moderately inclined slopes with incised upper slope drainage lines grading into broader lower slope drainage plains. Rock outcrop is rare. Cleared to partially cleared tall open forest.

Soils typically shallow to moderately deep (30–70 cm), well drained Brown Podzolic Soils and Yellow Podzolic Soils on sandstone parent material; moderately deep to deep (50–200 cm), moderately well-drained Brown Podzolic Soils, and Yellow Podzolic Soils; moderately deep to deep (100–200 cm), imperfectly drained Soloths in poorly drained areas. Dominant Soil Materials include:

- A1 – dark brown – brownish black commonly fine sandy-loam, rarely loam
- A2 – Hard setting dull yellowish brown massive sandy-clay-loam

Site landscape assessment generally conformed to the Soil Landscape mapping.

3.3 Site Vegetation

The site occurs over several soil landscapes, each proposed EMA is situated within the following:

Proposed Lots 1 and 9

Vegetation encountered within the North Arm Cove Soil Landscape is typically Open-forest to tall closed-forest and woodland which has been partially to extensively cleared. The woodland occurs mainly in dry exposed areas and supports species which include Angophora costata (smooth-barked apple), Eucalyptus signata (scribbly gum), Eucalyptus gummifera (red bloodwood), Allocasuarina torulosa (forest oak) and Eucalyptus acmenoides (white mahogany). A dry sclerophyll shrub understorey is often present with Banksia spinulosa var. collina (hill banksia), Lambertia formosa (mountain devil), Banksia oblongifolia and Persoonia levis (broad-leaf geebung).

In sheltered areas a tall open-forest with Eucalyptus maculata (spotted gum), Eucalyptus paniculata (grey ironbark) and the odd Angophora costata (smooth-barked apple), and Eucalyptus microcorys (tallowwood) occur. Various Melaleuca spp. (paperbarks) occur along drainage lines. North of Bundabah the original vegetation has been cleared and replaced with a pine (Pinus radiata) plantation.

Proposed Lot 2, 4, 5 and 7

Vegetation encountered within the Gan Gan Soil Landscape is typically predominantly uncleared low open forest with shrub understorey. Common tree species can include Angophora costata (smooth-barked apple), Eucalyptus punctata (grey gum), Eucalyptus acmenoides (white mahogany), Eucalyptus signata (scribbly gum), Eucalyptus gummifera (red bloodwood), Allocasuarina torulosa (forest oak), Eucalyptus microcorys (tallowwood), Eucalyptus maculata (spotted gum) and Eucalyptus paniculata (grey ironbark). Commonly a shrub understorey is present and can contain Banksia spinulosa var. collina (hill banksia), Lambertia Formosa (mountain devil), Xanthorrhoea spp. (black boy), Doryanthes excelsa (gymea lily), Dillwynia spp. (eggs and bacon), Persoonia spp. (geebung), Pteridium esculentum (bracken), and Hakea spp. Themeda australis (kangaroo grass) may occur as a herb layer.

On Tomaree Headland open-forests containing Eucalyptus umbra (bastard mahogany) with Banksia spinulosa (hairpin banksia) in the understorey and shrublands containing Acacia binervia (coast myall), Melaleuca armillaris and shrubby Allocasuarina spp. (she-oak) can be found.

Proposed Lot 6 and 8

Vegetation encountered within the Pindimar Road Soil Landscape is typically predominantly cleared to partially cleared (logged) tall open forest dominated by Eucalyptus maculata (spotted gum), Eucalyptus punctata (grey ironbark) and Eucalyptus acmenoides (white mahogany), and Allocasuarina torulosa (forest oak) with Acacia spp. (wattles) being common in the understorey.

On sandstones Angophora costata (smooth-barked apple) and Eucalyptus gummifera (red bloodwood) may occur with an understorey which may contain Xanthorrhoea spp. (black boys) and Banksia spinulosa var. collina (hill banksia). Melaleuca spp. (paperbarks) are common along drainage lines.

This assessment does not include a detailed vegetation assessment. However, vegetation coverage appeared to generally conform to the Soil Landscape mapping.

3.4 Depth to Bedrock / Hardpan

Soil depth was ascertained via sixteen (16) bore holes drilled across the site, targeting potential EMA's identified. Borehole samples were extracted via direct push tube. Adequate depth (600+ mm) was achieved within all potential EMAs except for that on Lot 5 (*Moderate Limitation)*.

Skeletal soils of variable depth were identified on Lot 5. As such, an additional 400+ mm of site-won soil must be spread over the nominated EMA on Lot 5 to ensure adequate soil depth (minimum 600mm) for moisture and nutrient sorption.

3.5 Depth to High Watertable

No visible free water, soil saturation, grey mottling or similar was encountered within the sampling depth, except for soils within EMA 2 at depths >600mm where grey mottling was identified *(Minor Limitation).*

3.6 Soil Permeability Category

Soil permeability has been assigned per Table 5.2 of AS1547:2012 for the excavation site(s) most representative of the EMA location. The hydraulically limiting strata for the application systems is bolded within Tables 3.6.1 - 3.6.7 below. Respective Boreholes for proposed EMA's chosen for respective proximity.

Table 3.6.1: Soil permeability and Design Irrigation Rate (EMA 1)

Excavation #		BH1A		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
300	Clay Loam	Moderate	0.5 – 1.5	3.5
600	**Light Clay**	**Moderate**	**0.06 – 0.12**	**3.0**
1100	Medium Clay	Strong	0.06 – 0.5	2.0

Table 3.6.2: Soil permeability and Design Irrigation Rate (EMA 2)

Excavation #		BH2B		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
250	Loam	Moderate	1.5 – 3.0	4
800	**Medium Clay**	**Moderate**	**< 0.06**	**2.0**
900	Medium Clay	Moderate	< 0.06	2.0

Table 3.6.3: Soil permeability and Design Irrigation Rate (EMA 4)

Excavation #		BH4A		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
300	Loam	Moderate	0.5 – 1.5	4.0
800	**Sandy Clay**	**Moderate**	**0.06 – 0.12**	**3.0**
1100	Sandy Clay	Weak	<0.06	3.0

Table 3.6.4: Soil permeability and Design Irrigation Rate (EMA 5)

Excavation #		BH5A		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
100	Sand	Massive	>3.0	5.0
300	**Loamy Sand**	**Massive**	**>3.0**	**4.0**

Table 3.6.5: Soil permeability and Design Irrigation Rate (EMA 6) - Presumed

Excavation #		BH5A		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
150	Sandy Clay Loam	High	0.5 – 1.5	3.5
600	**Fine Sandy Clay**	**Strong**	**0.12 – 0.5**	**3.0**

Table 3.6.6: Soil permeability and Design Irrigation Rate (EMA 7)

Excavation #		BH7A		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
200	Light Clay	Moderate	0.06 – 0.12	3.5
500	**Sandy Clay Loam**	**Strong**	**0.5 – 1.5**	**3.5**
1100	Sandy Clay	Moderate	0.12 – 0.5	3.0

Table 3.6.7: Soil permeability and Design Irrigation Rate (EMA 8)

Excavation #		BH8B		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
150	Sandy Clay Loam	High	0.5 – 1.5	3.5
600	**Fine Sandy Clay**	**Strong**	**0.12 – 0.5**	**3.0**

Table 3.6.8: Soil permeability and Design Irrigation Rate (EMA 9)

Excavation #		BH9A		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
300	Sandy Clay Loam	High	0.5 – 1.5	3.5
700	**Fine Sandy Clay**	**Moderate**	**0.5 – 1.5**	**3.5**
1100	Fine Sandy Clay	Moderate	0.5 – 1.5	3.5

3.7 Soil Profiles

Soil profiles provided within Appendix E.

3.8 Soil Chemistry

Five (5) topsoil and four (4) sub-soil soil samples were collected and tested at ALS for effluent re-use analysis. A copy of the results is provided in Appendix D. The results and recommendations are summarized below:

Table 3.8.1 Soil Chemistry Summary

Sample	Test	Result	Limitation	Recommendations
1A_1	pH	5.0	Moderate	Apply Ag-Lime to EMA @ 250g/m²
	ECe (dS/m)	0.14	Minor	-
	EAT Category	7	Minor	-
	CEC ($cmol^+/kg$)	1.5	Major	Increase Organics
	ESP (%)	9.4	Moderate	Use low sodium detergents
	P-Sorp (mg/kg)	792	Minor	-
1A_2	pH	4.5	Moderate	-
	ECe (dS/m)	2.39	Minor	-
	EAT Category	6	Minor	-
	CEC ($cmol^+/kg$)	9.7	Moderate	-
	ESP (%)	24.8	Major	-
	P-Sorp (mg/kg)	1730	Minor	-

4A_1	pH	4.8	Moderate	Apply Ag-Lime to EMA @ 325g/m²
	ECe (dS/m)	0.2	Minor	-
	EAT Category	7	Minor	-
	CEC ($cmol^+/kg$)	2	Major	Increase Organics
	ESP (%)	11.8	Moderate	Use low sodium detergents
	P-Sorp (mg/kg)	2080	Minor	-
4A_2	pH	4.9	Moderate	-
	ECe (dS/m)	0.4	Minor	-
	EAT Category	5	Minor	-
	CEC ($cmol^+/kg$)	4.7	Major	-
	ESP (%)	9.7	Moderate	-
	P-Sorp (mg/kg)	2560	Minor	-
5A_1	pH	4.8	Moderate	Apply Ag-Lime to EMA @ 325g/m²
	ECe (dS/m)	0.5	Minor	-
	EAT Category	5	Minor	-
	CEC ($cmol^+/kg$)	1.5	Major	Increase Organics
	ESP (%)	11.4	Moderate	Use low sodium detergents
	P-Sorp (mg/kg)	1450	Minor	-
7A_1	pH	6.5	Minor	-
	ECe (dS/m)	1.1	Minor	-
	EAT Category	7	Minor	-
	CEC ($cmol^+/kg$)	50.2	Minor	-
	ESP (%)	7.9	Moderate	Use low sodium detergents
	P-Sorp (mg/kg)	1660	Minor	-
7A_2	pH	8.1	Minor	-
	ECe (dS/m)	1.6	Minor	-
	EAT Category	1	Major	-
	CEC ($cmol^+/kg$)	37.8	Minor	-
	ESP (%)	13.3	Moderate	Use low sodium detergents
	P-Sorp (mg/kg)	1300	Minor	-
8A_1	pH	4.9	Moderate	Apply Ag-Lime to EMA @ 325g/m²
	ECe (dS/m)	0.2	Minor	-
	EAT Category	7	Minor	-
	CEC ($cmol^+/kg$)	2.8	Major	Increase Organics
	ESP (%)	9.6	Moderate	Use low sodium detergents
	P-Sorp (mg/kg)	1520	Minor	

8A_2	pH	4.8	Moderate	-
	ECe (dS/m)	0.43	Minor	-
	EAT Category	7	Minor	-
	CEC ($cmol^+/kg$)	11.6	Moderate	-
	ESP (%)	11.6	Moderate	-
	P-Sorp (mg/kg)	1760	Minor	-

3.9 Soil Ameliorants

As disposal is proposed via irrigation it is determined that the upper soil layer (L1) is the most pertinent condition for constraining soil chemistry. Tested soil parameters within the upper soil strata (Layer A_1) indicated the following restrictive properties to OSSM:

Soil Acidity:

Acidic soils were identified. Application of effluent tends to make the soil more acidic which may hinder vegetation growth. It is proposed to add Ag-lime to each EMA to increase the pH above 5.5.

Soil Sodicity:

Sodic soils were identified to have elevated ESP (Exchangeable Sodium Percentage) values. Effluent Application to sodic soils may potentially result in structural degradation (NSW DLG, 1998).

Sodicity may cause excessive swelling with water application which may lead to soil dispersion and crusting in surface soils. Crusting is indicated by the formation of a crust layer on top of the soil which separates from the subsoil, it will form cracks and sparse vegetation coverage will result.

It is proposed to utilise low sodium washing detergents, and if soil crusting is observed, spot surface application of gypsum at $250g/m^2$ is recommended to improve soil structure and performance of sodic soils. Ensure dense vegetation coverage is maintained over the EMA.

Limited Cation Exchange Capacity:

Low CEC values suggest an inability of soil to hold on to the nutrients dispersed by the effluent. This both hinders plant growth and presents the risk of cations leaching into the soil moisture. It is proposed to treat effluent to a secondary standard to reduce the nutrient loading and dispose effluent by irrigation to maximise the area available for nutrient uptake. Ongoing maintenance by increasing the amount of organic matter within the EMA is recommended, via addition of mulch, compost or manure and mowing the dispersal area with a mulching mower.

4 NOMINATED WASTEWATER MANAGEMENT

4.1 Proposed OSSM Summary

Site and soil constraints were evaluated in selection of appropriate treatment and effluent management method. A summary of the recommended OSSM system and application sizing is presented below:

I.D	Treatment	→	Effluent Management
1	AWTS + disinfection or equivalent	(Pumped dosing)	390 m^2 Subsurface Drip Irrigation
2	AWTS + disinfection or equivalent	(Pumped dosing)	640 m^2 Subsurface Drip Irrigation
4	AWTS + disinfection or equivalent	(Pumped dosing	390 m^2 Subsurface Drip Irrigation
5	AWTS + disinfection or equivalent	(Pumped dosing	390 m^2 Subsurface Drip Irrigation
6	AWTS + disinfection or equivalent	(Pumped dosing	390 m^2 Subsurface Drip Irrigation
7	AWTS + disinfection or equivalent	(Pumped dosing	390 m^2 Subsurface Drip Irrigation
8	AWTS + disinfection or equivalent	(Pumped dosing	390 m^2 Subsurface Drip Irrigation
9	AWTS + disinfection or equivalent	(Pumped dosing	390 m^2 Subsurface Drip Irrigation

4.2 Site Wastewater Loadings

For purpose of estimating effluent management, all lots have been presumed to be developed with a Five (5) Bedroom Dwelling.

Table 4.2.1 Site Wastewater Loading

I.D	Equivalent Bedrooms [1]	Population per Bedroom [1]	Equivalent Population [Persons]	Water Supply	Wastewater Generation Rate per Capita [L/Person/Day]	Design Wastewater Loading [L/Day]
Sites 1 - 9	5	1.67	8	Tank	120	960

4.3 Wastewater Treatment

It is proposed to treat all wastewater generated within each site to a **Secondary standard with disinfection** via New Aerated Wastewater Treatment Systems (AWTS). The units must be capable of sustainably treating the design wastewater loading to the secondary treatment targets (per DLG 1998) detailed in Table 4.3.1.

Justification of the proposed treatment method is as follows:

- Accidental or deliberate discharges are less detrimental to the environment and have less potential to adversely impact on health
- Higher quality effluent produced and high commercial availability
- Facilitates disposal via irrigation

A list of accredited AWTS systems and suppliers is available on the NSW Health website:

http://www.health.nsw.gov.au/environment/domesticwastewater/Pages/awts.aspx

Table 4.3.1: - Secondary Treatment Targets (per DLG 1998)

Biochemical Oxygen Demand (BOD^5)	Suspended Solids (TSS)	Total Nitrogen (TN)	Total Phosphorus (TP)	Faecal coliforms (disinfected)	Dissolved Oxygen (DO)
< 20 mg/L	< 30 mg/L	25 - 50 mg/L	10 - 15 mg/L	< 30 cfu/100 mL	> 2 mg/L

4.4 Effluent Management

Given the site and soil conditions encountered, and sensitivity of down-gradient receiving environments, it is proposed to dispose of effluent from the proposed residential dwellings via **Sub-surface Drip Irrigation**. Sizing of the application method was undertaken via water and nutrient balance in accordance with DLG 1998 and Mid Coast Council On-site Wastewater Management Strategy (2023). Specifically, the following were assumed / adopted:

- 960L/day per dwelling (5-bedrooms / tank water)
- A Climate Adjustment Factor (CAF) of 0.5 for Bundabah (Climate Zone 2)
- Site specific average phosphorus sorption values (p-sorp)
- Home site specific soil profiles (soil texture and depth)
- Maintained lawns
- AWTS + disinfection or equivalent level of treatment
- The larger of the three balances (hydraulic / phosphorus / Nitrogen) is adopted

Table 4.4.1 summarises the inputs and calculated effluent management areas.

Justification of the proposed treatment method is as follows:

- Irrigation maximises the surface disposal area and evapo-transpiration.
- An irrigation area is available on each allotment meeting the minimum buffer distances.
- Irrigation is a suitable method for the site landform and soil properties.
- Limited soil depth at some homes sites precludes absorption-based systems such as beds and tranches without significant earth work to improve soil depth
- Irrigation encourages the re-use of a resource (treated wastewater)
- Sub-surface irrigation restricts effluent dispersal to the nominated effluent management areas.

Table 4.4.1: Effluent Management Sizing and Selection

Flow Rate Q				= 960 L/day (See Table 4.2.1)					
Climate Adjustment Factor (CAF) – Bundabah				= 0.5 (Mid Coast Climate Zone 2)					
Lot.	Slope [3]	Soil Depth (mm) [1]	Limiting Layer [1]	DIR (mm/hr)	DIR – CAF (mm/hr) [2]	Hydraulic Area (m²) [3]	Nitrogen (m)[4]	Phosphorus (m²) [4]	Disposal Method
1	7.1%	1100	Light Clay	3	2.5	390	292	221	**390m²** Subsurface Drip Irrigation
2	19.7%	1100	Medium Clay	2	1.5	640	292	208	**640m²** Subsurface Drip Irrigation
4	4.6%	1100	Sandy Clay	3	2.5	390	292	142	**390m²** Subsurface Drip Irrigation
5	23.2%	200	Loamy Sand	5	4.5	220	292	208	**390m²** Subsurface Drip Irrigation [5]
6	3.4%	600	Fine Sandy Clay	3	2.5	390	292	310	**390m²** Subsurface Drip Irrigation
7	16.2%	1100	Sandy Clay	3	2.5	390	292	142	**390m²** Subsurface Drip Irrigation
8	8.8%	600	Fine Sandy Clay	3	2.5	390	292	142	**390m²** Subsurface Drip Irrigation
9	5.4%	1100	Fine Sandy Clay	3	2.5	390	292	310	**390m²** Subsurface Drip Irrigation

[1] See Appendix E: Soil Profiles

[2] Area = Q/(DIR-CAF) (Per MidCoast Council DAF: 6.5.3 Sizing of Land Application Areas)

[3] Average slope within nominated EMA

[4] See Appendix B3: Nutrient Balances & ALS Results for Soil P-sorp Capacity

[5] Minimum 390m² Subsurface Drip Irrigation conservatively adopted across the site

4.5 Minimum Standards: Subsurface Drip Irrigation

The following material has been sourced from the MidCoast Council On-Site Sewage DAF (2020).

Subsurface irrigation or drip technology involves the installation of a matrix of small diameter pressure compensating dripline within the land application area that emit effluent through specially designed emitters at very low flow rates (typically less than 3 L/hr from each emitter). It is important that the pipework is buried within the root zone of the vegetation, whether grass or shrubs, typically 150 – 200mm below ground surface. Lateral (horizontal) spacings for the pipework is typically between 600mm and 1000mm (maximum spacing permitted) depending on soil type. It is critical that the lateral (horizontal) spacings be matched to the soil type to prevent "zebra" striping, a sign of inefficient effluent distribution.

Only commercially available pressure compensating subsurface irrigation pipework specifically designed for the dispersal of treated wastewater is to be installed. Pressure compensation is critical to effective land application as it ensures even distribution of effluent over variable topography. Effluent dripline either comes with in-built root inhibitor and bactericide and / or requires dosing through a filter system. Pressure compensating subsurface drip irrigation requires secondary quality effluent as a minimum to prevent blockage. The disposal of septic tank effluent using this disposal method is not permitted.

It is important that an appropriately qualified and experienced person or company be consulted for the design work. An under sized or poorly designed system will lead to failure with potential environmental and health related impacts. Alternatively, an oversized or over designed system could lead to the poor distribution of effluent, un-necessary cost burden and the un-necessary sterilization of land.

Drip technology is a well-established industry and as such companies producing subsurface products have written excellent design and installation guidelines. Manufacturer's specifications, standard drawings and design guidelines should be used to support applications. Care must still be taken to ensure the disposal area design considers both the manufacturers recommended design guidelines as well as the specific site, soil and climatic conditions of the property in question.

A critical element of the design process is hydraulic design including selection of appropriate dripline, dosing and flush manifold pipe, lateral and emitter spacings and pump performance. Dripline typically needs an operating pressure at the emitter of 10-40 m to maintain pressure compensation. As such, higher head, low flow pumps are required to service drip irrigation systems that differ from pumps traditionally used in on-site sewage management. For smaller systems, standard sizing tables and charts from dripline manufacturers will typically suffice for hydraulic design. Larger systems will require a full hydraulic analysis to be undertaken where Total Dynamic Head (TDH) for the proposed system is determined. From this point a suitable pump, capable of delivering the end of line pressure (10-40 m) can be selected. Checks should

also be completed by the nominated system installer to ensure the pump can deliver flushing flows during open valve conditions.

An in-line disc filter should be installed for final effluent filtration prior irrigation. Vacuum breakers and flush valves will be required for each sub-zone. Laterals should still be installed parallel with land contours despite the pressure compensating emitters. Valve access boxes should be installed at all corners of the area. Only experienced irrigation contractors are recommended for installation to prevent costly errors and / or poor system performance.

4.6 Recommended Site Modifications

To address present site constraints, the following modifications are recommended:

- Wherever possible, EMAs have been located within presumed APZ zoning for the proposed building envelopes where vegetation management is required for asset protection.
- Following the implementation of the EMA, the areas are to be maintained with dense non-invasive grass or low growing vegetation coverage.
- Where necessary, fencing is to be erected to restrict access from livestock, vehicles and unnecessary traffic.
- Soil depth was limited and variable within Lot 5. An additional 400+mm of site-won soil is recommended to be added to EMA and subsequently dense coverage of vegetation should be achieved prior to commissioning.
- Due to the site wide consistency of the recorded soil chemistry, it is proposed that all lot developments adhere to the proposed recommendations of Section 3.7.1 including:
    - Addition of Ag-lime at 325g/m^2
    - Spot Application of Gypsum where soil cracking is observed
    - Maintain use of low sodium detergents
    - Application of organic matter and mowing with a mulcher.
    - Minimising pedestrian traffic as required to maintain vegetation growth

5 ADDITIONAL INFORMATION

5.1 Pipework Detail

All associated plumbing / drainage work is to be in accordance with AS 3500.2:2015 *Sanitary Plumbing Drainage*. Positioning of the receiving treatment system is to ensure drainage from internal plumbing fixtures achieves the minimum grade and cover of the excerpts below.

Table 6.1 – Excerpts of AS3500.2:2015

Nominal Pipe Diameter (DN)	Minimum Grade	
(mm)	(%)	(Ratio)
65	2.50	1:40
80	1.65	1:60
100	1.65*****	1:60*****
125	1.25	1:80
150	1.00	1:100

*Drains from treatment plants may be 1.00% Min.

	Minimum depth of cover (mm)	
Location	Cast iron & Ductile iron	Other materials
Subject to vehicular loading	300	500
All other locations	NIL	300

5.2 Licensing

Operating a system of sewage management is a Prescribed Activity under the Local Government Act 1993. This means that an 'Approval to Operate' a system of sewage management must be obtained from Council on an annual basis.

5.3 Detailed Design

A detailed system design will be implemented at the 'Application to Install' stage or with subsequent individual Development Applications for dwelling house on each subdivided lot. This design will include the size and location of all system components including tanks, distribution lines, valves, etc. These additional requirements will be furnished by the nominated treatment system suppliers / licensed installers. Additional information for the property owner is available in Appendix C.

A signature from the wastewater design consultant as part of a 'Statement of Design Conformity' may be required (at the discretion of Council) to ensure that the installed on-site system meets the design and wastewater management report prepared for system approval, or any modifications are discussed and acceptable prior to system installation. This is not a certification against the 'Approval to Install' as only Council is authorised to inspect and sign-off the system. However, this signed Conformity Statement provides a linkage to ensure what has been proposed at the design stage by the consultant has been carried through to the final system installation

6 CONCLUSION

- It is proposed to subdivide the site into Nine (9) new residential lots on Proposed Subdivision at 253 Bundabah Road, Bundabah
- For the purpose designing preliminary EMAs, it has been assumed that each lot will be developed with a Five (5) Bedroom Dwelling. This approach is considered conservative as not all new developments will be this large or each 8 persons residing in each dwelling.
- It is proposed to treat all wastewater generated within each residence to a Secondary standard with disinfection, this is proposed to be via a new Aerated Wastewater Treatment Systems (AWTS) or equivalent within each lot.
- Site modifications are provided within section 4.5 of this report which must be followed.
- Given the site and soil conditions encountered, and sensitivity of down-gradient receiving environments, it is proposed to dispose of effluent from the proposed residential dwellings via **Subsurface Drip Irrigation**. Sizing of the application method was undertaken via water and nutrient balance in accordance with DLG 1998 and Mid Coast Council On-site Wastewater Management Strategy (2023).
- Effluent management areas must be stabilised with suitable low growing non-invasive vegetation such as grass prior to commissioning.

Lots 1 and 4 – 9:

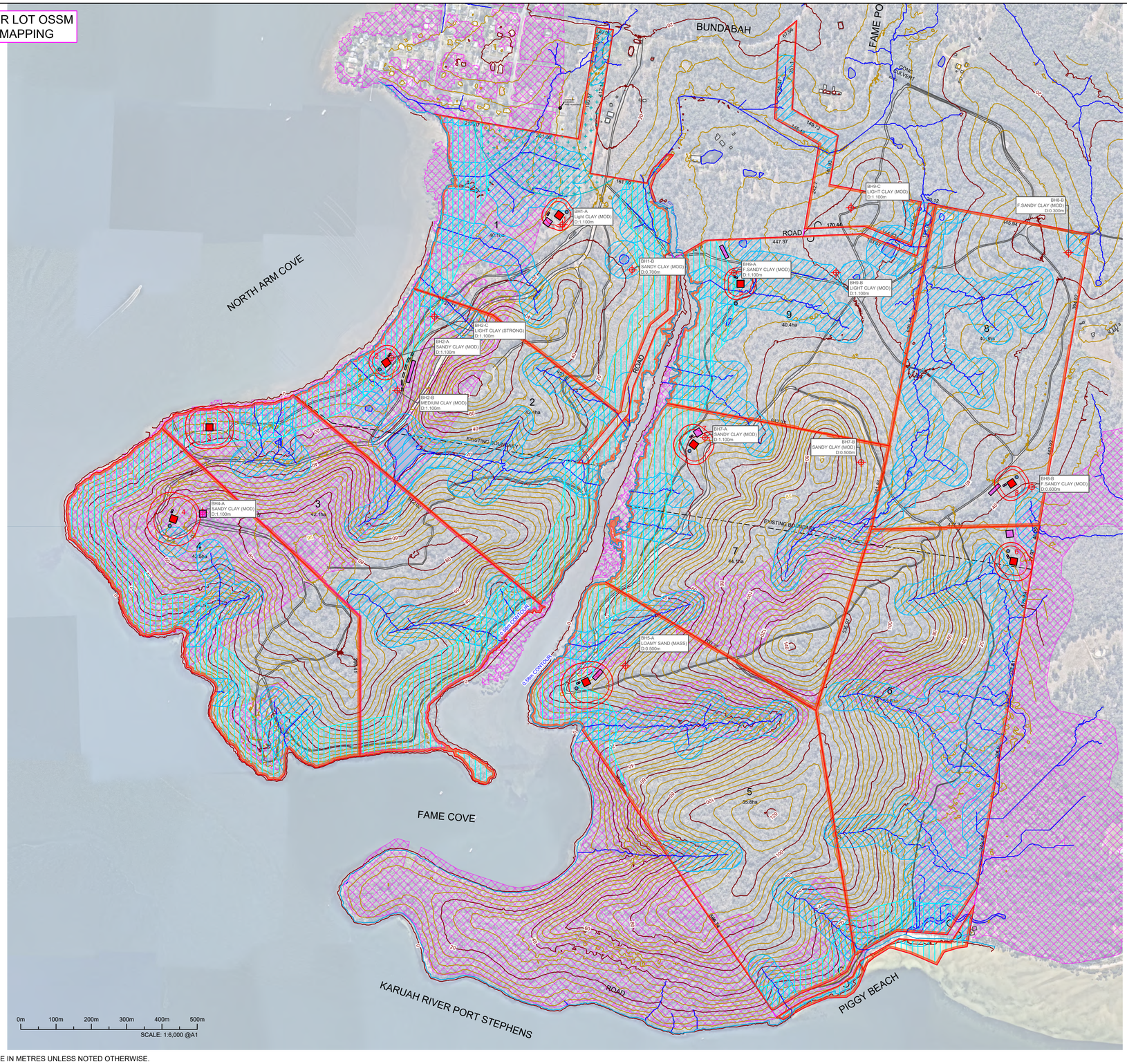
- The anticipated wastewater loading rates generated by is calculated to be **960L/day.**
- Application of the effluent is proposed via **390m^2 Subsurface Drip Irrigation** within the area(s) nominated in Appendix A.

Lot 2:

- The anticipated wastewater loading rates generated is calculated to be **960L/day.**
- Application of the effluent is proposed via **640m^2 Subsurface Drip Irrigation** within the area(s) nominated in Appendix A.

APPENDIX A: SITE PLAN

SEE SH.21 FOR LOT OSSM VIABILITY MAPPING



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- IPA / OPA — ASSET PROTECTION ZONES (APZs) (19kW)
- 40 / 20 — CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GW205107 [ID#] D:22.000m [DEPTH] WSZ 18.000mBGL [WATER BEARING ZONE BELOW GROUND LEVEL] — GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- BH2-B [ID#] SANDY CLAY [RESTRICTIVE SOIL TYPE] D:1.200m [SAMPLE DEPTH] — SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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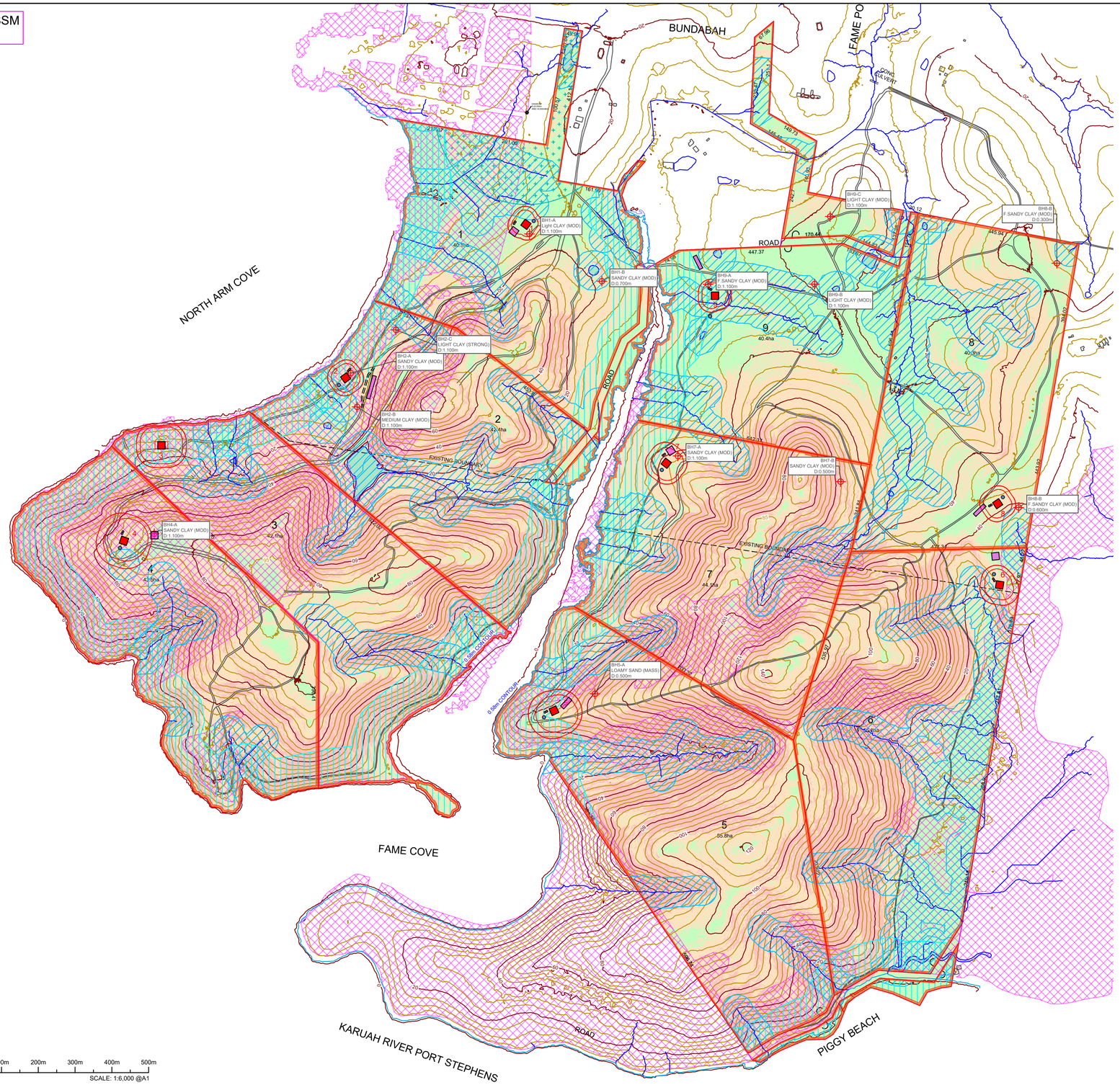
ENVIRONMENTAL FLOOD STORMWATER GEOTECHNICAL ACOUSTICS WASTEWATER
BROADCREST CONSULTING PTY LTD | ACN 622 508 187

PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: SUBDIVISION OVERVIEW (SATELLITE MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID: 4046-WW
SCALE: 1:12,000 @A3 / 1:6,000 @A1
SHEET NO.: 1 OF 21

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE MADE INCOMPLETE IF COPIED
0 5 10 15 20 25 30 35 40 45 50mm A3 0 10 20 30 40 50mm A1

SEE SH.21 FOR LOT OSSM VIABILITY MAPPING



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

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- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

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- ASSET PROTECTION ZONES (APZs) (19kW) — IPA / OPA
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES) — GW205107 [ID#] D:22.000m [DEPTH] WSZ 18.000mBGL [WATER BEARING ZONE BELOW GROUND LEVEL]
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION — BH2-B [ID#] SANDY CLAY [RESTRICTIVE SOIL TYPE] D:1.200m [SAMPLE DEPTH]
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
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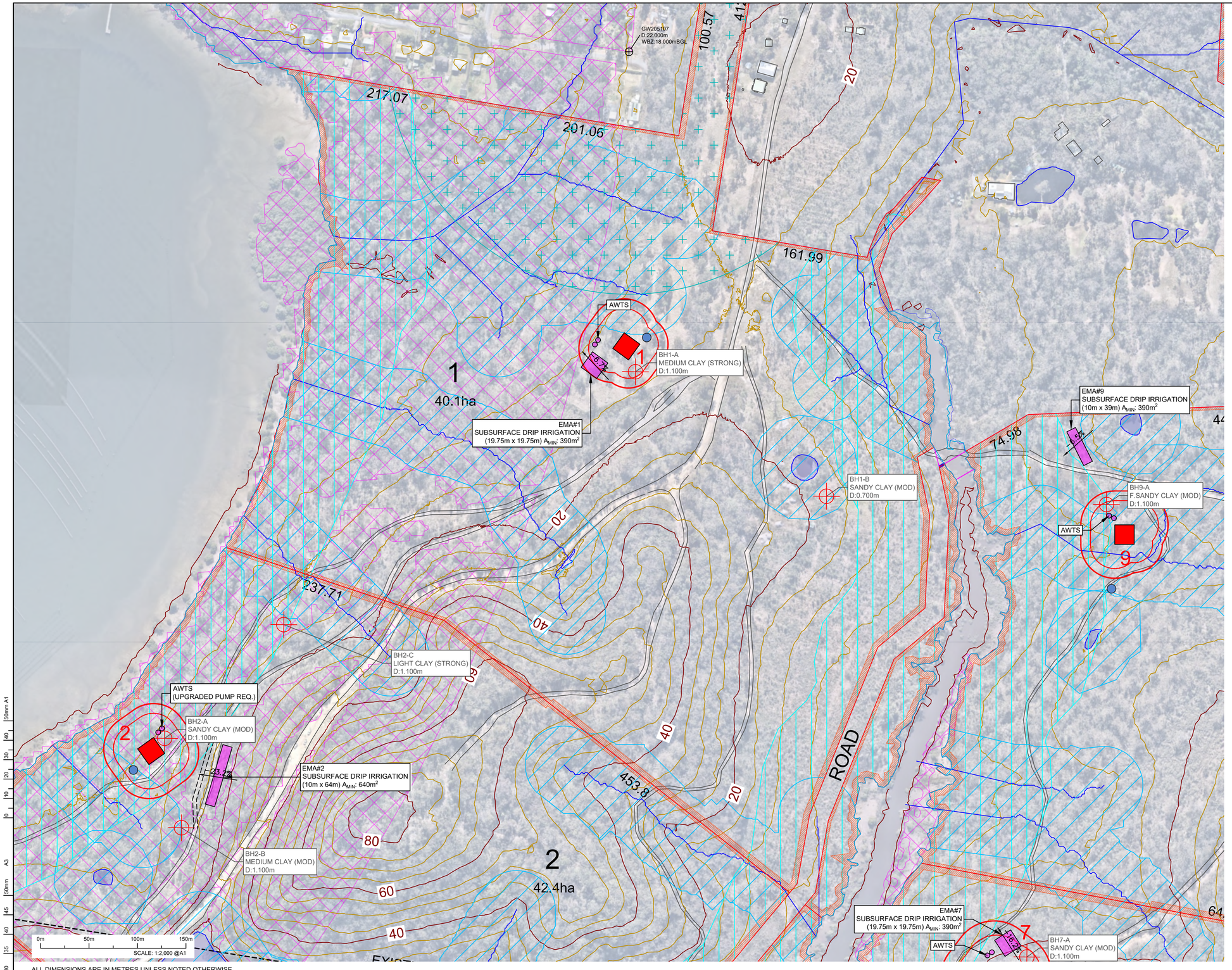
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: SUBDIVISION OVERVIEW (SLOPE HEAT MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID: 4046-WW
SCALE: 1:12,000 @A3, 1:6,000 @A1
SHEET NO.: 2 OF 21

N



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

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ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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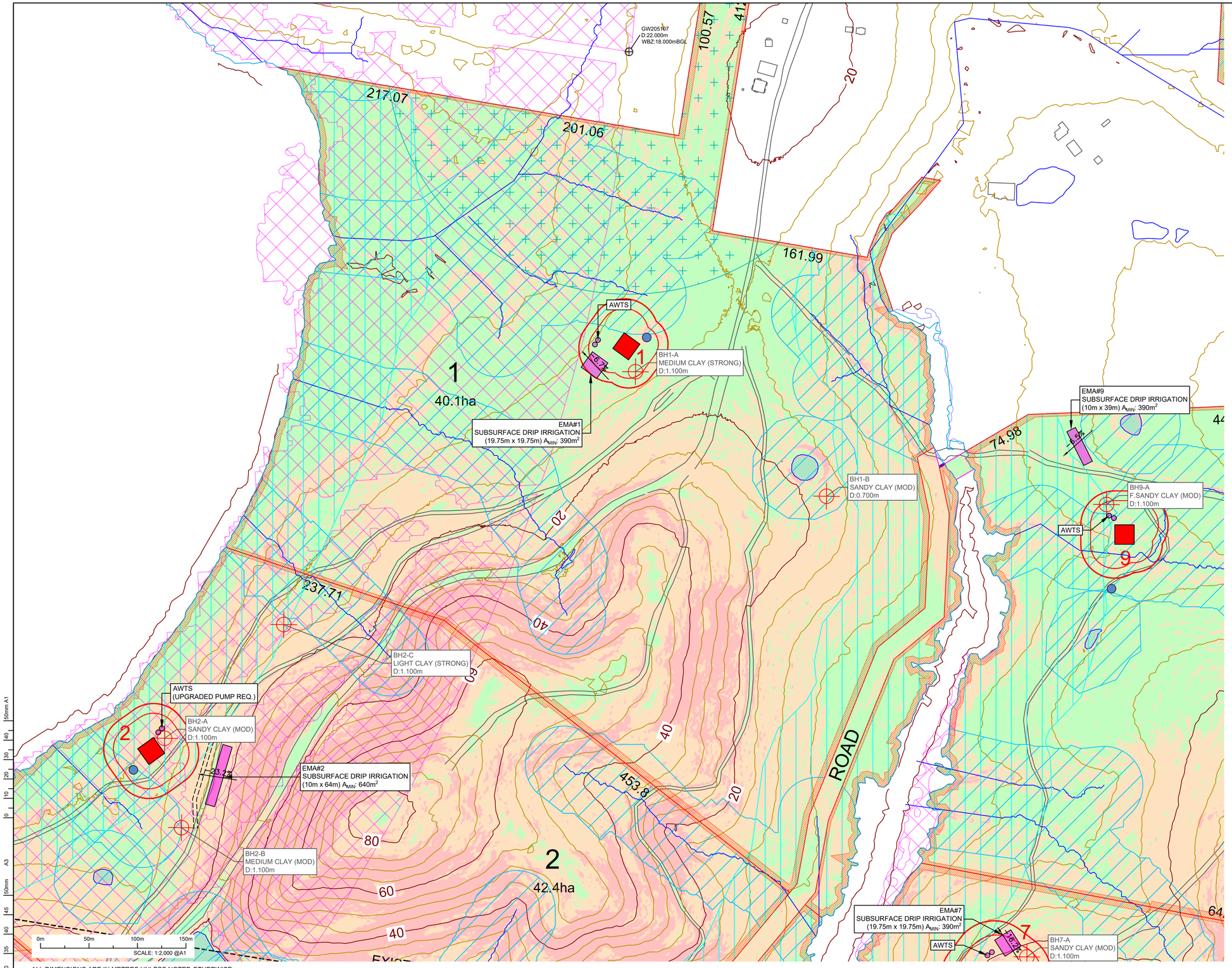
PROJECT DESCRIPTION	PROPOSED SUBDIVISION
PROJECT SITE	251 BUNDABAH ROAD, BUNDABAH NSW
LGA	MID-COAST COUNCIL
SHEET	LOT 1 (SATELLITE MAPPING)
PLAN	ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
CLIENT	TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	3 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- IPA / OPA — ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GW205107 [ID#] D:22.000m [DEPTH] WBZ:18.000mBGL [WATER BEARING ZONE BELOW GROUND LEVEL] — GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- BH2-B [ID#] SANDY CLAY [RESTRICTIVE SOIL TYPE] D:1.200m [SAMPLE DEPTH] — SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

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REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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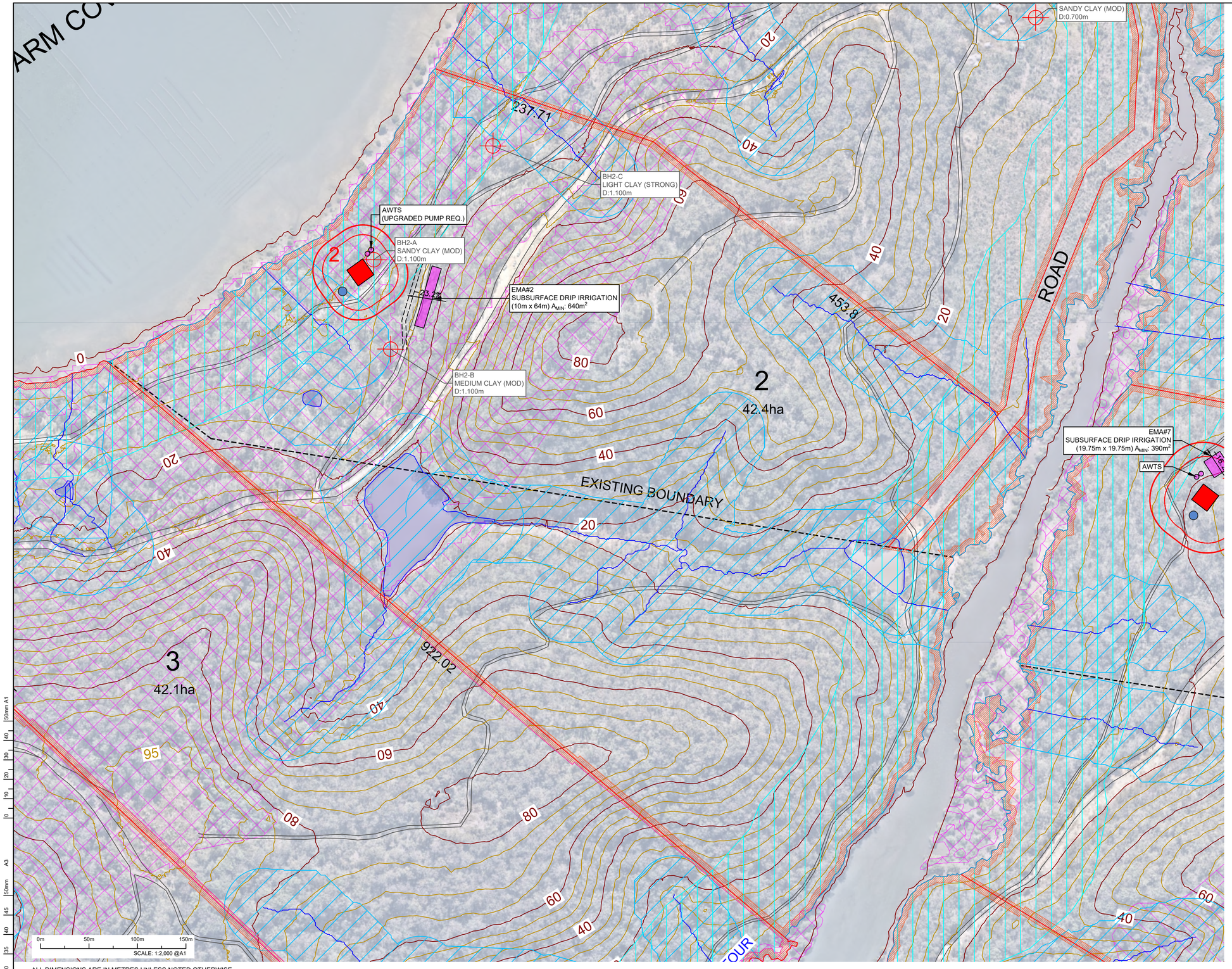
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 1 (SLOPE HEAT MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	4 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE MADE INCOMPLETE IF COPIED A3 50mm A1 594mm

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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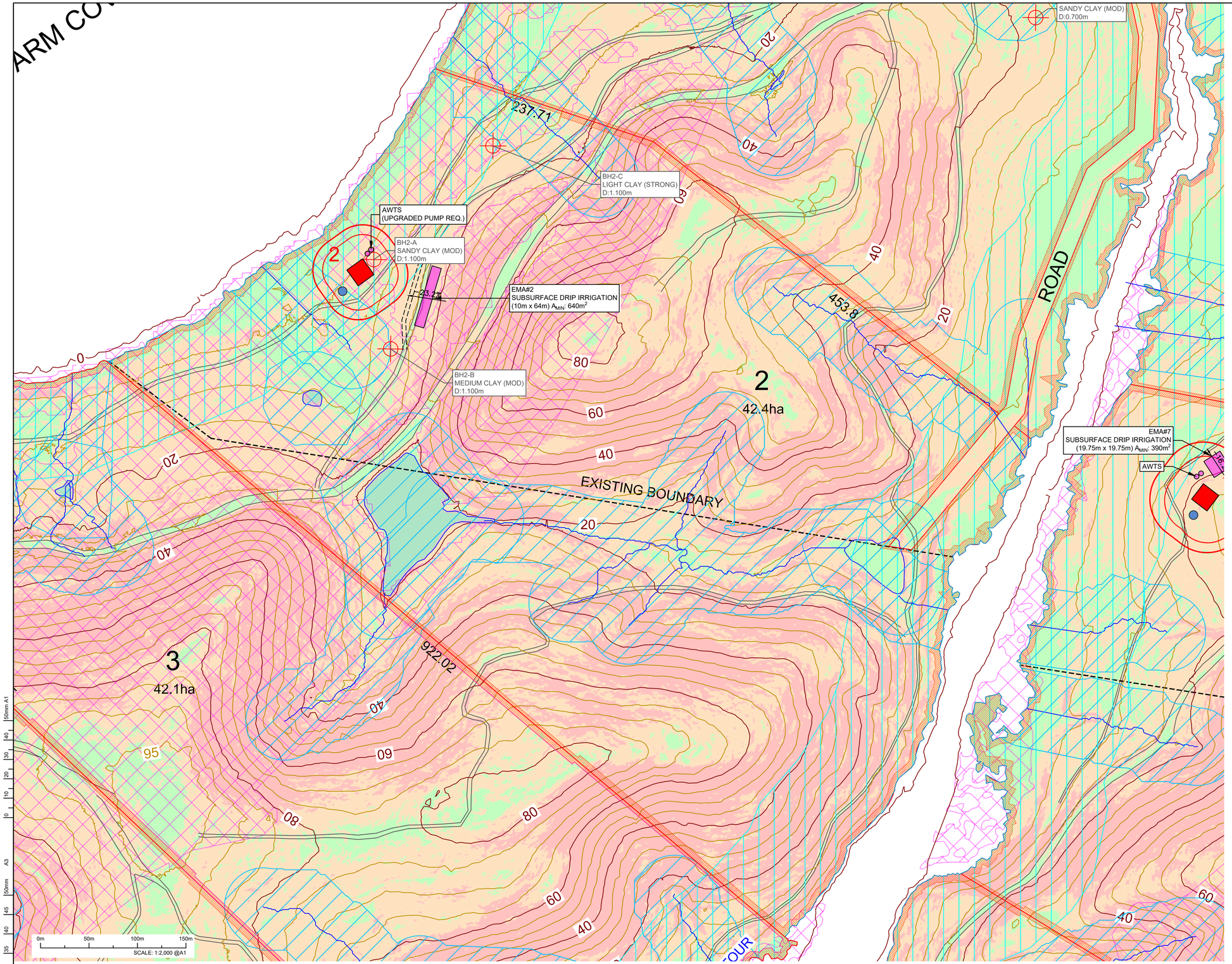
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 2 (SATELLITE MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	5 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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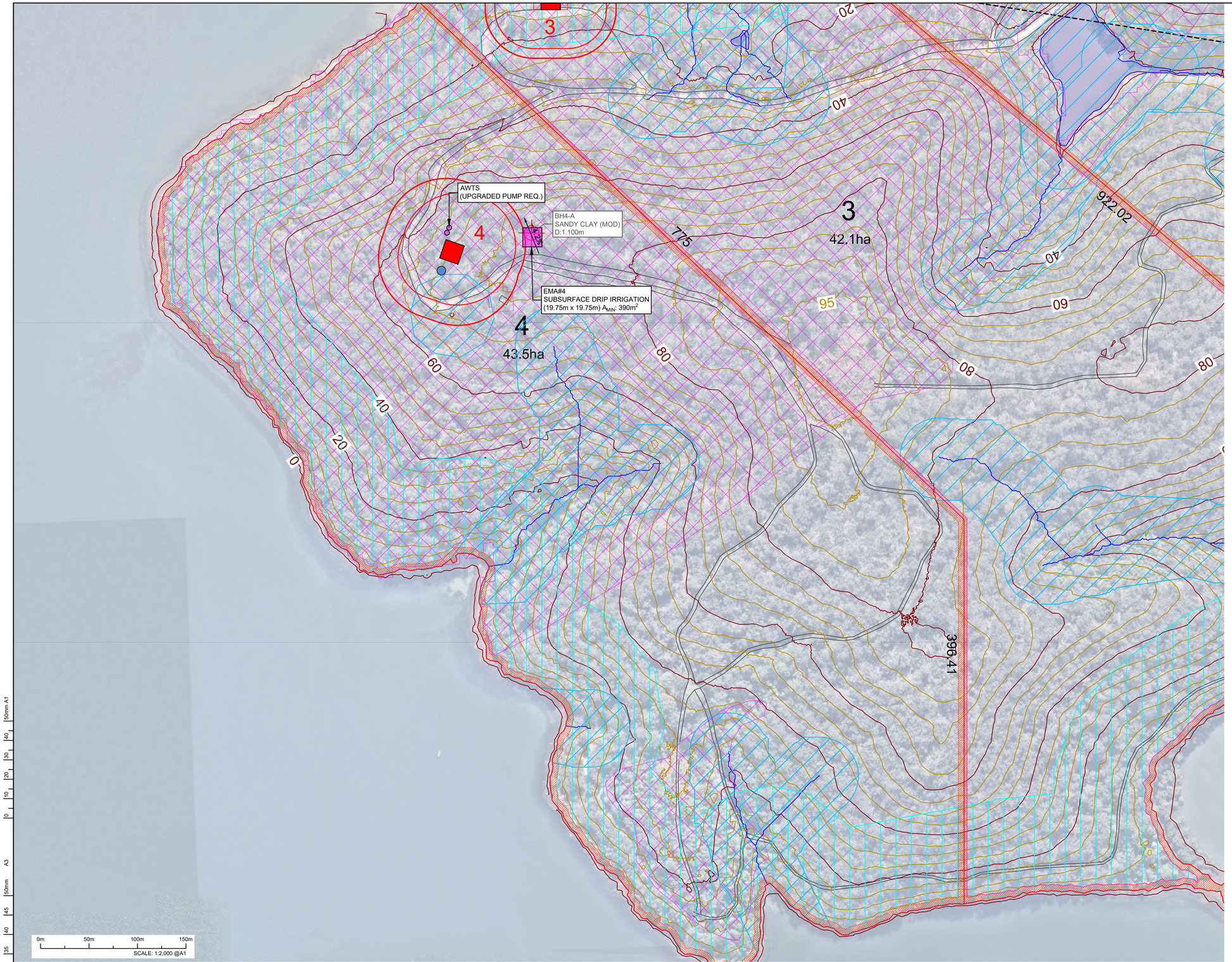
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 2 (SLOPE HEAT MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	6 OF 21

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE MADE INCOMPLETE IF COPIED



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

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REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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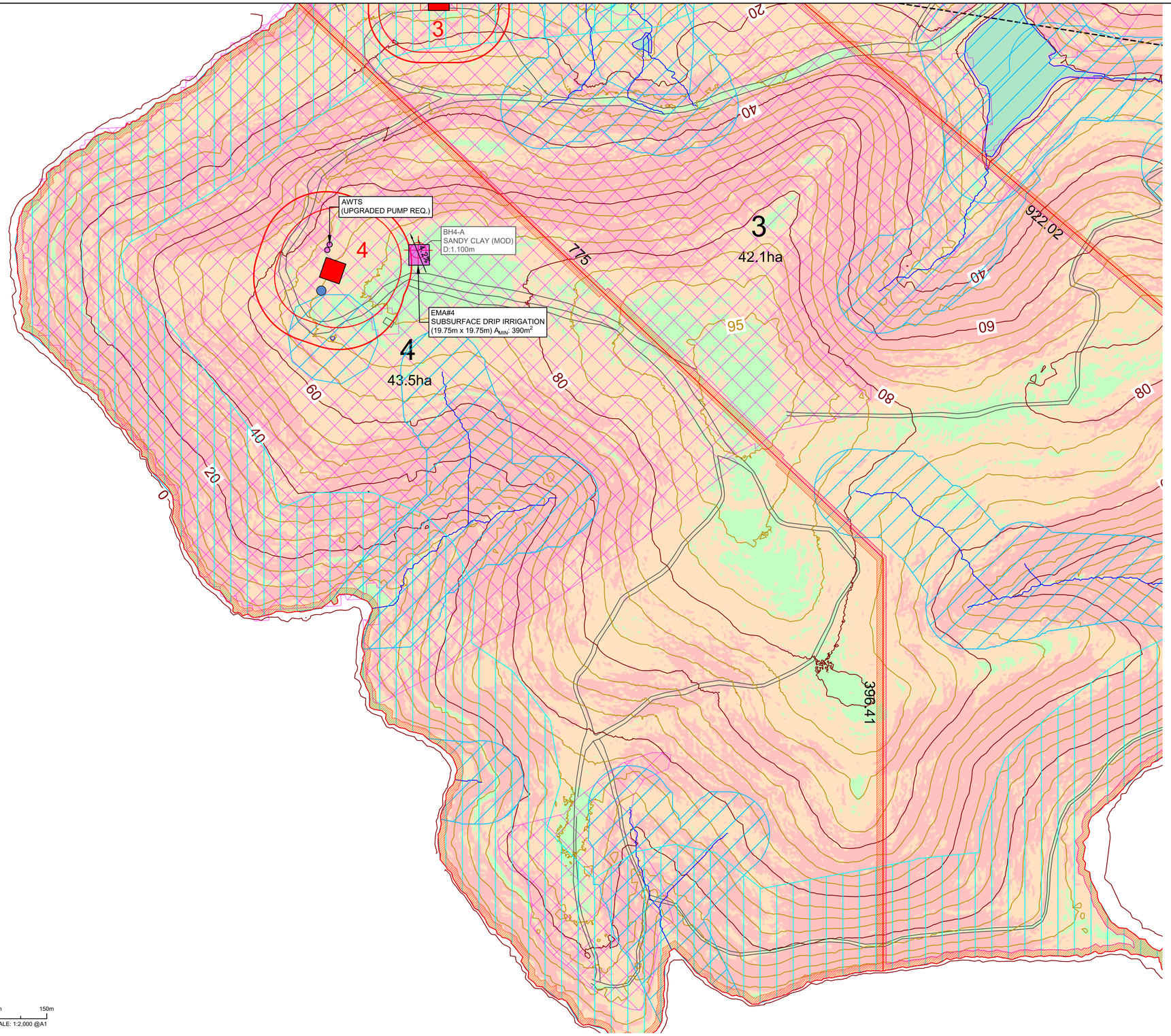
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 4 (SATELLITE MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	7 OF 21



0m 50m 100m 150m
SCALE: 1:2,000 @A1

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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0 5 10 15 20 25 30 35 40 45 50mm A3 0 10 20 30 40 50mm A1

KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW) (IPA / OPA)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES) [GW205107 [IDM] D:22.000m [DEPTH] WBZ:18.000mBGL [WATER BEARING ZONE BELOW GROUND LEVEL]]
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION [BH2-B [IDM] SANDY CLAY [RESTRICTIVE SOIL TYPE] D:1.200m [SAMPLE DEPTH]]
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
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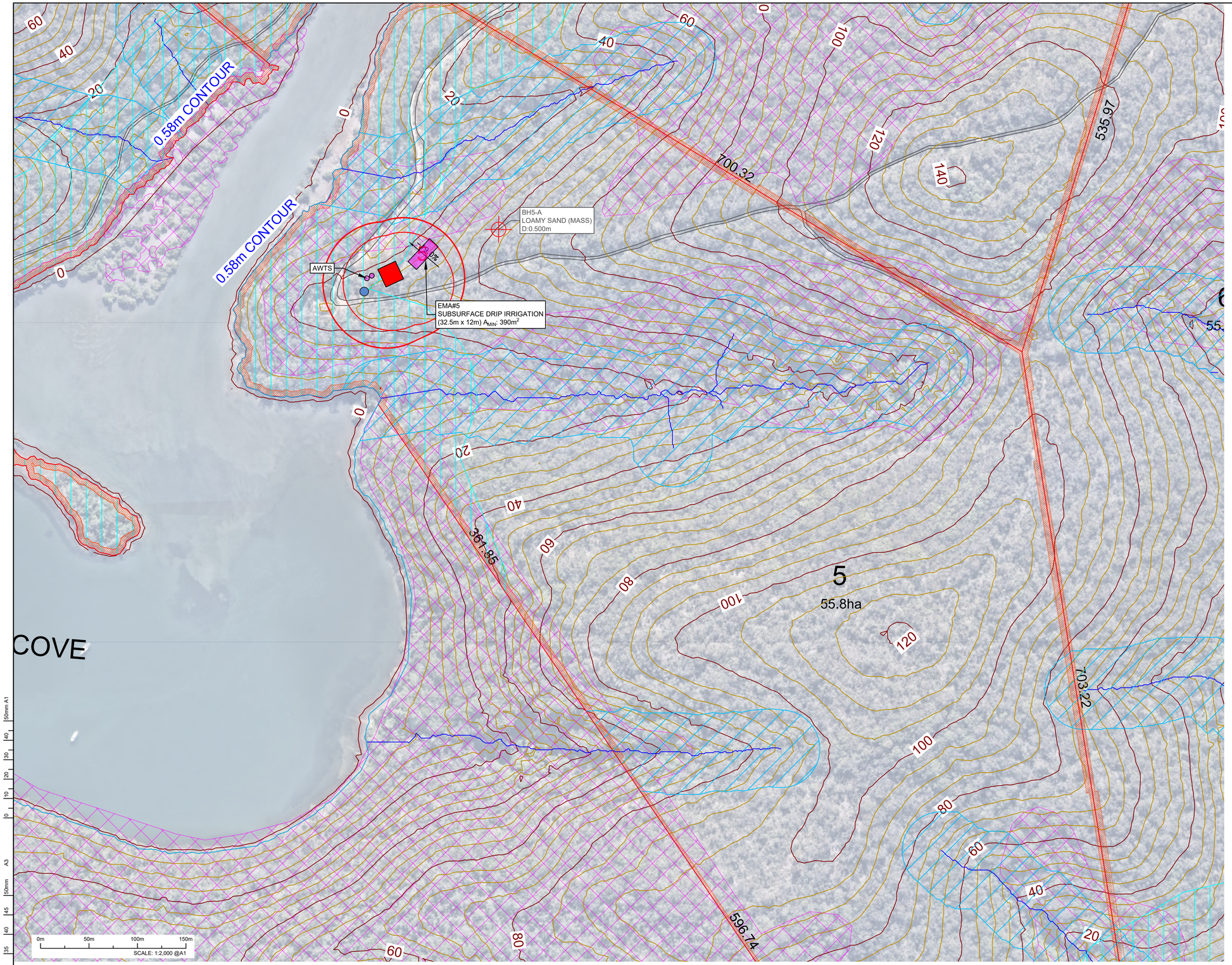
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 4 (SATELLITE MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	8 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
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- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
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- GROUNDWATER BORE SETBACK (250m)

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REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
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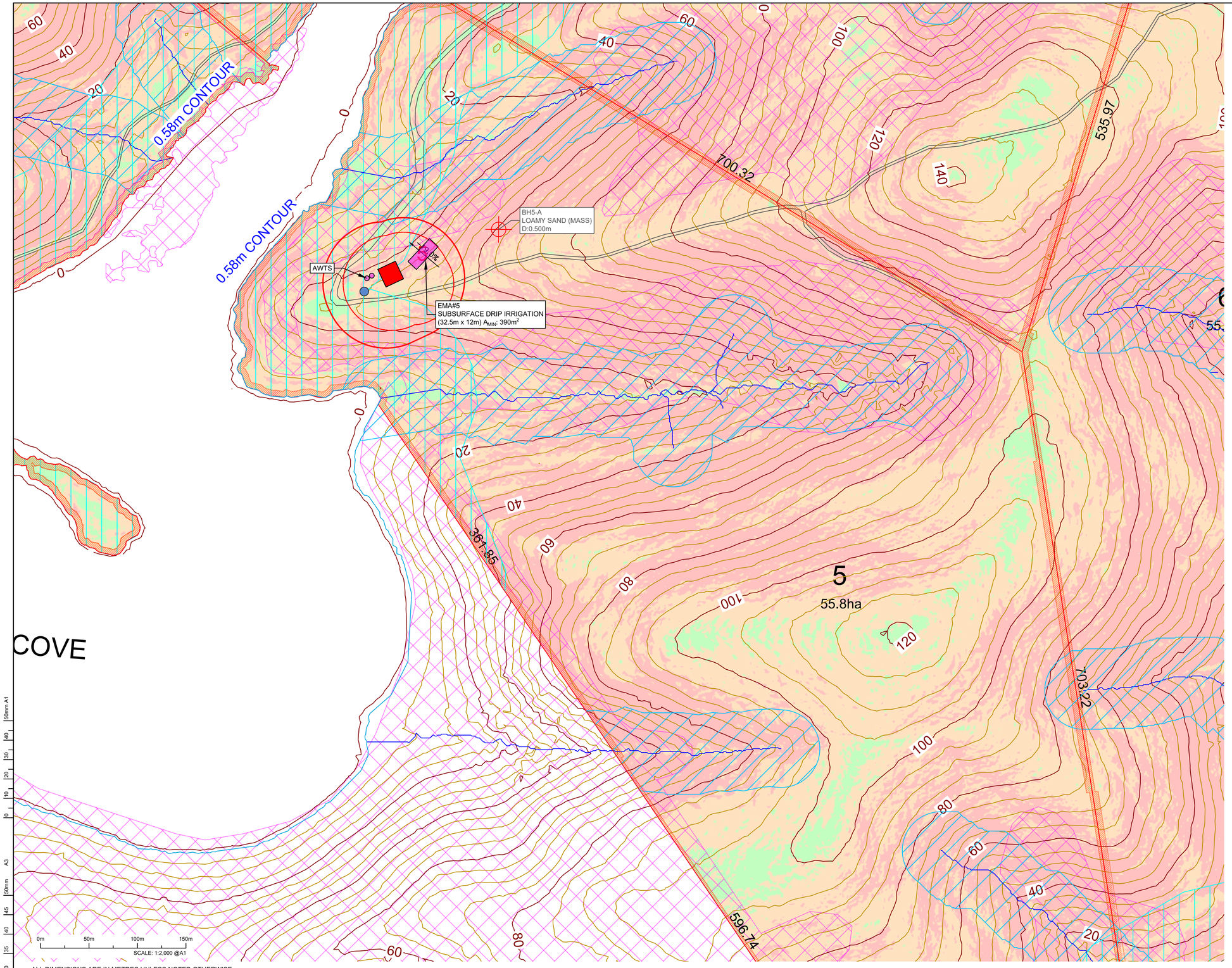
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 5 (SATELLITE MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	9 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
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- COASTAL WATERWAY MHWM (0.58mAHD)
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KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

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REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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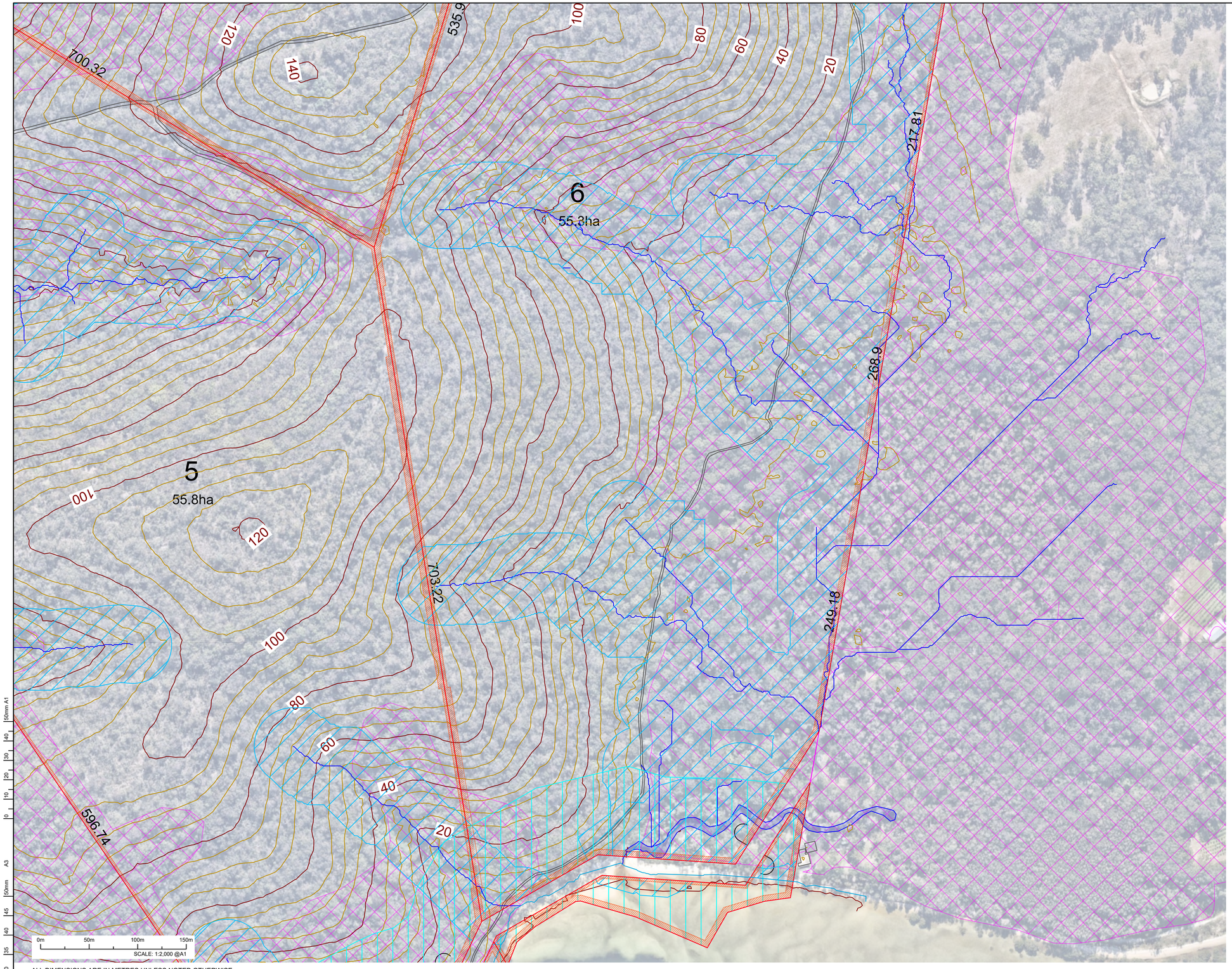
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 5 (SLOPE HEAT MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	10 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- NAMED WATERCOURSE & COASTAL WATERWAY MHWM SETBACK (100m)
- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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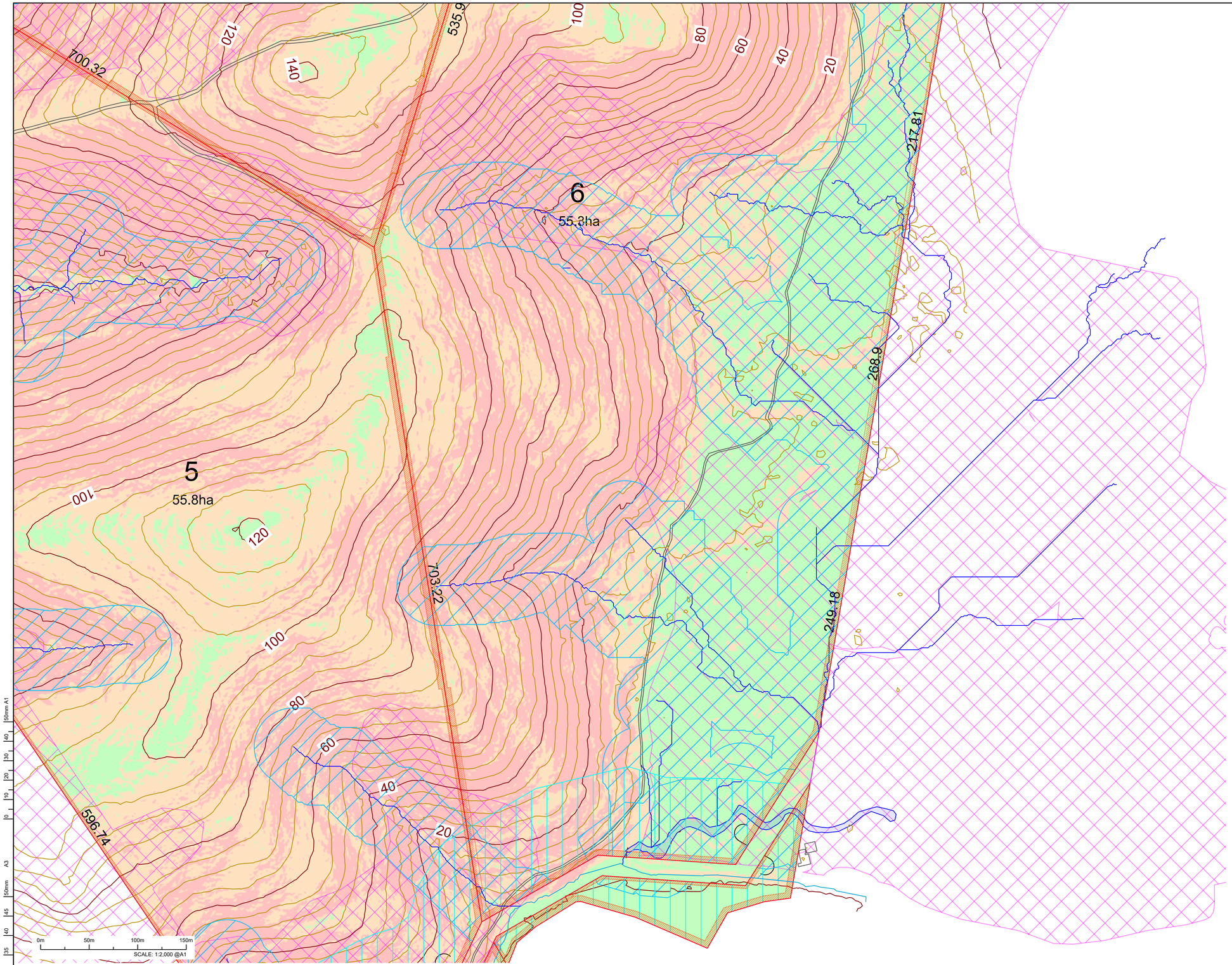
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 6 (1 OF 2) (SATELLITE MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	11 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- IPA / OPA — ASSET PROTECTION ZONES (APZs) (19kW)
- 40 / 20 — CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GW205107 [ID#] D:22.000m [DEPTH] WBZ:18.000mBGL [WATER BEARING ZONE BELOW GROUND LEVEL] — GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- BH2-B [ID#] SANDY CLAY [RESTRICTIVE SOIL TYPE] D:1.200m [SAMPLE DEPTH] — SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
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- GROUNDWATER BORE SETBACK (250m)

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A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
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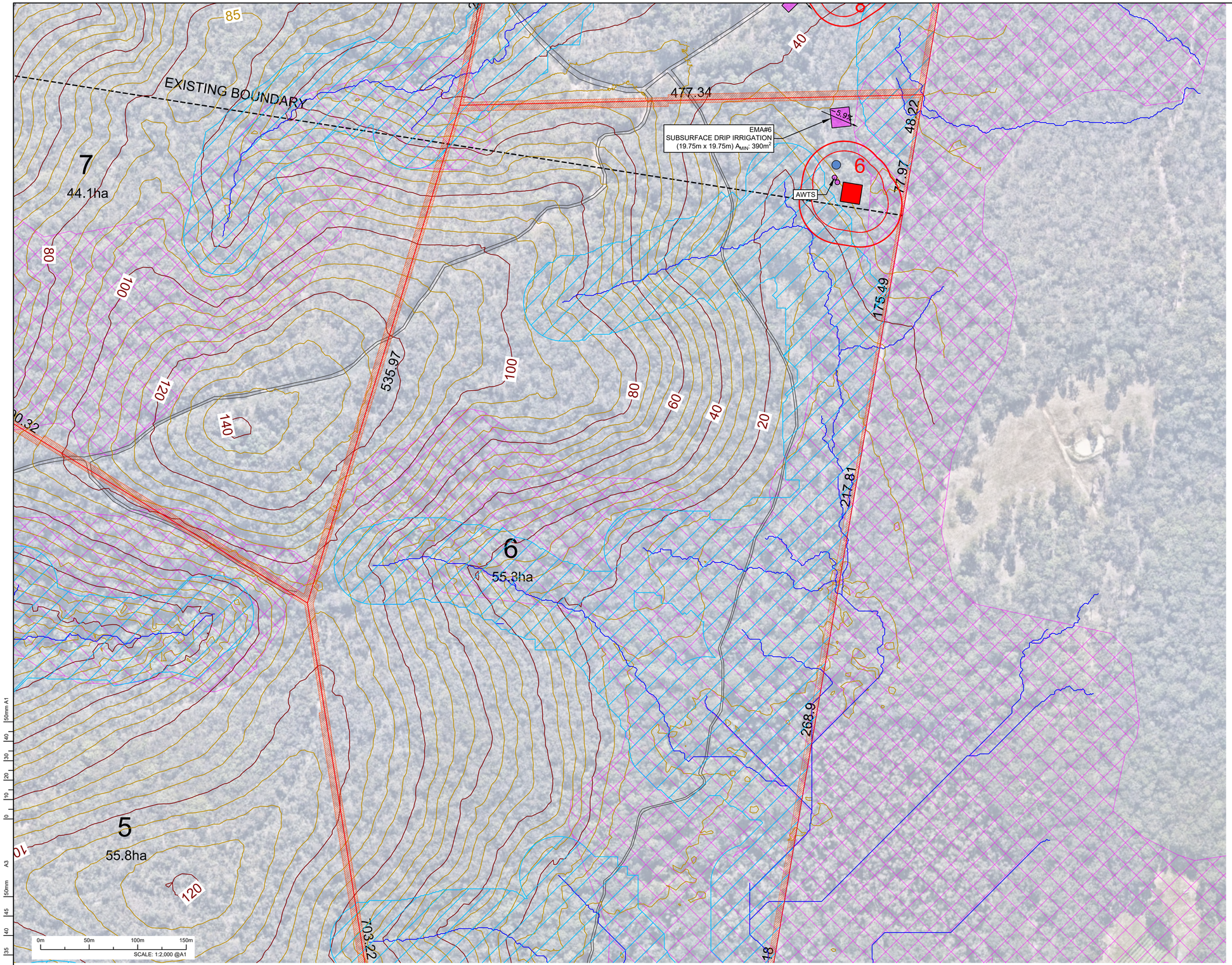
PROJECT DESCRIPTION	PROPOSED SUBDIVISION
PROJECT SITE	251 BUNDABAH ROAD, BUNDABAH NSW
LGA	MID-COAST COUNCIL
SHEET	LOT 6 (1 OF 2) (SLOPE HEAT MAPPING)
PLAN	ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
CLIENT	TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	12 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

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KEY - SUBDIVISION FEATURES

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KEY - WASTEWATER & CONSTRAINT MAPPING

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REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
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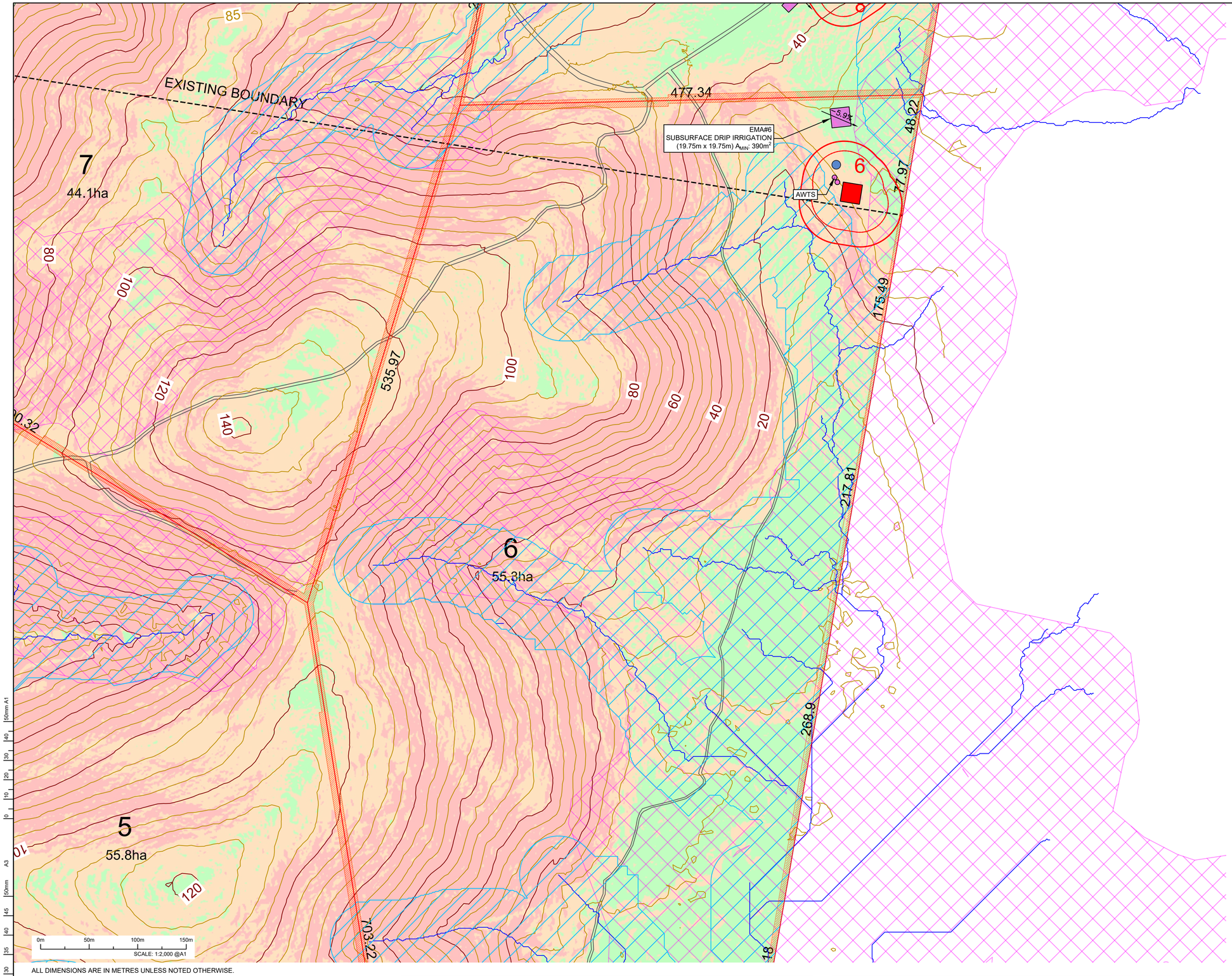
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 6 (2 OF 2) (SATELLITE MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	13 OF 21



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

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KEY - SUBDIVISION FEATURES

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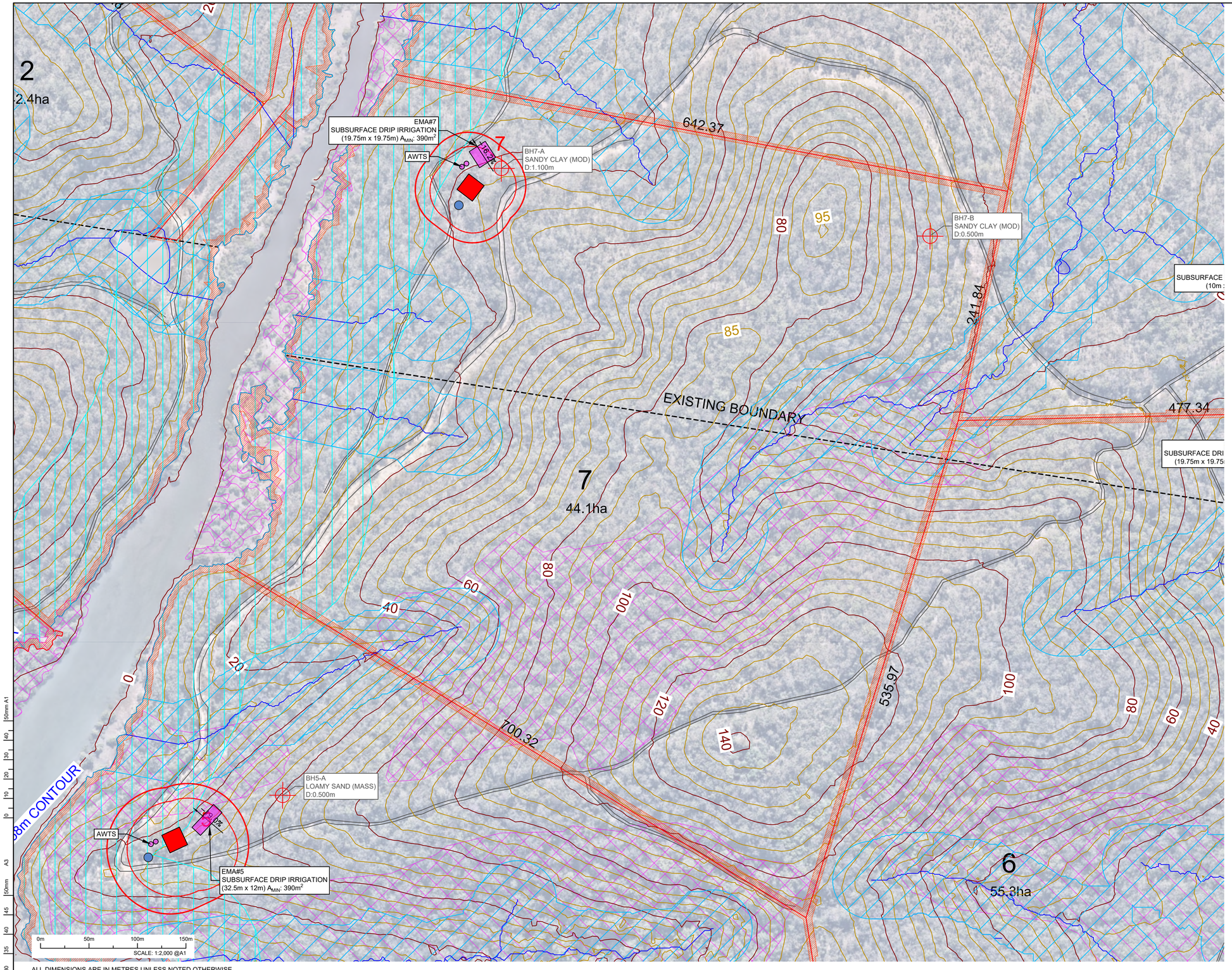
PROJECT DESCRIPTION	PROPOSED SUBDIVISION
SHEET	LOT 6 (2 OF 2) (SLOPE HEAT MAPPING)
PROJECT SITE	251 BUNDABAH ROAD, BUNDABAH NSW
PLAN	ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA	MID-COAST COUNCIL
CLIENT	TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	14 OF 21



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- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW) (IPA / OPA)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES) [GW205107 [ID#] D:22.000m [DEPTH] WSZ:18.000mBGL [WATER BEARING ZONE BELOW GROUND LEVEL]]
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
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- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION [BH2-B [ID#] SANDY CLAY [RESTRICTIVE SOIL TYPE] D:1.200m [SAMPLE DEPTH]]
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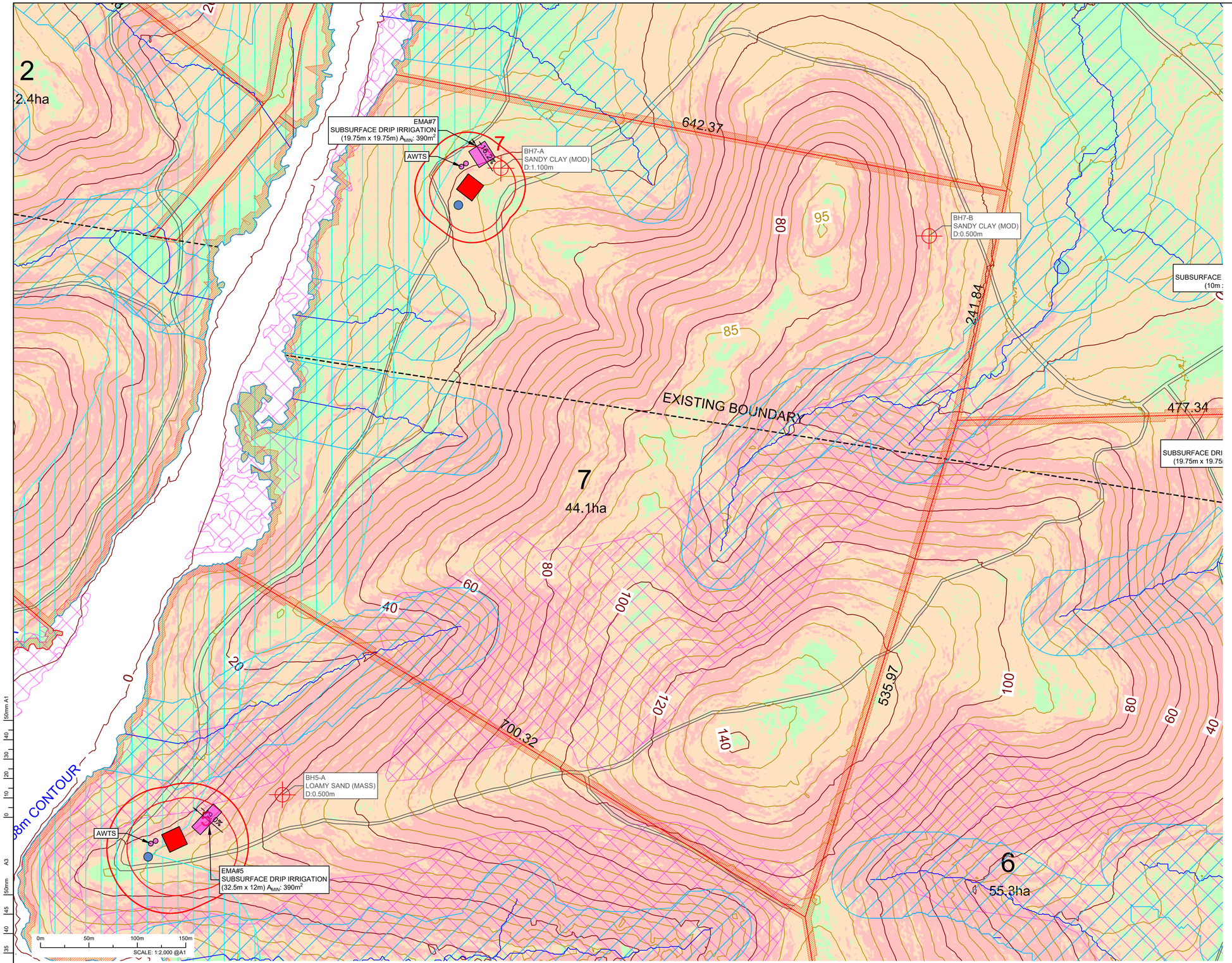
PROJECT DESCRIPTION	PROPOSED SUBDIVISION
PROJECT SITE	251 BUNDABAH ROAD, BUNDABAH NSW
LGA	MID-COAST COUNCIL
SHEET	LOT 7 (SATELLITE MAPPING)
PLAN	ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
CLIENT	TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	15 OF 21



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KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

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KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
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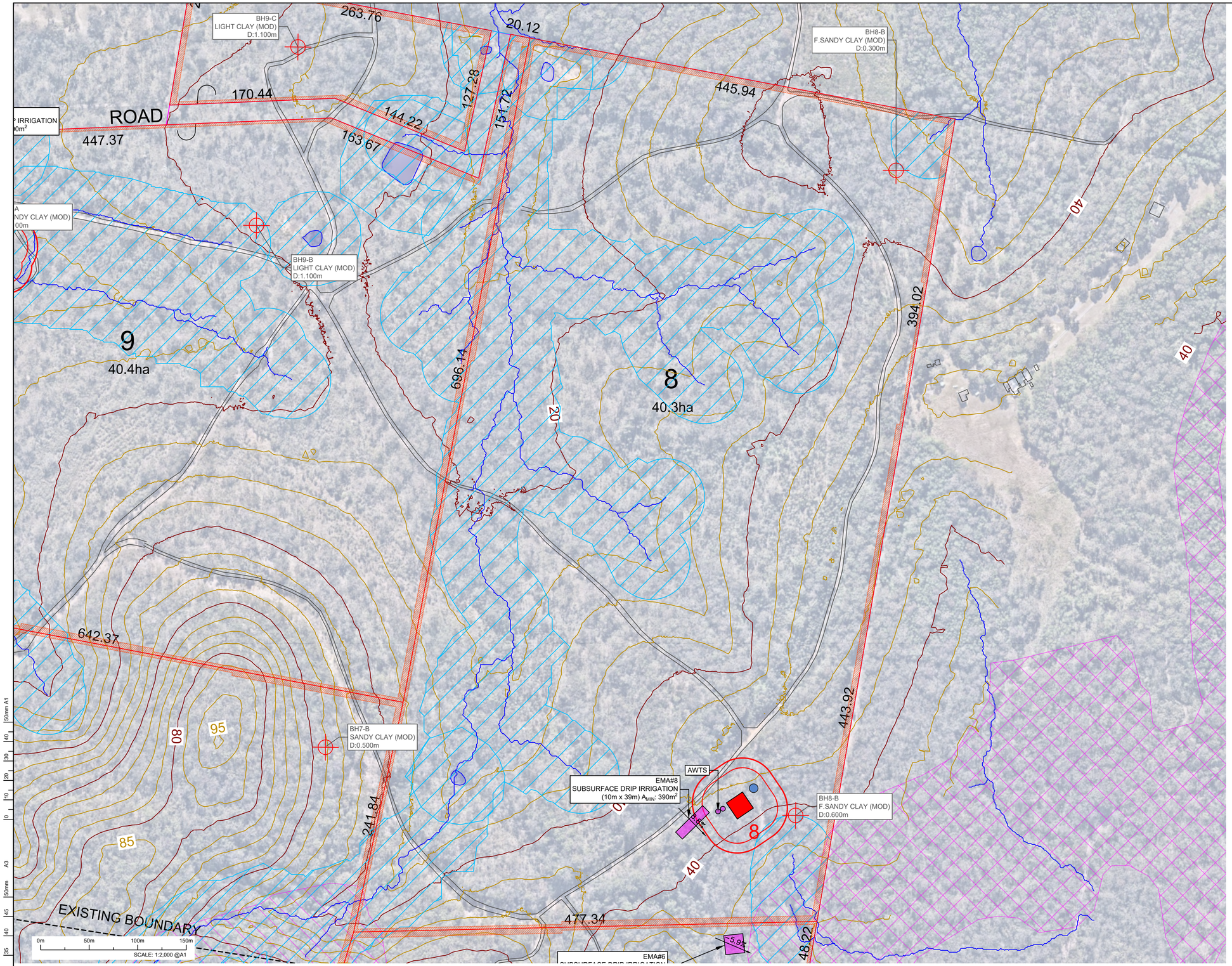
PROJECT DESCRIPTION	PROPOSED SUBDIVISION
PROJECT SITE	251 BUNDABAH ROAD, BUNDABAH NSW
LGA	MID-COAST COUNCIL
SHEET	LOT 7 (SLOPE HEAT MAPPING)
PLAN	ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
CLIENT	TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	16 OF 21



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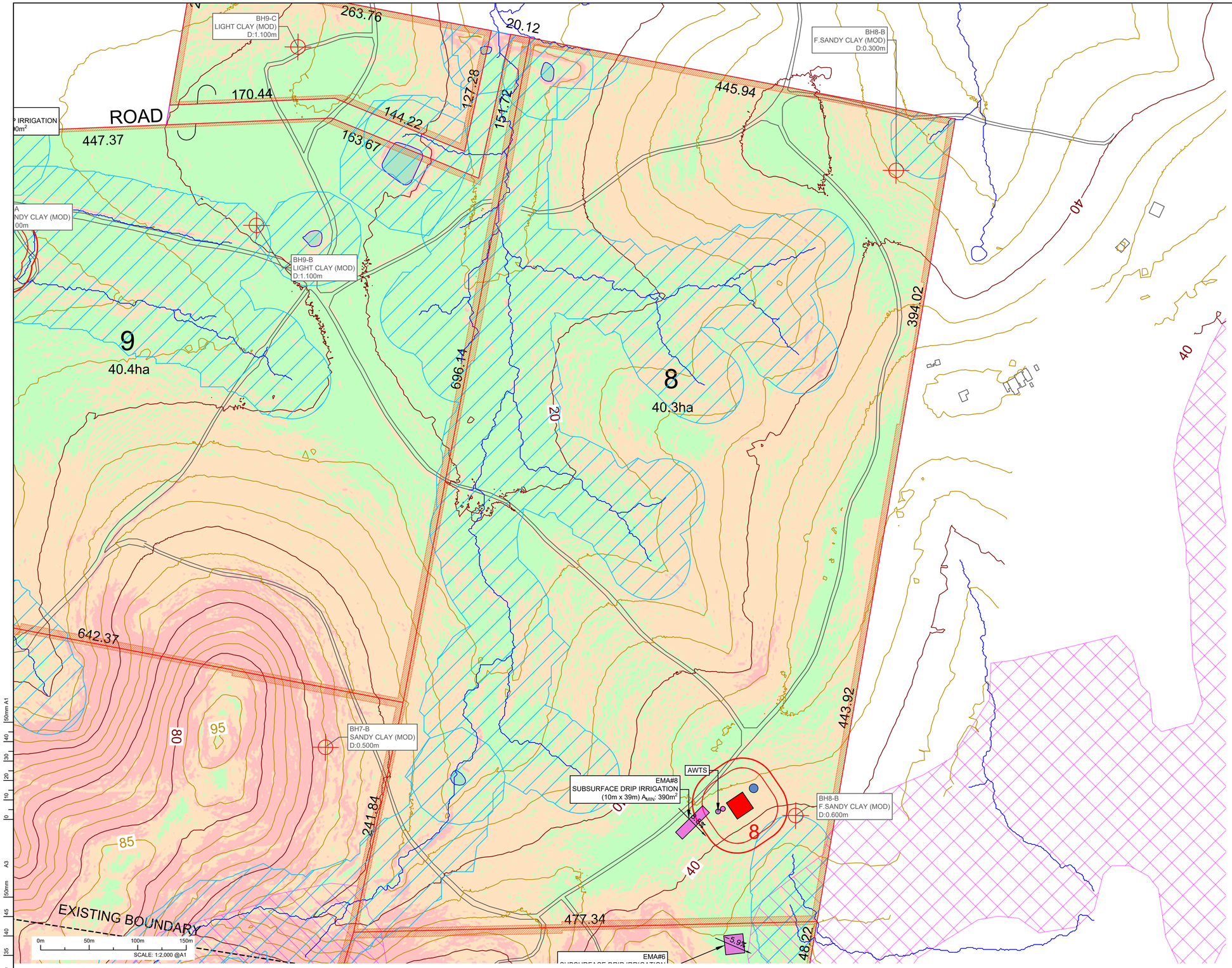
PROJECT DESCRIPTION	PROPOSED SUBDIVISION
PROJECT SITE	251 BUNDABAH ROAD, BUNDABAH NSW
LGA	MID-COAST COUNCIL
SHEET	LOT 8 (SATELLITE MAPPING)
PLAN	ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
CLIENT	TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	17 OF 21

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE MADE INCOMPLETE IF COPIED
50mm A1 40 30 20 10 0 A3 50mm 45 40 35 30 25 20 15 10 5 0



KEY - SLOPE HEAT MAPPING [EFFLUENT DISPOSAL]

- SURFACE IRRIGATION SUITABLE (≤10% SLOPE)
- SUB-SURFACE IRRIGATION SUITABLE (10%-30% SLOPE)
- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

KEY - SUBDIVISION FEATURES

- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
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- BOUNDARY SETBACK (6m DOWN-SLOPE & 3m UP-SLOPE [OF E.M.A.])
- GROUNDWATER BORE SETBACK (250m)

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-02	19-02-25	RS	RS	CH	UPDATED APZS
A-01	18-12-24	KR	RS	CH	ISSUE FOR DEVELOPMENT APPLICATION
PRE-1	18-11-24	CH	RS	CH	PRELIMINARY FOR CLIENT REVIEW

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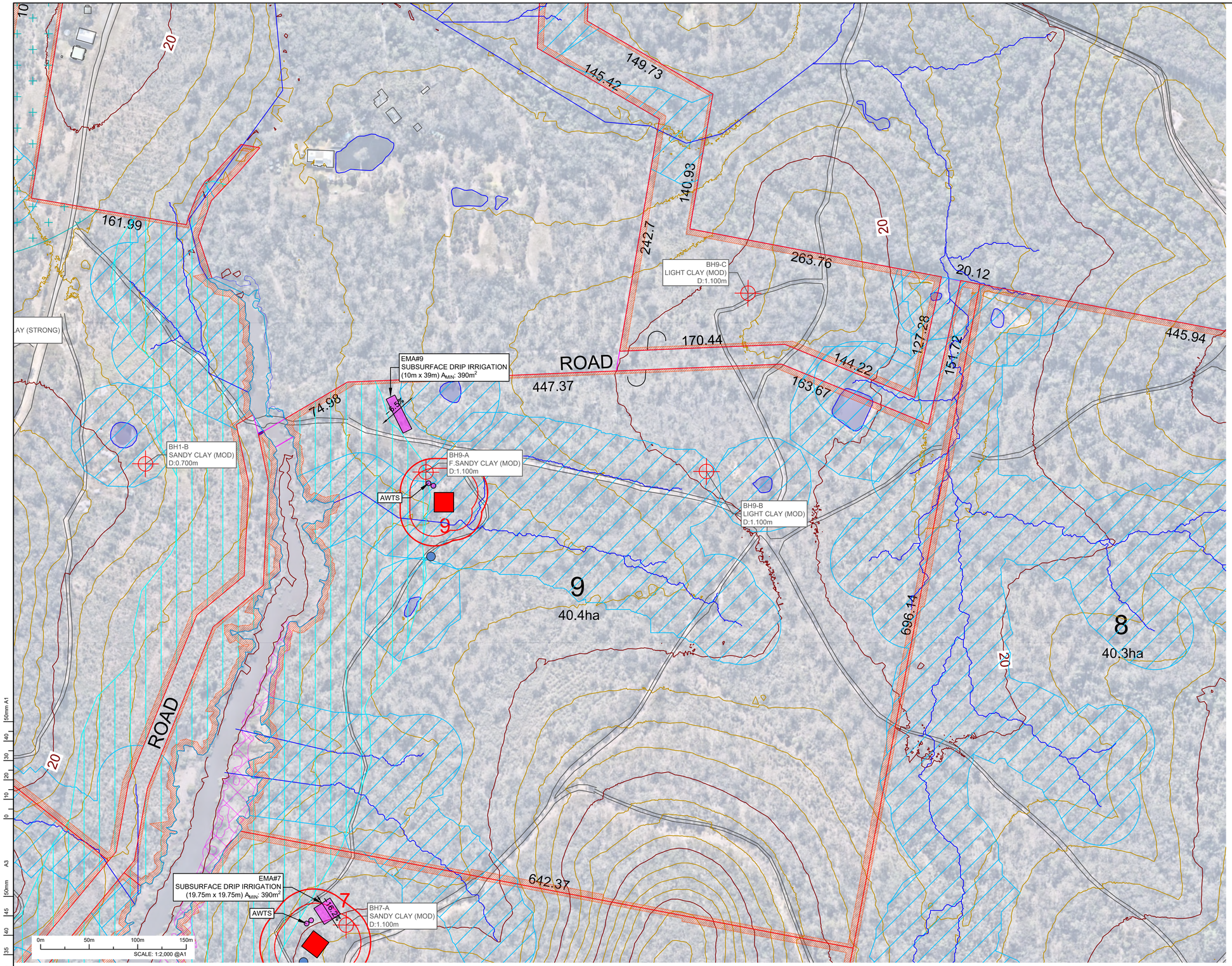
BROADCREST CONSULTING PTY LTD | ACN 622 508 187

PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 8 (SLOPE HEAT MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	18 OF 21



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- UNSUITABLE FOR EFFLUENT DISPOSAL (>30% SLOPE)

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- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
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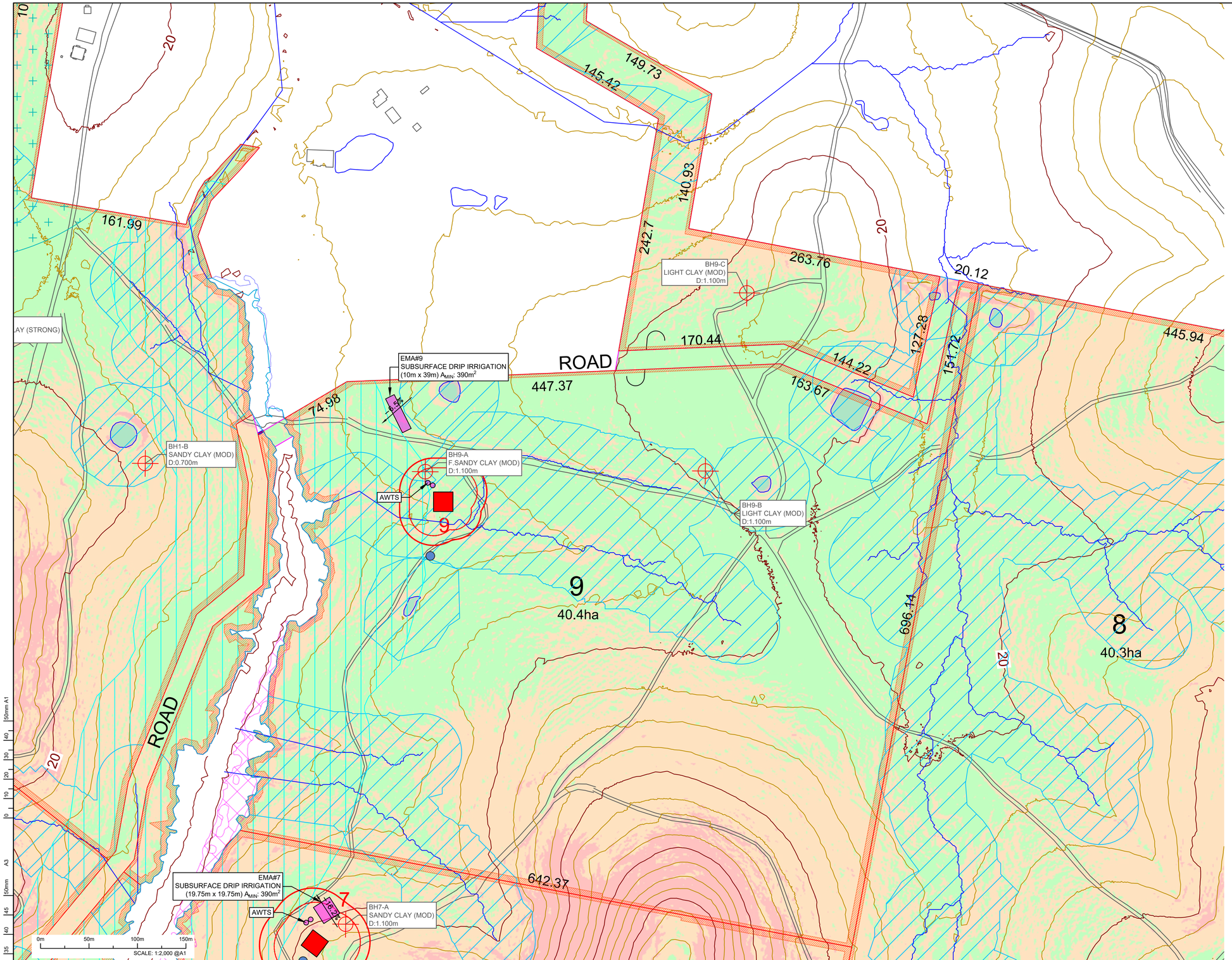
BROADCREST CONSULTING PTY LTD | ACN 622 508 187

PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 9 (SATELLITE MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	19 OF 21



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- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- ASSET PROTECTION ZONES (APZs) (19kW)
- CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
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BROADCREST CONSULTING PTY LTD | ACN 622 508 187

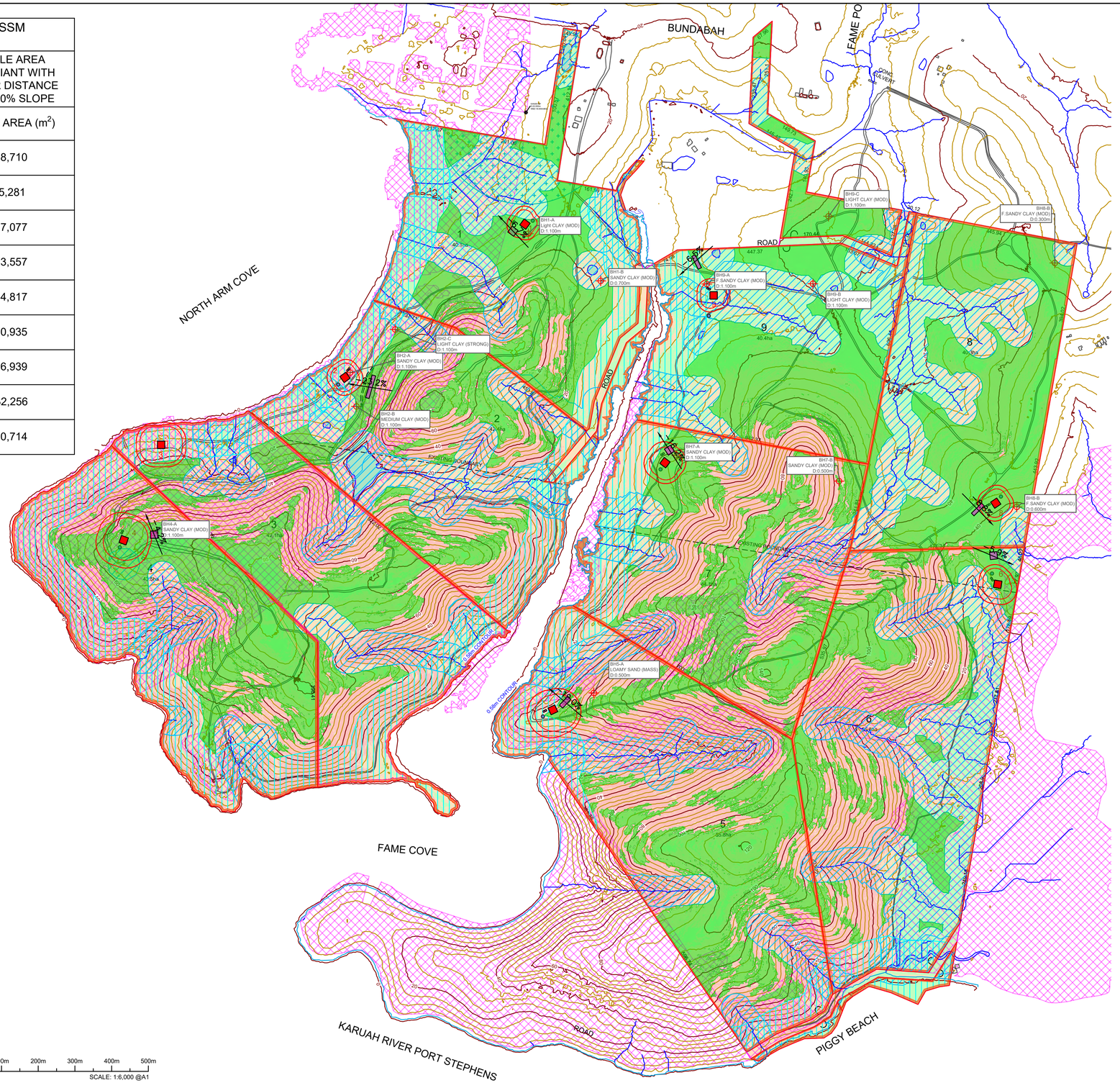
PROJECT DESCRIPTION: PROPOSED SUBDIVISION	SHEET: LOT 9 (SLOPE HEAT MAPPING)
PROJECT SITE: 251 BUNDABAH ROAD, BUNDABAH NSW	PLAN: ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
LGA: MID-COAST COUNCIL	CLIENT: TEA GARDEN FARMS

PROJECT ID	4046-WW
SCALE	1:4,000 @ A3 1:2,000 @ A1
SHEET NO.	20 OF 21

KEY & SCHEDULE - OSSM USABLE AREA

USABLE AREA COMPLIANT WITH BUFFER DISTANCE AND ≤30% SLOPE

LOT	VIABLE AREA (m^2)
1	148,710
2	85,281
3	107,077
4	143,557
5	164,817
6	110,935
7	136,939
8	232,256
9	190,714



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- PROPOSED LOT BOUNDARIES
- POTENTIAL HOUSE SITE (20m x 20m)
- DRIVEWAYS / ACCESS-WAYS
- WATER TANKS (POTABLE SUPPLY; INDICATIVE; Ø9m)
- IPA / OPA — ASSET PROTECTION ZONES (APZs) (19kW)
- 40 / 20 — CONTOURS (INDICATIVE) (5m MINOR & 20m MAJOR INTERVAL) (NSW GOV. 2012 LiDAR)
- GW205107 [ID#] D:22.000m [DEPTH] WSZ 18.000mBGL [WATER BEARING ZONE BELOW GROUND LEVEL] — GROUNDWATER BORE LOCATION (WATERNSW GROUNDWATER SITES)
- UNNAMED WATERCOURSES (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
- WATER BODIES (DAMS, PONDS, ETC) (DEFINED BY SURVEY)
- COASTAL WATERWAY MHWM (0.58mAHD)
- BIODIVERSITY VALUES MAPPING (NSW ENVIRONMENT & HERITAGE)

KEY - WASTEWATER & CONSTRAINT MAPPING

- BH2-B [ID#] SANDY CLAY [RESTRICTIVE SOIL TYPE] D:1.200m [SAMPLE DEPTH] — SOIL BOREHOLE SAMPLE LOCATION
- INDICATIVE ON-SITE AERATED WASTEWATER WASTEWATER TREATMENT SYSTEM (AWTS)
- EFFLUENT MANAGEMENT AREA (E.M.A.) (SUBSURFACE DRIP IRRIGATION)
- UNNAMED WATERWAY SETBACK (40m) (DEFINED BY STRAHLER ANALYSIS 7TH ORDER CONFLUENCE)
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PROJECT DESCRIPTION	PROPOSED SUBDIVISION
PROJECT SITE	251 BUNDABAH ROAD, BUNDABAH NSW
LGA	MID-COAST COUNCIL
SHEET	OSSM USABLE LAND MAPPING
PLAN	ON-SITE WASTEWATER CONSTRAINTS ANALYSIS
CLIENT	TEA GARDEN FARMS
PROJECT ID	4046-WW
SCALE	1:12,000 @A3 1:6,000 @A1
SHEET NO.	21 OF 21

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE MADE INCOMPLETE IF COPIED
0 5 10 15 20 25 30 35 40 45 50mm A3 0 10 20 30 40 50mm A1

APPENDIX B: CLIMATE & NUTRIENT DATA

B1. - Climate Statistics

Table B1.1. Weather Stations

Statistic	Station No.	Station Name	Distance from site [km]
Temperature	61078	WILLIAMTOWN RAAF	26.02
Precipitation	61072	TAHLEE (CARRINGTON (CHURCH ST))	4.93
Evaporation	61078	WILLIAMTOWN RAAF	26.02

Figure B.1 - Monthly Cimate Statistics

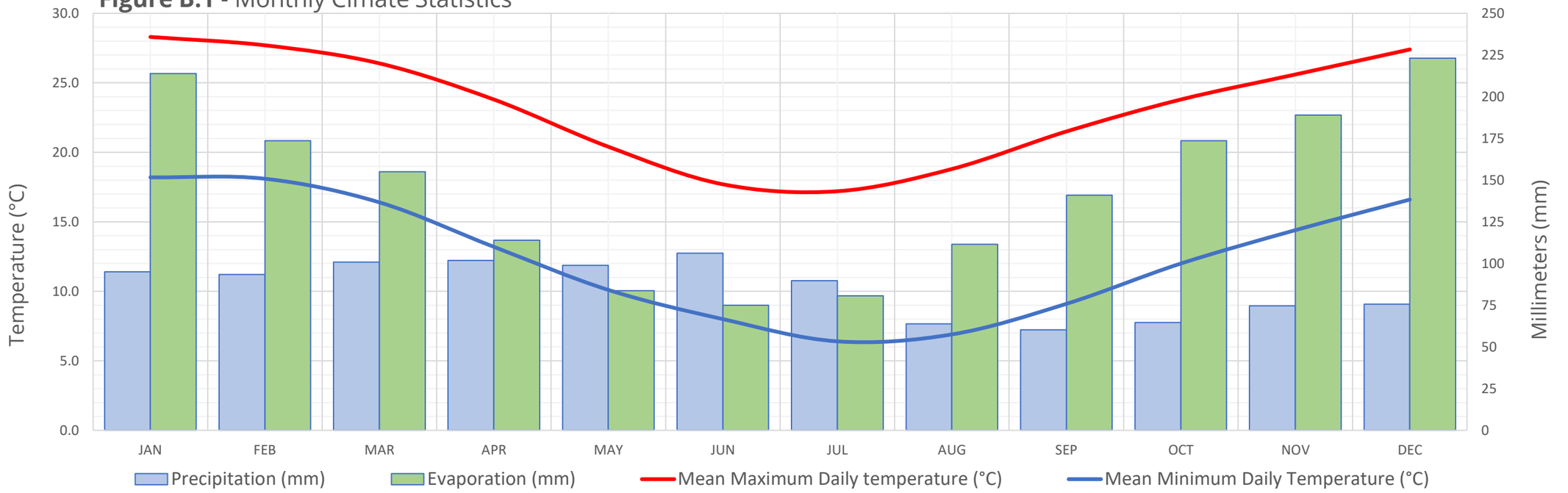


Table B1.2. Site Climate Statistics

Site Factors	Symbol	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Mean Max. Temperature	[T]	[°C]	**28.3**	27.7	26.4	23.8	20.4	17.7	17.2	18.8	21.5	23.8	25.6	27.4	23.2
Mean Min. Temperature	[T]	[°C]	18.2	18.1	16.4	13.2	10.1	8.0	**6.4**	6.9	9.1	12.0	14.4	16.6	12.4
Days	[D]		31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation[1]	[P]	[mm/month]	95	93.4	100.8	101.9	98.9	106.2	89.7	63.9	60.2	64.7	74.7	75.7	1154.3
Evaporation	[E]	[mm/day]	6.9	6.2	5	3.8	2.7	2.5	2.6	3.6	4.7	5.6	6.3	7.2	4.8
		[mm/month]	213.9	173.6	155	114	83.7	75	80.6	111.6	141	173.6	189	223.2	1752
Natural Site Balance[2]	[P-E]	[mm/month]	-118.9	-80.2	-54.2	-12.1	15.2	31.2	9.1	-47.7	-80.8	-108.9	-114.3	-147.5	

[1] Median historic precipitation. Note: total is not equivalent to annual median.

[2] Negative value indicates monthly mean evaporation > precipitation

Table B3.1. Nitrogen Balance

Parameter	**Symbols**	**Values**	**Units**
Design Wastewater Flowrate	Q	960	L/day
Surface Vegetation	Lawn - fully managed (clippings removed)		
Effluent Total Nitrogen (TN) Concentration[1]	TN	20	mg/L
Critical TN Loading Rate[2]	$L_{n.sfc}$	66	$mg/m^2/day$
Minimum Application Area	$A_{n.sfc}$	**292**	m^2

[1.] Nominal ATWS Nutrient Concerntrations (DLG 1998, AS1547.3:2012)

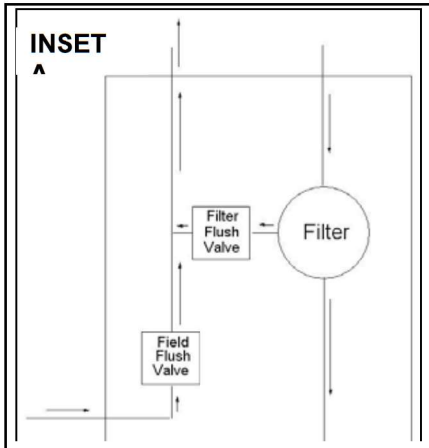
Table B3.2. Phosphorus Balance

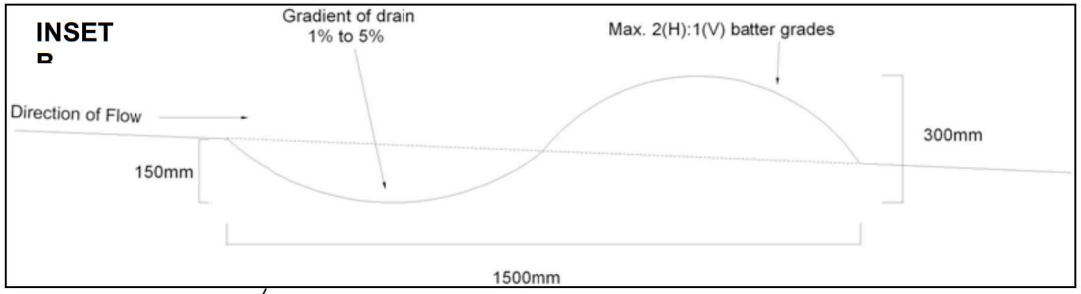
Effluent Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	960	L/day
Surface Vegetation	Lawn - fully managed (clippings removed)		
Effluent Total Phosphorus (TP) Concentration[1]	TP	10	mg/L
Phosphorus Generated 50_{YR}	P_{gen}	175.2	kg
Borehole 1A Parameter			
Soil Phosphorus Sorption Capacity	P_{sorp}	19,307	kg/Ha
Phosphorus Absorped 50_{YR}	P_{absorb}	0.644	kg/m^2
Critical TP Loading Rate[2]	$L_{p.sfc}$	8	$mg/m^2/day$
Phosphorus Uptake 50YR	$P_{uptake.sfc}$	0.150	kg/m^2
Minimum Application Area	$A_{p.sfc}$	**221**	m^2
Borehole 4A Parameter			
Soil Phosphorus Sorption Capacity	P_{sorp}	32,656	kg/Ha
Phosphorus Absorped 50_{YR}	P_{absorb}	1.088	kg/m^2
Critical TP Loading Rate[2]	$L_{p.sfc}$	8	$mg/m^2/day$
Phosphorus Uptake 50YR	$P_{uptake.sfc}$	0.150	kg/m^2
Minimum Application Area	$A_{p.sfc}$	**142**	m^2
Borehole 7A Parameter			
Soil Phosphorus Sorption Capacity	P_{sorp}	18,616	kg/Ha
Phosphorus Absorped 50_{YR}	P_{absorb}	0.620	kg/m^2
Critical TP Loading Rate[2]	$L_{p.sfc}$	8	$mg/m^2/day$
Phosphorus Uptake 50YR	$P_{uptake.sfc}$	0.150	kg/m^2
Minimum Application Area	$A_{p.sfc}$	**228**	m^2
Borehole 8A Parameter			
Soil Phosphorus Sorption Capacity	P_{sorp}	11,424	kg/Ha
Phosphorus Absorped 50_{YR}	P_{absorb}	0.381	kg/m^2
Critical TP Loading Rate[2]	$L_{p.sfc}$	8	$mg/m^2/day$
Phosphorus Uptake 50YR	$P_{uptake.sfc}$	0.150	kg/m^2
Minimum Application Area	$A_{p.sfc}$	**331**	m^2

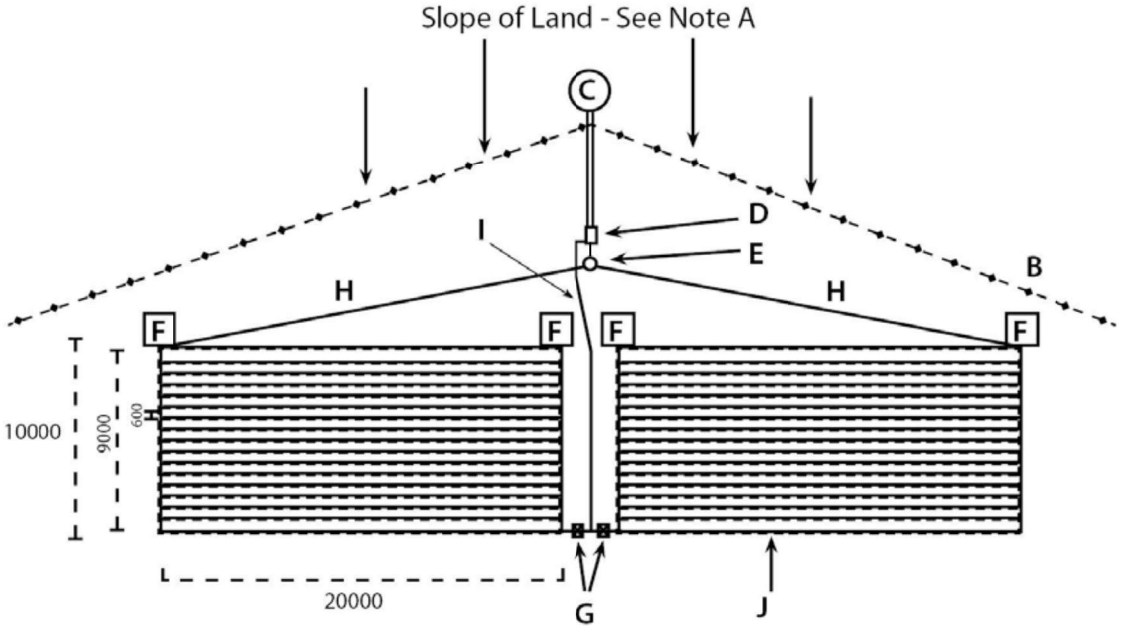
[2.] Appendix 6, 'On-site sewage management for single households' (DLG 1998, AS1547.3:2012)

[3.] Soil Phosphorus Sorption Capcity calculated from Phosphorus Sorption Values recorded in attached ALS Results

APPENDIX C: INFORMATION FOR THE PROPERTY OWNER







This standard design has been based on a generic area of 400 m^2 for irrigation based on typical conditions. It does not eliminate the need for a site and soil evaluation to be carried out or any additional consideration of site specific issues. It should be used as a generic guide only.

Subsurface Irrigation Area Construction

A Design for relatively uniform slope. Additional design work may be required where slope exceeds 12% or if system is to be installed over undulating ground.

B An earth bank diversion drain must be constructed upslope of the area to divert stormwater run-on if this is appreciable (see Inset B and Standard Drawing No.13A).

C Secondary treatment system – the irrigation pump must provide a *minimum* 20 m head and a flow rate that matches the design output of the selected dripline. Flow rate will vary depending on emitter spacing, flow rate and lineal metres of line. A full hydraulic design must be carried out. Each area should be capable of discharging a minimum of 80 L/min.

D Filtration and flushing mechanism (see Inset A) – a field flush valve must be installed on the return line to facilitate periodic flushing to the treatment tank. An additional filter flush valve should be installed downstream of the field flush valve. A 100-150 micron cylindrical filter should be installed and cleaned regularly. Where there are potential problems in returning irrigation field flush back to the treatment tank, a small (approximately 3 m x 0.6 m) absorption area sited below the effluent irrigation area can be used to accommodate the flushed effluent.

E An automatic, hydraulically operated sequencing valve should be installed to deliver effluent evenly to the two areas.

F Air release valves must be installed at high points in each area. Additional air release valves may be required in undulating terrain.

G Check valves are required for each irrigation field to facilitate periodic flushing.

H Distribution manifolds should be 25 mm uPVC or polyethylene pipe buried 300 mm below the ground surface.

I Flushing return manifold should be 25 mm uPVC or polyethylene pipe buried 100-150 mm below the ground surface within the irrigation area. Outside this area, the pipe must be buried at a minimum of 300 mm depth.

J Pressure compensating (PC) subsurface drip line laterals (typically 16 mm) with emitters and laterals at approximately 600 mm spacings (maximum 1,000 mm spacings) and buried to a depth 100-150 mm. Only subsurface dripline specifically designed for effluent irrigation must be used.

Standard Drawing 13B - Subsurface Effluent Irrigation

(not to scale)

ON-SITE SEWAGE MANAGEMENT SYSTEMS

If you live in or rent a house that is not connected to the main sewer then chances are that your yard contains an on-site sewage management system. If this is the case then you have a special responsibility to ensure that it is working as well as it can.

The aim of this pamphlet is to introduce you to some of the most popular types of on-site sewage management systems and provide some general information to help you maintain your system effectively. You should find out what type of system you have and how it works.

More information can be obtained from the pamphlets:

Your Septic System
Your Aerated Wastewater Treatment System
Your Composting Toilet
Your Land Application Area

You can get a copy of these pamphlets from your local council or the address marked on the back of this pamphlet.

It is important to keep in mind that maintenance needs to be performed properly and regularly. Poorly maintained on-site sewage management systems can significantly affect you and your family's health as well as the local environment.

What is an on-site sewage management system?

A domestic on-site sewage management system is made up of various components which - if properly designed, installed and maintained - allow the treatment and utilisation of wastewater from a house, completely within the boundary of the property.

Wastewater may be blackwater (toilet waste), or greywater (water from showers, sinks, and washing machines), or a combination of both.

Partial on-site systems - eg. pump out and common effluent systems (CES) - also exist. These usually involve the preliminary on-site treatment of wastewater in a septic tank, followed by collection and transport of the treated wastewater to an off-site management facility. Pump out systems use road tankers to transport the effluent, and CES use a network of small diameter pipes.

How does an on-site sewage management system work?

For complete on-site systems there are two main processes:

1. treatment of wastewater to a certain standard
2. its application to a dedicated area of land.

The type of application permitted depends on the quality of treatment, although you should try to avoid contact with all treated and untreated wastewater, and thoroughly wash affected areas if contact does occur.

Treatment and application can be carried out using various methods:

Septic Tank
Septic tanks treat both greywater and blackwater, but they provide only limited treatment through the settling of solids and the flotation of fats and greases. Bacteria in the tank break down the solids over a period of time. Wastewater that has been treated in a septic tank can only be applied to land through a covered soil absorption system, as the effluent is still too contaminated for above ground or near surface irrigation.

AWTS
Aerated wastewater treatment systems (AWTS) treat all household wastewater and have several treatment compartments. The first is like a septic tank, but in the second compartment air is mixed with the wastewater to assist bacteria to break down solids. A third compartment allows settling of more solids and a final chlorination contact chamber allows disinfection. Some AWTS are constructed with all the compartments inside a single tank. The effluent produced may be surface or sub-surface irrigated in a dedicated area.

Composting Toilets
Composting toilets collect and treat toilet waste only. Water from the shower, sinks and the washing machine needs to be treated separately (for example in a septic tank or AWTS as above). The compost produced by a composting toilet has special requirements but is usually buried on-site.

These are just some of the treatment and application methods available, and there are many other types such as sand filter beds, wetlands, and amended earth mounds. Your local council or the NSW Department of Health have more information on these systems if you need it.

Regulations and recommendations

The NSW Department of Health determines the design and structural requirements for treatment systems for single households. Local councils are primarily responsible for approving the installation of smaller domestic septic tank systems, composting toilets and AWTSs in their area, and are also responsible for approving land application areas. The NSW Environment Protection Authority approves larger systems.

The design and installation of on-site sewage management systems, including plumbing and drainage, should only be carried out by suitably qualified or experienced people. Care is needed to ensure correct sizing of the treatment system and application area.

Heavy fines may be imposed under the Clean Waters Act if wastewater is not managed properly.

Keeping your on-site sewage management system operating well

What you put down your drains and toilets has a lot to do with how well your system performs. Maintenance of your sewage management system also needs to be done well and on-time. The following is a guide to the types of things you should and should not do with your system.

DO

- ✓ Learn how your sewage management system works and its operational and maintenance requirements.
- ✓ Learn the location and layout of your sewage management system.
- ✓ Have your AWTS (if installed) inspected and serviced four times per year by an approved contractor. Other systems should be inspected at least once every year. Assessment should be applicable to the system design.
- ✓ Keep a record of desludgings, inspections, and other maintenance.
- ✓ Have your septic tank or AWTS desludged every three years to prevent sludge build up, which may 'clog' the pipes.
- ✓ Conserve water. Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.
- ✓ Discuss with your local council the adequacy of your existing sewage management system if you are considering house extensions for increased occupancy.

DON'T

- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with effluent.
- ✗ Don't extract untreated groundwater for cooking and drinking.
- ✗ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your system via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't install or use a garbage grinder or spa bath if your system is not designed for it.

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby waterway.

Your sewage management system is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

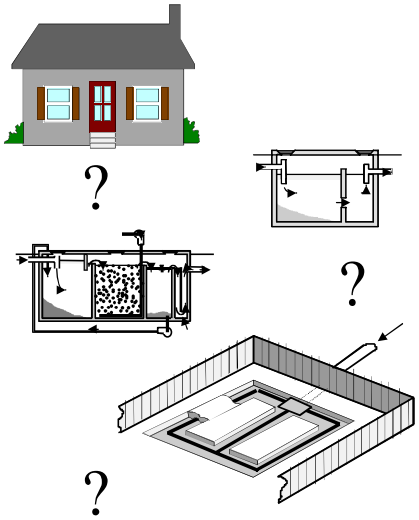
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained sewage management systems are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your management system you can do your part in helping to protect the environment and the health of you and your community.

For more information please contact:

Managing Wastewater In Your Backyard



Aerated Wastewater Treatment Systems (AWTS)

In unsewered areas, the proper treatment and utilisation of household wastewater on-site is critical in preserving the health of the public and the environment. AWTS have been developed as a way of achieving this.

What is an AWTS?

An AWTS is a purpose built system used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

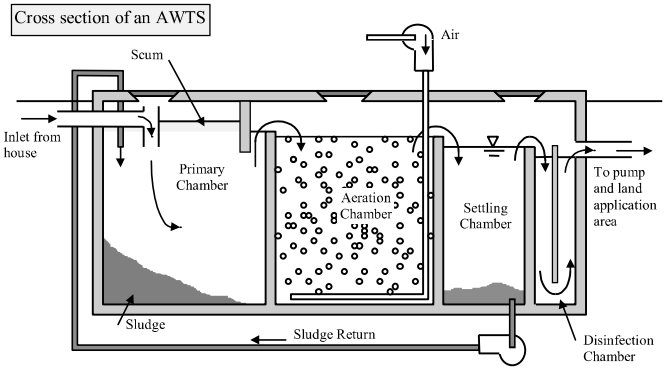
It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

How does an AWTS work?

Wastewater from a household is treated in stages in several separate chambers. The first chamber is similar to a conventional septic tank. The wastewater enters the chamber where the solids settle to the bottom and are retained in the tank forming a sludge layer. Scum collects at the top, and the partially clarified wastewater flows into a second chamber. Here the wastewater is mixed with air to assist bacteria to further treat it. A third chamber allows additional clarification through the settling of solids, which are returned for further treatment to either the septic chamber (as shown) or to the aeration chamber. The clarified effluent is disinfected in another chamber (usually by chlorination) before irrigation can take place.

Bacteria in the first chamber break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the chamber and must be pumped out periodically.

Cross section of an AWTS



Regulations and recommendations

Local councils are primarily responsible for approving the smaller, domestic AWTSs in their area. The Environment Protection Authority (EPA) approves larger units, whilst the NSW Department of Health determines the design and structural requirements for all AWTSs.

At present AWTSs need to be serviced quarterly by an approved contractor at a cost to the owner. Local councils should also maintain a register of the servicing of each system within their area.

AWTSs should be fitted with an alarm having visual and audible components to indicate mechanical and electrical equipment malfunctions. The alarm should provide a signal adjacent to the alarm and at a relevant position inside the house. The alarm should incorporate a warning lamp which may only be reset by the service agent.

Maintaining your AWTS

The effectiveness of the system will, in part, depend on how it is used and maintained. The following is a guide on good maintenance procedures that you should follow:

DO

- ✓ Have your AWTS inspected and serviced four times per year by an approved contractor. Assessment should be applicable to the system design.
- ✓ Have your system service include assessment of sludge and scum levels in all tanks, and performance of irrigation areas.
- ✓ Have all your tanks desludged at least every three years.
- ✓ Have your disinfection chamber inspected and tested quarterly to ensure correct disinfectant levels.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of pumping, inspections, and other maintenance.
- ✓ Learn the location and layout of your AWTS and land application area.
- ✓ Use biodegradable liquid detergents such as concentrates with low sodium and phosphorous levels.
- ✓ Conserve water.

DON'T

- ✗ Don't put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into your AWTS via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't use more than the recommended amounts of detergents.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't switch off power to the AWTS, even if you are going on holidays

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your AWTS. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system entering a nearby river, creek or dam.

Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.

Your AWTS is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

Warning signs

You can look out for a few warning signs that signal to you that there are troubles with your AWTS. Ensure that these problems are attended to immediately to protect your health and the environment.

Look out for the following warning signs:

- Water that drains too slowly.
- Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- Sewage smells, this indicates a serious problem.
- Water backing up into your sink which may indicate that your system is already failing.
- Wastewater pooling over the land application area.
- Black coloured effluent in the aerated tank.
- Excess noise from the blower or pumping equipment
- Poor vegetation growth in irrigated area.

Odour problems from a vent on the AWTS can be a result of slow or inadequate breakdown of solids. Call a technician to service the system.

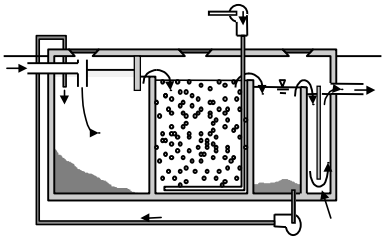
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained AWTSs are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your treatment system you can do your part in helping to protect the environment and the health of you and your family.

If you would like more information please contact:

Your Aerated Wastewater Treatment System



LAND APPLICATION AREAS

The reuse of domestic wastewater on-site can be an economical and environmentally sound use of resources.

What are land application areas?

These are areas that allow treated domestic wastewater to be managed entirely on-site.

The area must be able to utilise the wastewater and treat any organic matter and wastes it may contain. The wastewater is rich in nutrients, and can provide excellent nourishment for flower gardens, lawns, certain shrubs and trees. The vegetation should be suitably tolerant of high water and nutrient loads.

How does a land application area work?

Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

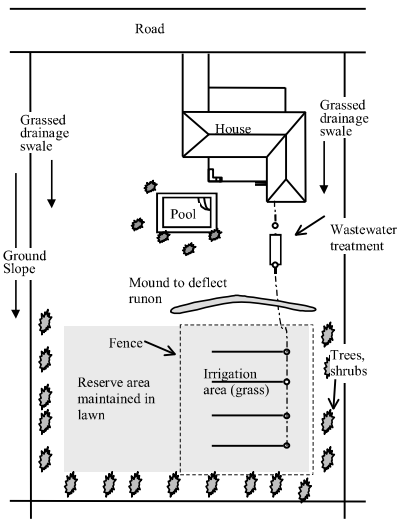
Soil absorption systems do not require highly treated effluent, and wastewater treated by a septic tank is reasonable as the solids content in the effluent has been reduced. Absorption systems release the effluent into the soil at a depth that cannot be reached by the roots of most small shrubs and grasses. They rely mainly on the processes of soil treatment and then transmission to the water table, with minimal evaporation and up-take by plants. **These systems are not recommended in sensitive areas as they may lead to contamination of surface water and groundwater.**

Irrigation systems may be classed as either subsurface or surface irrigation. If an irrigation system is to be used, wastewater needs to be pre-treated to at least the quality produced by an aerated wastewater treatment system (AWTS).

Subsurface irrigation requires highly treated effluent that is introduced into the soil close to the surface. The effluent is utilised mainly by plants and evaporation.

Surface irrigation requires highly treated effluent that has undergone aeration and disinfection treatments, so as to reduce the possibility of bacteria and virus contamination.

Typical Site Layout (not to scale)



The effluent is then applied to the land area through a series of drip, trickle, or spray points which are designed to eliminate airborne drift and run-off into neighbouring properties.

There are some public health and environmental concerns about surface irrigation. There is the risk of contact with treated effluent and the potential for surface run-off. Given these problems, subsurface irrigation is arguably the safest, most efficient and effective method of effluent utilisation.

Regulations and recommendations

The design and installation of land application areas should only be carried out by suitably qualified or experienced people, and only after a site and soil evaluation is done by a soil scientist. Care should be taken to ensure correct buffer distances are left between the application area and bores, waterways, buildings, and neighbouring properties.

Heavy fines may be imposed under the Clean Waters Act if effluent is managed improperly.

At least two warning signs should be installed along the boundary of a land application area. The signs should comprise of 20mm high Series C lettering in black or white on a green background with the words:

RECLAIMED EFFLUENT
NOT FOR DRINKING
AVOID CONTACT

Depending on the requirements of your local council, wet weather storage and soil moisture sensors may need to be installed to ensure that effluent is only irrigated when the soil is not saturated.

Regular checks should be undertaken of any mechanical equipment to ensure that it is operating correctly. Local councils may require periodic analysis of soil or groundwater characteristics

Humans and animals should be excluded from land application areas during and immediately after the application of treated wastewater. The longer the period of exclusion from an area, the lower the risk to public health.

The householder is required to enter into a service contract with the installation company, its agent or the manufacturer of their sewage management system, this will ensure that the system operates efficiently.

Location of the application area

Treated wastewater has the potential to have negative impacts on public health and the environment. For this reason the application area must be located in accordance with the results of a site evaluation, and approved landscaping must be completed prior to occupation of the building. Sandy soil and clayey soils may present special problems.

The system must allow even distribution of treated wastewater over the land application area.

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- × Don't erect any structures, construct paths, graze animals or drive over the land application area.
- × Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- × Don't plant trees or shrubs near or on house drains.
- × Don't alter stormwater lines to discharge into or near the land application area.
- × Don't flood the land application area through the use of hoses or sprinklers.
- × Don't let children or pets play on land application areas.
- × Don't water fruit and vegetables with the effluent.
- × Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- surface ponding and run-off of treated wastewater
- soil quality deterioration
- poor vegetation growth
- unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- ∧ Overloading the treatment system with wastewater.
- ∧ The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- ∧ The application area has been poorly designed.
- ∧ Stormwater is running onto the area.

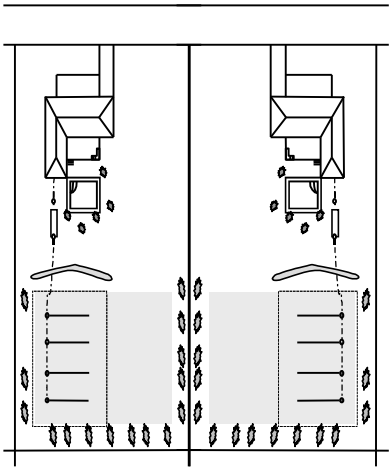
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area



APPENDIX D: SOIL PROFILES

Soil Profiles

Table 3.6.1						
Excavation #	BH1A	Sample size:	50	[mm]	Date Completed:	31/10/2024
Inspection Method:	50 mm Direct Push Tube				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	300	Moderately Moist	Medium Brown	Clay Loam	Moderate	<5%
2	600	Slightly Moist	Medium Grey-Brown	Light Clay	Moderate	<5%
3	1100	Slightly Moist	Pale Brown	Medium Clay	Strong	<5%
Refusal:	Refusal not encountered					
Photo:						

Table 3.7.1						
Excavation #	BH2A	Sample size:	50	[mm]	Date Completed:	31/10/2024
Inspection Method:	50 mm Direct Push Tube				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	200	Dry	Dark Brown	Loam	Moderate	<5%
2	800	Dry	Pale Brown	Medium Clay	Moderate	<5%
3	1100	Dry	Grey	Medium Clay	Moderate	<5%
Refusal:	Refusal not encountered					
Photo:						

Table 3.8.2						
Excavation #	BH4A	Sample size:	50	[mm]	Date Completed:	31/10/2024
Inspection Method:	50 mm Direct Push Tube				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	250	Dry	Dark Brown	Loam	Moderate	<5%
2	900	Dry	Pale Brown	Sandy Clay	Moderate	<5%
3	1100	Dry	Pale Brown	Sandy Clay	Weak	<5%
Refusal:	Refusal encountered on underlying sandstone bedrock					
Photo:						

Table 3.9.3						
Excavation #	BH5A	Sample size:	50	[mm]	Date Completed:	31/10/2024
Inspection Method:	50 mm Direct Push Tube				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	150	Dry	Pale Brown	Sand	Massive	<5%
2	500	Dry	Brown	Loamy Sand	Massive	<5%
Refusal:	Refusal encountered on underlying sandstone bedrock					
Photo:						

Table 3.10.4						
Excavation #	BH7A	Sample size:	50	[mm]	Date Completed:	31/10/2024
Inspection Method:	50 mm Direct Push Tube				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	200	Dry	Dark Brown	Light Clay	Moderate	<5%
2	500	Dry	Pale Brown	Sandy Clay Loam	Strong	<5%
3	1100	Dry	Pale Brown	Sandy Clay	Moderate	<5%
Refusal:	Refusal not encountered					
Photo:						

Table 3.11.1						
Excavation #	BH8A	Sample size:	50	[mm]	Date Completed:	31/10/2024
Inspection Method:	50 mm Direct Push Tube				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	150	Dry	Grey-Brown	Sandy Clay Loam	Moderate	<5%
2	600	Dry	Orange Brown	Fine Sandy Clay	Moderate	<5%
Refusal:	Refusal encountered on underlying sandstone bedrock					
Photo:						

Table 3.12.2						
Excavation #	BH9A	Sample size:	50	[mm]	Date Completed:	31/10/2024
Inspection Method:	50 mm Direct Push Tube				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	300	Dry	Dark Brown	Sandy Clay Loam	Strong	<5%
2	700	Dry	Pale Brown	Fine Sandy Clay	Moderate	<5%
3	1100	Dry	Red with Grey Mottle	Fine Sandy Clay	Moderate	<5%
Refusal:	Refusal not encountered					
Photo:						

APPENDIX E: ALS LAB RESULTS

CERTIFICATE OF ANALYSIS

Work Order	: **ES2435924**	Page	: 1 of 4
Client	: **BROADCREST PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: CHEYNE HUDSON	Contact	: Customer Services ES
Address	: 101 Pyramid Street Emu Plains 2750	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Bundabah (WW)	Date Samples Received	: 05-Nov-2024 15:09
Order number	: 4046	Date Analysis Commenced	: 06-Nov-2024
C-O-C number	: ----	Issue Date	: 14-Nov-2024 16:54
Sampler	: M Kirby		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	1A_1	1A_2	4A_1	4A_2	5A_2
			Sampling date / time	30-Oct-2024 00:00	30-Oct-2024 00:00	30-Oct-2024 00:00	30-Oct-2024 00:00	30-Oct-2024 00:00
Compound	CAS Number	LOR	Unit	ES2435924-001	ES2435924-002	ES2435924-003	ES2435924-004	ES2435924-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**5.0**	**4.5**	**4.8**	**4.9**	**4.8**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**16**	**278**	**26**	**44**	**20**
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	**Gray (7.5YR 5/1)**	**Gray (7.5YR 6/1)**	**Gray (7.5YR 5/1)**	**Light Brownish Gray (10YR 6/2)**	**Light Gray (10YR 7/2)**
Emerson Class Number	EC/TC	-	-	**7**	**6**	**7**	**5**	**5**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**0.4**	<0.1	<0.1	<0.1	**0.2**
Exchangeable Magnesium	----	0.1	meq/100g	**0.9**	**7.1**	**1.6**	**4.0**	**0.9**
Exchangeable Potassium	----	0.1	meq/100g	**0.1**	**0.1**	**0.1**	**0.2**	**0.2**
Exchangeable Sodium	----	0.1	meq/100g	**0.1**	**2.4**	**0.2**	**0.4**	**0.2**
Cation Exchange Capacity	----	0.1	meq/100g	**1.5**	**9.7**	**2.0**	**4.7**	**1.5**
Exchangeable Sodium Percent	----	0.1	%	**9.4**	**24.8**	**11.8**	**9.7**	**11.4**
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**792**	**1730**	**2080**	**2560**	**1450**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	7A_1	7A_1	8A_1	8A_2	----
			Sampling date / time	30-Oct-2024 00:00	30-Oct-2024 00:00	30-Oct-2024 00:00	30-Oct-2024 00:00	----
Compound	CAS Number	LOR	Unit	ES2435924-006	ES2435924-007	ES2435924-008	ES2435924-009	--------
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.5**	**8.1**	**4.9**	**4.8**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**125**	**182**	**19**	**50**	**----**
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	**Pinkish Gray (7.5YR 6/2)**	**Grayish Brown (2.5Y 5/2)**	**Dark Gray (5YR 4/1)**	**Gray (7.5YR 5/1)**	**----**
Emerson Class Number	EC/TC	-	-	**7**	**1**	**7**	**7**	**----**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**13.8**	**10.9**	**0.2**	<0.1	**----**
Exchangeable Magnesium	----	0.1	meq/100g	**32.4**	**21.8**	**2.2**	**9.8**	**----**
Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	**0.1**	**0.3**	**----**
Exchangeable Sodium	----	0.1	meq/100g	**4.0**	**5.0**	**0.3**	**1.3**	**----**
Cation Exchange Capacity	----	0.1	meq/100g	**50.2**	**37.8**	**2.8**	**11.6**	**----**
Exchangeable Sodium Percent	----	0.1	%	**7.9**	**13.3**	**9.6**	**11.6**	**----**
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**1660**	**1300**	**1520**	**1760**	**----**

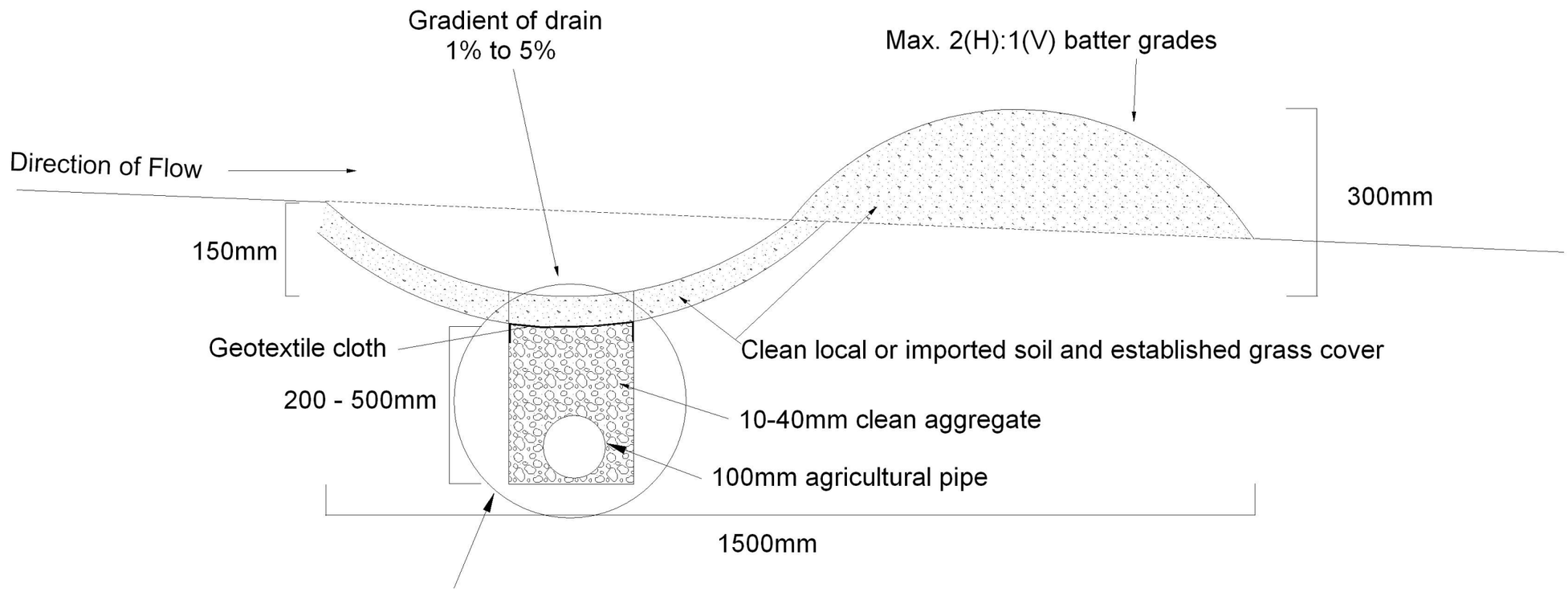
Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry / Biology).

(SOIL) EA058: Emerson Aggregate Test

APPENDIX F: STORMWATER DIVERSION

Cross Section: Upslope Diversion Drain



Standard Drawing 8A – Upslope Diversion Drain

(not to scale)